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Editorial – Volume 20, Issue 2

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Welcome to the second issue of 2019. These last few months has seen a whirlwind of activity for *IRRODL* with transitioning to a new online journal system this year, as well as coping with the continued increasing number of excellent submissions that is, quite frankly, testing our capacity. You will have noticed that as of May 1, 2019 we will be taking a short break from accepting submissions (not more than six months) and will be moving to a regularized publication schedule in 2020.

The first article by **Maletić**, **Barać**, **Naumović**, **Bogdanović**, and **Radenković** investigates the role of crowdvoting techniques on competing student projects to increase active participation and interest in the e-learning process.

In the following paper, **Petrovic-Dzerdz** examines the improvement of long-term knowledge retention by employing gamification principles in online, open-book, multiple-choice tests in order to motivate students to engage in repeated retrieval-based learning activities.

While media diversity is commonly viewed as a vehicle to increase learner interest and engagement **Fanguy**, **Costley**, **Baldwin**, **Lange**, and **Wang** have shown that higher levels can actually lead to lower levels of student performance. This study provides some insight on student behavior that can affect learning and opens the discussion on seeking that level of media diversity that is optimal.

Given the importance of interpersonal contact to students' sense of community **Berry** explores how and where online students form relationships outside of class. A three-day in person orientation provides further insights on how this is enhanced and the important role of extracurricular activities in building community in both digital and physical spaces.

Knowing parent involvement can play an important role in lowering online high school student attrition rates. **Borup**, **Chambers**, and **Stimson** have identified ways parents can effectively engage in their child's online learning experience. The study also flags problems faced by parents in this process, as well as obstacles encountered by teachers and facilitators when they attempted to support parents.

With the increased use of social media professionally, **Jordon** examines how academics use their online networks in the context of their formal roles and academic identity. The study identified several strategies in their use of social networking sites and notes that prioritization of these can be associated with different career stages.

Leal, **Navarro-Corona**, and **González** systematically explores the existing literature (2015-2018) on massive and open learning courses (MOOCs), which confirms that participation patterns and instructional design appear as the main topics of interest in the field, but also reveals that a considerable increase in published articles on academic engagement. Given the low completion rate of learners in MOOCs, having a better understanding of how students participate in this educational modality is vital.

Zhang, **Bonafini**, **Lockee**, **Jablokow**, and **Hu** focus their investigation on the degree to which different variables, like demographics and motivation, affect the completion of a MOOC. Among other results, completion rates appear to increase with reputation of institution, when the MOOC provides experiences that add to students' current academic background, and with older learners (age > 50 years).

In their paper, **Kara** and **Can** explore non-thesis Master's students' perceptions and expectations of good tutors and advisors in distance education programs and their relation to student characteristics including age, gender, university, program, semester, and previous online learning experience.

Stracke discusses the need to innovate education due to global changes to keep its status as a human right and public good and introduces Open Education theory, and the subsequent development and application of the OpenEd Quality Framework, to fulfil these requirements.

High school students' educational use of YouTube can be predicted by performance expectancy and social influence. **Bardaki** examines one of the most prevalent social media sites across the globe to examine the intention to use and acceptance by young learners

Muggli and **Westermann** examine learner perceptions and performance using two open educational resources (OER) compared with a traditional commercial textbook for first-year mathematics courses. In both face-to-face and blended scenarios, student use of OER resulted in better performance but lower attendance.

In the next article, **Cross**, **Sharples**, **Healing**, and **Ellis** investigate how and where distance learners use handheld devices and the impact this has on learning habits, access to learning content and quality of work. The study concludes by proposing two new concepts building on Castells' framework: the *flow of places* and *place of space*.

Despite the advancement of mobile communication technology to interconnect the world, the rising generation is lacking some of the skill and capacity to examine societal issues and work alongside those of various backgrounds to make a change. **Fox** proposes that in addition to linking the world, mobile devices can also be used to strengthen global competence in university students.

We then go to an m-learning literature review with an important geographic focus. Increased access to mobile technologies offers an opportunity for transformational change in both medical education and practice in the remote and resource-constrained locations of Sub-Saharan Africa (SSA). **Yunusa**, **Umar**, and **Bervell** provide a review (2010-2018) and analysis of the state of distributed medical education in SSA, culminating in key recommendations for improvement.

This issue finishes with one field note from **Ally** who carefully identifies competencies required by the digital teacher of the future to function effectively. The end product of the research is a Competency Profile for the Digital Teacher, which can be used to train and eventually orient future educators.

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Blending Crowdvoting in Modern e-Learning Environments

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Abstract

Given that the most students spend considerable time on social networks, many educational institutions use this habit as a basis for educational purposes. Increasing students' active participation in learning activities is one of the main goals of education. The purpose of this research was to investigate to what extent crowdvoting techniques can increase students' participation and interest in the e-learning process. Additionally, we set out to explore social networks as a medium for crowdvoting, contests, and collaboration among students. The research participants included 131 students in the information technologies area of the Faculty of Organizational Sciences, University of Belgrade who participated in contest related to their 3D modeling projects. Voting was performed via Facebook. The students voted for particular projects primarily based on the quality of the project itself. Additionally, the competition was an incentive for students to prove themselves to colleagues, but also to provide an opportunity for teamwork, additional engagement, and acquisition of new skills and knowledge. The research results indicate a generally positive attitude among students towards the competition and rewards.

Keywords: crowdvoting, social networks, e-education, crowd wisdom, crowd learning

Introduction

Crowdsourcing is an emerging concept that involves user participation in problem solving. This term implies the process of collecting opinions, ideas, services, or content from a particular group of individuals (so-called *crowd*) usually via an online community (Howe, 2006). It includes a wide range of Internet activities, with crowdvoting included as one of the crowdsourcing categories (Howe, 2009; Starbird, 2012). Crowdvoting is usually used to assess the prominent ideas of the crowd (Standing & Standing, 2017).

Educators and researchers are continually trying to find new ways to increase student interaction and participation in educational activities. Social networks and other modern technologies have become pervasive among youth, and they also allow individuals to contribute to decision-making processes simply by voting. In recent years, the use of social networks has also become popular for stimulating critical thinking skills, collaboration, and knowledge construction (Griesemer, 2014).

In this paper, we investigate whether harnessing crowdvoting techniques and social networks can have a positive impact on the results of student learning and interaction. Further, we set to explore social networks as a medium for crowdvoting, contests, and collaboration among students. Using crowdvoting techniques within courses should help teachers improve many aspects of their teaching.

Theoretical Background

Crowdvoting in Education

As James Surowiecki (2005) stated, crowdsourcing is a combination of crowd and outsourcing that collects the wisdom of crowds, which refers to the superiority of groups over individuals in predicting public opinion.

There are several existing crowdsourcing applications and communities used as online education support tools (Buecheler, Sieg, Füchslin, & Pfeifer, 2010), since they allow Web-enabled tools to produce online learning materials (Recker, Yuan, & Ye, 2014; Skaržauskaite, 2012).

Crowdvoting is a crowdsourcing method for collecting ideas, opinions, and concepts in an intelligent, accurate, and cost-effective way (Dietrich & Amrein, 2016). Crowdvoting increases community participation and awareness of the importance of business decisions (Pedersen, et al., 2013).

When it comes to security and privacy issues, it should be mentioned that crowdvoting systems have certain problems and constraints in terms of misuse, hacking, lobbying, social engineering, and so on. Given that users post information about themselves on a crowdsourcing platform, the data they post is no longer under their control and it can easily become public (Rahim, Ismail, & Samy, 2014; Sarwar & Khan, 2013). As crowdsourcing becomes more popular, the phenomenon of *crowd attacking* becomes more frequent (Hassan & Rahim, 2017).

Despite the issues and constraints when harnessed crowdvoting in an educational context, the role of crowdvoting activities in both our educational system and specific approach studied here was to encourage students to be engaged and more interested in course content.

Crowdvoting is applicable in education in that it enables students to evaluate their colleagues' projects and thus encourage participation in the educational process (Bogdanović, Labus, Simić, Ratković-Živanović, & Milinović, 2015). Al-Jumeily, Hussain, Alghamdi, Dobbins, and Lunn (2015) stated that crowdvoting techniques can effectively be applied to technology-enhanced learning since it can help collect the crowd's view on a certain subject. Wang and Kinuthia (2004) stated the four characteristics of technology-enhanced learning environments: motivation, learning enrichment, learning implementation, and learning assessment and evaluation. Therefore, we can conclude that crowdvoting techniques can be applied to learning purposes through discussions, group projects, feedback, and so on (Keppell, Au, Ma, & Chan, 2006). As well, we should not ignore the influence of peer learning on students' performance, like development of social and leadership skills, and high attendance rates (Stiller-Reeve, et al., 2016). This also includes peer assessment which can be both formal and informal (McLuckie & Topping, 2004). Barker and Bennett (2011) described the process of evaluating projects by using an electronic voting system (EVS). Voters evaluated the quality of the websites made by their fellow students, as well as the quality of the applications within the websites. The research results showed that the voting process was objective and was not based on acquaintance with the candidate.

The Utah Valley University organized a competition with use of digital media that relied on the wisdom of the crowd whose choice influenced the selection of the winner. The winners had the highest number of online votes, and the technologies they used during the competition included mobile and Web applications, video games, 3D animation, film, special effects, and digital audio (Solemon, Ariffin, Din, & Anwar, 2013).

As Kibble (2007) stated, rewards increase students' participation, so it is important to investigate whether the reward concept provides an incentive and has a positive impact on students' learning outcomes. Baranek (1996) stated that grades are the most common type of reward (Seoane & Smink, 1991). Therefore, one of the research questions in this study deals with which type of prize would most encourage students to participate in the competition.

Educational Aspects of Social Networks

The information availability makes individuals feel dependent on social networks, and accordingly, reduces their interest in and focus on studies (Labus, Despotović-Zrakić, Radenković, Bogdanović, & Radenković, 2015; Tariq, Mehboob, Khan, & Ullah, 2012; Yuen & Yuen, 2008). Also, some authors consider social networks as source of "psychological distress (Chen & Lee, 2013), lower quality of life (Bevan, Gomez, & Sparks, 2014), and reduced subjective wellbeing (Kross, et al., 2013)" (Doleck & Lajoie, 2018, p. 437). On the other hand, several studies have proved that many students use social networks to discuss their classes, learning outside of school, and planning for college (Yuen & Yuen, 2008). The open nature of social networks as well as their accessibility, efficiency, and ease of use can help students' learning experiences (Abrahim, Mir, Suhara, & Sato, 2018; Labus, Simić, Vulić, Despotović-Zrakić, & Bogdanović, 2012). However, a few studies could not find scientific proof of a link between use of social networks and academic performance (Doleck & Lajoie, 2018).

Educational institutions should consider use of social media to support the creation of knowledge (Macià & Garcia, 2017; Moskaliuk, Kimmerle, & Cress, 2009). There are numerous groups on social networks that are maintained by universities for the purpose of interacting with students (Selwyn, 2012) and contributing to their persistence and motivation to study (Mason & Rennie, 2007). Cost, accessibility, and flexibility are the advantages for students and educational institutions to engage in online learning (Chau, 2010).

Authors like Junco, Heiberger, and Loken (2011) and Hung and Yuen (2010) stated that social networks have a positive influence on students' grades. Positive aspects of using social networks for educational purposes are:

- Better communication and quick information sharing (e.g., increased productivity and team work) (Waycott, Thompson, Sheard, & Clerehan, 2017).
- Creating and maintaining connections (e.g., developing a career).
- Focus on technology for educational and business purposes (e.g., building skills).
- Getting instant feedback from friends and family (e.g., developing artistic abilities and getting confidence) (Raut & Patil, 2016; Vural, 2015).

Mesipuu (2012) investigated the translation system improvement process of both open (e.g., Facebook) and closed (e.g., Skype) social networks where the user-translators voted for appropriate or inappropriate translations. Traunmueller and Schieck (2013) emphasized that social networks also allow the users to give their opinion using the voting system. Since the participants in this research voted via Facebook, we examined whether social networks are a suitable channel for implementing crowdvoting techniques and the benefits of such channels.

Research Questions

Based on the analyzed literature, the main research questions set during this study are:

> RQ1: Does crowdvoting have a positive impact on the students' participation in educational activities? (Al-Jumeily et al., 2015).
>
> RQ2: Are social networks suitable channel for crowdvoting implementation? (Mesipuu, 2012; Traunmueller & Schieck, 2013).
>
> RQ3: Which factors influence the voting choice when it comes to students' projects? (Barker & Bennett, 2011).
>
> RQ4: Does the reward concept provide an incentive and have a positive impact on students' learning outcomes? What type of reward motivates students the most? (Kibble, 2007; Baranek, 1996).

Methodology

Research Design

Figure 1 shows the research methodology. As part of a course in the fourth year of undergraduate studies, at the Faculty of Organizational Sciences, University of Belgrade, students were tasked with creating a 3D model and animation. They worked in teams of three. After creating the projects, students uploaded them on the Moodle learning management system, which is used as an open and distance learning engine. After the projects were analyzed and evaluated by teachers, the best 10 projects were selected and published on the course's official Facebook page. Students could vote for one or more projects; the three projects with the highest number of votes (likes) were declared as winners. Depending on the ranking, winners got prizes. These prizes were (a) additional points within the course that can help students to get a higher grade, (b) promotion and presentation of the animation on the e-Business Department website, or (c) free participation in ELAB summer school and free printed e-Business textbook.

Instruments

A survey was conducted in order to examine student attitudes regarding crowdvoting on the social network, as well as the concept of the competition and prizes. The survey was intended to examine whether the crowdvoting process encouraged students to make creative projects or to promote their work. Since the voting was performed on Facebook, it is important to examine whether students voted based on acquaintance with the candidate or exclusively based on the quality of the project itself, as well as how the rewards influenced their interest to participate in the competition.

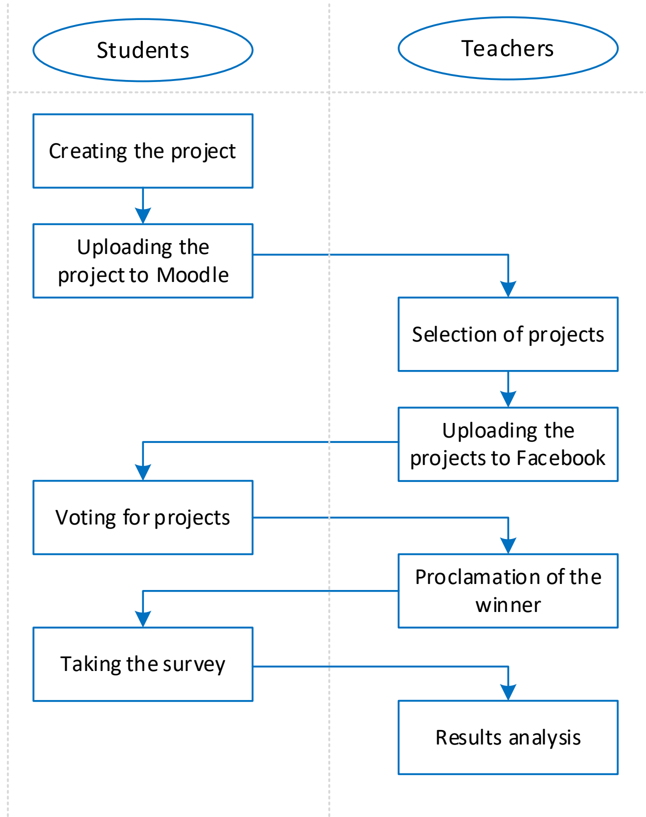

Figure 1. Research methodology.

The questionnaire created for this research consisted of three parts. The first part contained 13 yes/no questions. These questions examined the students' behavior related to the competition. The second part contained one half-open question related to the reason for which the respondent was encouraged to participate in the competition, and three open questions to examine students' opinions on the significance of winning the competition. Here, students could provide suggestions for future prizes and additional comments regarding the course. The third part of the survey contained 15 Likert-type questions for examining students' opinions on the competition and rewards. Table 1 provides an overview of the questions used within the questionnaire.

Table 1

Measurement Items Included in Questionnaire

Model construct	Measurement item
Impact of crowdvoting on the students' participation in educational activities (Al-Jumeily et al., 2015) (RQ1)	• Did you participate in the competition? • You did not participate because you did not create project on time. • You did not participate because you did not want to. • Was your project selected for voting? • Have you looked at the selected projects? • I think the best project has won. • Would you participate again in the ELAB competition? • I think that the candidates were encouraged by teamwork. • I think that the candidates were encouraged by additional engagement and acquiring new skills.
Suitability of social networks as a crowdvoting implementation channel (Mesipuu, 2012; Traunmueller & Schieck, 2013) (RQ2)	• Are you familiar with the ELAB competition? • Did you participate in the voting? • You voted for one project. • You voted for more projects. • I think the competition is useless.
Influencing factors on voting choice (Barker & Bennett, 2011) (RQ3)	• I voted based on my acquaintance with the candidate. • I voted based on the quality and creativity of the project.
Impact of the rewards on students' learning outcomes and their role as an incentive (Kibble, 2007) Rewards with the greatest motivational impact on students (Baranek, 1996) (RQ4)	• What does it mean for you to win this competition? • I think the rewards are appropriate and motivating. • I think the prizes are unnecessary. • I think that the candidates were encouraged by the prizes. • What inspired you to participate in the competition? • Make a proposal for a prize that would encourage you to participate in the competition. • I think that additional points are the most useful reward. • I consider promotion and presentation of animation on the site of the e-Business Department as the most useful prize. • I consider the ELAB summer school course as the most useful prize. • I consider the e-Business textbook as the most useful prize.

In order to examine the consistency and reliability of a data set, the Cronbach's alpha measure was used. The values for research questions RQ1, RQ2, RQ3, and RQ4 are, respectively: 0.758, 0.818, 0.416, and 0.729. Given that Cronbach's alpha for RQ1 is 0.758 we can conclude that the reliability for this research question is respectable, as is RQ4; reliability for RQ2 is very good. However, for RQ3, Cronbach's alpha cannot be appropriately used as the format of questions within RQ3 were mostly yes/no type.

Participants

Participants in this research were undergraduate students in their fourth year at the Faculty of Organizational Sciences, University of Belgrade (born between 1988 and 1995), with average grade during study 8.32. There were 131 students who participated in the survey (59.23% females and 40.77% males).

Results

Participation and Attitude Toward Competition

The results show that almost all respondents were familiar with the competition (only three respondents were not). Most respondents created a project; approximately 28.09% of respondents did not want to participate in the competition. A fairly high number of respondents (74.16%) viewed the selected projects posted on Facebook and almost half of the total number participated in the voting process. Nearly half of the respondents (45.24%) said that their projects were selected for voting. The majority of the respondents found the competition interesting (71.43%). A surprisingly small percentage of respondents (8.91%) were satisfied with the existing prizes. Most of them thought that the competition was an interesting way to encourage students to do the project and thus increase their participation in the educational process. However, there were also those who believed that determining the winner based on the number of votes collected on Facebook was not adequate, because in this way the quality of the project itself was neglected, and increases in the number of votes was affected by the candidates' self-marketing (i.e., collecting votes from friends or family).

Respondents' answers to the questions defined by the Likert-type scale are shown in Table 2. According to the results, the students gave positive answers regarding encouraging both teamwork (mean score = 3.6) and acquiring new skills (mean score = 3.616). In addition, the students did not agree that competition was useless (mean score = 2.1).

Table 2

Likert-Type Questions Related to Participation and Attitude Toward Competition

Research question	Mean	SD
RQ 1: I think that the candidates were encouraged by teamwork.	3.600	1.288
RQ 1: I think that the candidates were encouraged by additional engagement and acquiring new skills.	3.616	1.0983
RQ 2: I think that the competition is useless.	2.121	1.2853
RQ 2: I consider such competitions as useless.	2.064	1.2296

Incentives for Participation and Rewards Types

The analysis found that the teamwork (39.53%), acquiring new skills (31.40%), and rewards (22.09%), respectively, were the biggest incentives for respondents to participate in the competition. The category "Other" includes competitive spirit, grade, obligatory homework, and points (Figure 2).

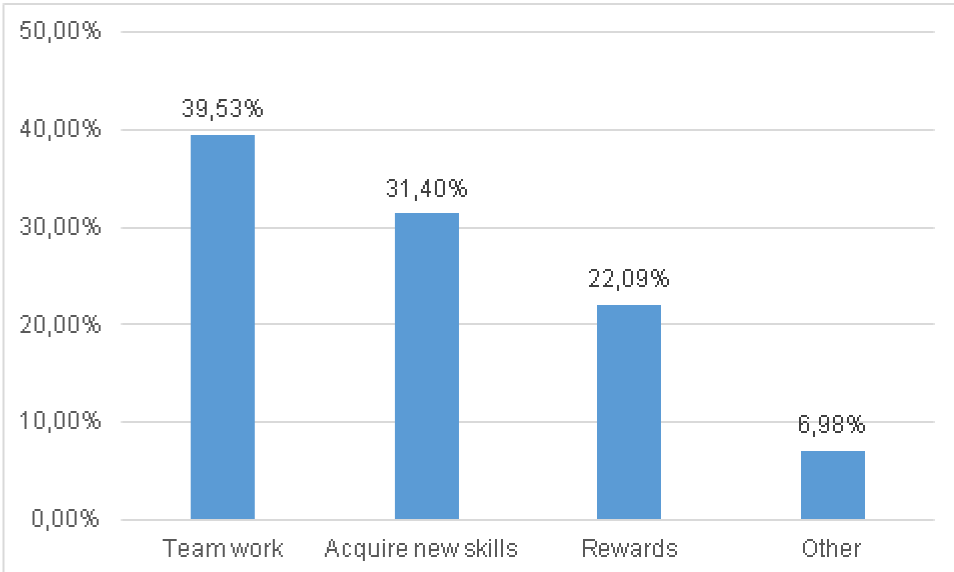

Figure 2. The incentives for participating in the competition.

Figure 3 shows what winning this competition meant to the respondents. Most of them thought that winning in this competition was a kind of effort recognition (34.78%). The category "Other" included personal satisfaction and socializing. The respondents were also asked to propose a reward which would most encourage them to participate in the competition (Figure 4). Grades and points were mostly proposed as rewards (43.48%).

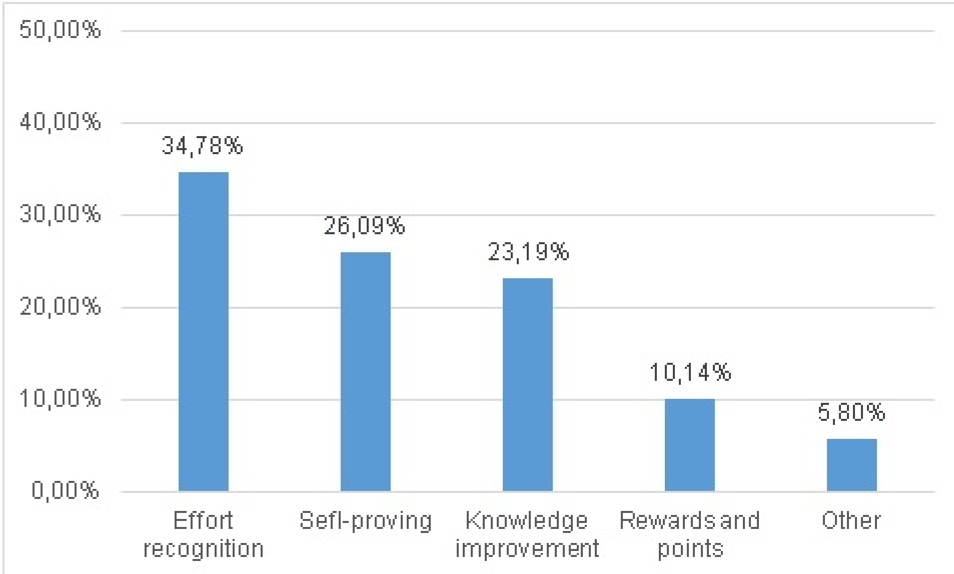

Figure 3. The significance of winning the competition.

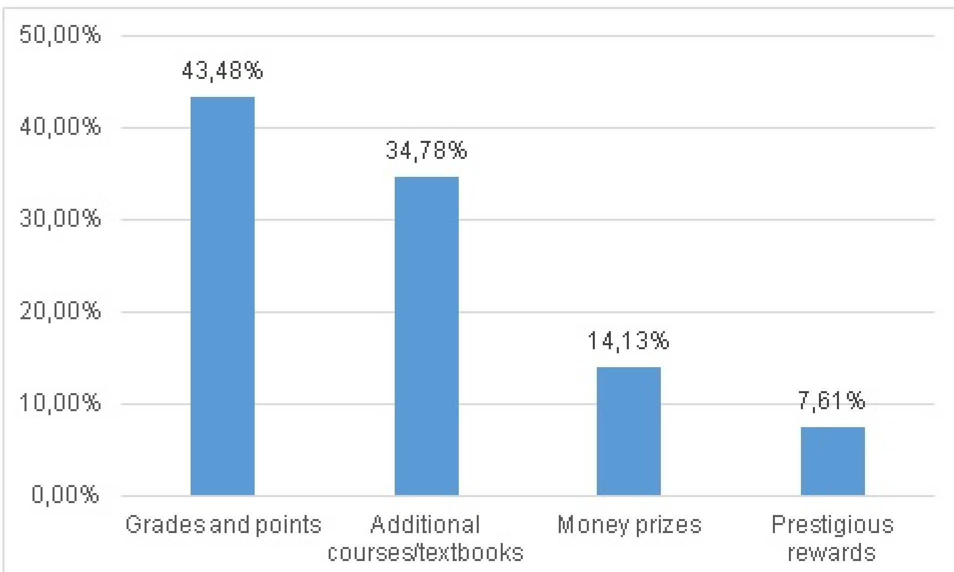

Figure 4. Rewards proposals.

Students' answers for RQ3 and RQ4 are shown in Table 3. The majority of students stated that they voted based on the quality and creativity of the project (mean score = 3.975). The prizes were appropriate and motivating for the students (mean score = 3.72). The ELAB summer school courses prize was considered the most beneficial (mean score = 3.888).

Table 3

Likert-Type Questions Related to Incentives for Participation and Rewards Types

Research question	Mean	SD
RQ3: I voted based on acquaintance with the candidate.	2.758	1.4894
RQ3: I voted based on quality and creativity of the project.	3.975	1.3621
RQ4: I think that the competition is interesting and motivating.	3.823	1.1897
RQ4: I consider such competitions as desirable and interesting.	3.782	1.1157
RQ4: I think that the prizes are unnecessary.	2.064	1.1482
RQ4: I think that the prizes are appropriate and motivating.	3.720	1.0671
RQ4: I think that the candidates were encouraged by rewards.	3.605	1.0956
RQ4: I consider additional points as the most useful prize.	3.488	1.2548
RQ4: I consider promotion and presentation of realized animation on the site of the e-Business Department as the most useful prize.	2.928	1.1858
RQ4: I consider the ELAB summer school course as the most useful prize.	3.888	1.1232
RQ4: I consider the e-Business textbook as the most useful prize.	3.024	1.3528

Correlation Analysis

Correlation analysis identified the links between individual questions, with the goal of determining how consistent the respondents were in their evaluation of prizes and competition. The analysis found that the highest correlations (more than 50%) were observed between the following indicators:

- 68% between questions “I consider these competitions as desirable and interesting” and “I think that the rewards are appropriate and motivating.”
- 61% between questions “I think that the candidates were encouraged by teamwork” and “I think that the candidates were encouraged by additional engagement and acquiring new skills.”
- 55% between questions “I think the competition is interesting and motivating” and “I think the rewards are appropriate and motivating.”
- 54% between the questions “I think the rewards are appropriate and motivating” and “I think that the candidates were encouraged by the prizes.”

All of these correlations are statistically significant (1%). The data were analyzed by using the IBM SPSS tool.

In order to determine the consistency of the answers from respondents who participated in the competition, we examined whether they considered that the candidates were encouraged by the rewards, teamwork, or by additional engagement and acquiring new skills. Also, among the respondents who did not want to participate in the competition, it was important to investigate whether they believed that the competition was useless. During this analysis, the authors of this paper had to take into account the opinions from the respondents who voted for projects based on their quality and creativity and who thought that the best projects had won. It was also important to investigate whether the respondents who participated in the voting process considered that the competition was interesting or useless. Therefore, we created 16 variables for determining the consistency in the respondents' answers. In order to determine the relationships between individual variables, a statistical method of cross tabulation (contingency table) was used, and it was performed by using the χ^2 test. Table 4 shows the naming conventions for the individual variables.

Table 4

Results of the Pearson's χ^2 Coefficient for Examined Variables

	Question combinations	Variables	Pearson's χ^2 coefficient	P level
1.	Did you participate in the competition? * I think that the candidates were encouraged by the prizes.	Competition participant → Prizes encouragement	1.706	0.790
2.	Did you participate in the competition? * I think that the candidates were encouraged by teamwork.	Competition participant → Teamwork encouragement	6.689	0.153
3.	Did you participate in the competition? * I think that the candidates were encouraged by added engagement and acquiring new skills.	Competition participant → Additional engagement / new skills	5.459	0.243
4.	You did not participate because you did not want to. * I think the competition is useless.	Non-participant → Competition uselessness	6.482	0.166
5.	I think that the best project has won. * I voted on the quality and creativity of project.	Best project wins → Quality fulfillment	17.132	0.002**
6.	Did you participate in the voting? * I think the competition is interesting and motivating.	Voter → Interesting competition	1.079	0.898
7.	Did you participate in the voting? * I consider such competitions as desirable and interesting.	Voter → Desirable competition	0.819	0.936

8.	Did you participate in the voting? * I consider such competitions as useless.	Voter → Useless competition	1.950	0.745

Since the value of Pearson's χ^2 coefficient is 1.706 for the 5% significance level, and P level for the first combination of questions (*Competition participant → Prizes encouragement*) is 0.790, we can conclude that there is no relationship between the variables we have chosen. In other words, there are no statistically significant differences in the answers between the students who participated in the competition and those who did not, in relation to their opinion regarding the incentive of the prizes to the candidates.

Table 4 indicates that there is a statistically significant difference for just one of the examined combinations of questions because the Pearson's coefficient is 17.132 and the P level is 0.002 for 5% significance, which means there is a relationship between the answers to the question "I think the best project has won" and "I voted based on quality and creativity of the project."

Given the results of our analysis, we can conclude that the selected variables were independent of each other, except in one case. When we observe these selected combinations separately, we realize that there is no statistically significant difference between those who participated in the competition and those who did not, in relation to their opinions on candidates' incentive regarding prizes, teamwork, and additional engagement. Also, there is no difference in answers from the respondents who did not want to create the project and those who did, in relation to their opinions on the competition's uselessness. Finally, there is no statistically significant difference between the respondents who voted and those who did not, in relation to their opinion on the competition as interesting or as useless.

Discussion and Conclusions

Impact of Crowdvoting on the Students' Participation (RQ1)

The crowdvoting concept itself can have a positive impact on students' learning and on increasing their participation in educational activities. Conclusions from RQ1 testify to this by indicating that more than half of respondents participated in the project creation, and also mastered the use of advanced techniques in the field of 3D modeling and animation. As Al-Jumeily et al. (2015) stated, crowdvoting can help students improve their engagement as well as their learning skills, bearing in mind their learning style preference. The competition shows that teamwork, as well as additional engagement, have had a positive impact on students.

Social Networks as a Crowdvoting Channel (RQ2)

As assumed, results confirm that crowdvoting techniques can be successfully conducted via Facebook, in agreement with Mesipuu (2012) and Taunmueller and Schieck (2013). Therefore, social networks have been showed as a suitable channel for voting. In this research, not only students, but also friends and family of candidates who had access to the Facebook account participated in the voting process.

Factors That Influence Voting Choice (RQ3)

There are pros and cons to using crowdvoting principles on a social network. On the positive side is certainly easier accessibility and transparency. According to RQ3 and influencing factors on voting, the negative aspect is reflected in the fact that in some situations, project quality can be neglected and someone with better self-marketing can be declared a winner. However, the research has shown that the voters who thought the best project won were most probably those who voted based on the project's quality and creativity. It can be said that the acquaintance with the candidate in some cases is not crucial factor in voting process.

Impact of Rewards (RQ4)

It can be concluded that the competition itself encouraged many students to create a project. Rewards were also an incentive for students to do a better project and thus learn more. Although students highlighted free-of-charge participation in ELAB summer school course as the most desirable of the offered prizes, additional points were also a reward that provided students with an incentive to participate in the competition. According to RQ4, a majority of the respondents were satisfied with the provided prizes. Further, that additional points were the most desirable rewards among the students conforms to Baranek (1996). However, there were those for whom further learning and recognition by colleagues were more important.

Findings

This study examined two roles—the project creator and the voter. Project creators, under the influence of the prizes or some other internal urge, tried to create better and more creative projects by using advanced technologies. If their project was selected in the top 10 and published on the course Facebook page, they most likely promoted their project. On the other hand, there were voters who were most probably students who did not want or failed to participate in the competition. They are the ones who decide who will win the competition. Some of the terms from the analyzed literature highlighted in this paper are: crowdvoting techniques, social networks, peer assessment, reward influence. Given that the majority of students were familiar with the competition, and that very few of them did not create a project, it can be said that students were generally interested in participating in the competition. The results certainly point out the fact that the rewards were an incentive for students, as was assumed. However, teamwork has been singled out as the biggest incentive for our respondents.

Based on this research, we can conclude that the concept of rewarding certainly has a positive impact on students and their additional engagement, and consequently on their learning results, as Kibble (2007) stated. Although the prizes of this competition were of a prestigious character, it turned out that for most of the students, winning meant a recognition by their colleagues.

The correlation analysis showed that the creativity and quality of the project were the most important in terms of voting for a particular candidate. In other words, the students who voted for the candidates based on acquaintance with them still considered that they voted based on the quality of the project. This shows that Barker and Bennet's (2011) assumption is correct—students vote for candidates regardless of their acquaintance. Nevertheless, survey results indicate that the quality of the project was a key factor for voting as well for the respondents who did not know the candidates for whose projects they voted. A topic for some further research may be examining ways to overcome candidates' self-promotion in order to make the quality of a project most prominent.

The contribution of this research is in providing an overview of how crowdvoting principles can be implemented in a social network environment for e-education purposes. The authors of this paper believe that the findings can be used as a framework for other education practitioners, in order to help them adjust learning methods to students' needs and habits. This paper describes an example of how educators can innovate by designing new interesting ways to encourage students to be more involved in such activities and also become more creative. As well, it calls attention to the importance of taking measures to ensure that more teaching activities account for students' opinions and let them participate in the decision-making process. Such approaches can certainly elicit a number of positive reactions from students as well as a greater sense of control. Bearing in mind that social networks are close to students and that they spend time following events on them, it seems logical to integrate teaching activities into social network structures. The primary aim of this research is to make an impact on practice and to provide educators with needed information regarding students' attitude towards crowdvoting implementation in a competition context.

This paper brings new value to e-education, as it encourages lecturers to increase students' participation in an acceptable way and thus positively influence the results of their learning. Our analysis indicates that for most respondents, recognition for their effort is very important, as it can be identified by proving themselves in front of their colleagues. Students should be allowed to express themselves in creative ways and in a familiar environment, such as the social network, and enabled to participate in the decision-making process, such as crowdvoting. All these factors can help students improve their level of engagement as well as their learning skills.

Table 5 provides a list of the main implications and practical recommendations for different interested parties in the educational process.

Table 5

Implications for Teachers, Education Practitioners, and Students

Interested parties	Implications
Teachers	1. Teachers have to continue encouraging students to be more engaged in educational activities as it can definitely increase their knowledge as well as experience (Dougiamas & Taylor, 2003; Reeve, 2009; Skiner & Belmont, 1993). 2. As it is necessary to invest time and effort in e-education in order to achieve positive results, the use of social networks integrated with crowdvoting techniques can make students feel they are important actors in the decision-making process (Cubillo, Sánchez, & Cerviño, 2006). This contributes to their sense of control and desire for additional engagement (Moogan, Baron, & Harris, 1999; Siribunnam, Nuangchalerm,

	& Jansawang, 2014). In addition to the feeling of control in the decision-making process, teamwork and additional engagement were of a great importance to the participants. 3. When it comes to rewards, the research indicates that additional points and the possibility of further learning and promotion are very important for the participants in the competition. This should not be neglected and rewards should be chosen carefully. Although prizes are only a part of what encouraged the students to participate in the competition, a reward system must be designed to have a positive impact on students (Sloggett, 1971).
Education practitioners	1. The crowdvoting process on the social network should be organized in a way to highlight the quality of the project itself. Since voting takes place on Facebook, the choice of winner should not be influenced by candidates' self-marketing through collecting votes from friends or family. Voting should be performed within a closed group so voters are not familiar with or able to identify the author of a particular project (Kennedy & Cutts, 2005). For instance, a closed Facebook group could be visible only to the voters, without including the author's name. 2. Generally, the use of crowdvoting principles on social networks has its advantages (Brady, Holcomb, & Smith, 2010), because of the quick and easy way decisions can be made on a given topic (Wang, Gill, Mohanlal, Zheng, & Zhao, 2013). 3. The use of social networks does not represent a major investment for educational institutions; therefore, this kind of environment can be easily used for educational purposes (Madge, Meek, Wellens, & Hooley, 2009; Roblyer, McDaniel, Webb, Herman, & Witty, 2010). However, there are some challenges in the use of social networks such as security and unproductive behavior which should not be neglected (Ngonidzashe, 2013).
Students	1. Due to the use of social networks for educational purposes, students are given the opportunity to invest more effort in the development of their projects, with the possibility of showing their creativity to the broader audience. 2. In addition to the assessment by professors, crowdvoting takes into account the opinions of other evaluators such as peer colleagues. This could encourage students' participation in the educational process and develop their social skills. 3. Public recognition may have an impact on their future career and provide a reference for further work.

Research has shown that in this case, the use of crowdvoting techniques is possible and has potential but with certain limitations. The main limitation is that the research was conducted solely within the course of 3D modeling and animation. Thus, it is not possible to guarantee that these results are applicable to other educational contexts. Authors of this paper, however, believe that this kind of competition can be applied to other courses and environments as well. An additional limitation is self-marketing by some candidates which resulted in them getting more likes from friends and family members than from peers. In fact, a method of preventing candidates' self-marketing should be devised. In this way, the voting would have been exclusively based on the quality and creativity of the project (i.e., being acquainted with the candidate would have no effect on the voting results). However, the focus of our research was on increasing student engagement, interest, and participation, not on constraints of crowdvoting.

The possibilities of using crowdvoting/sourcing in education are still on a low level and have to be fueled in future research. Further research should be conducted in order to explore topics such as social engineering, negative marketing, as well as motivation for voting and taking a part in the competition. Taking into account that crowdvoting and other crowdsourcing techniques are rather a philosophy than a well-established concept, it is of great importance to investigate how to implement them in different contexts. Understanding all the challenges in implementation of crowdvoting could be of great interest for both academia and practitioners in order to enhance students' motivation and participation, particularly within millennial generations.

References

Abrahim, S., Mir, B. A., Suhara, H., & Sato, M. (2018). Exploring Academic use of online social networking sites (SNS) for language learning: Japanese students' perceptions and attitudes towards facebook. *Journal of Information Technology & Software Engineering, 8(1)*, 1-5. doi:10.4172/2165-7866.1000223

Al-Jumeily, D., Hussain, A., Alghamdi, M., Dobbins, C., & Lunn, J. (2015). Educational crowdsourcing to support the learning of computer programming. *Research and Practice in Technology Enhanced Learning, 10*(13), 1-15. doi:10.1186/s41039-015-0011-3

Baranek, L. K. (1996). *The effect of rewards and motivation on student achievement.* (Master's Thesis). Grand Valley State University, Allendale, Michigan.

Barker, T., & Bennett, S. (2011). Marking complex assignments using peer assessment with an electronic voting system and an automated feedback tool. *International Journal of e-Assessment, 1*(1), 1-15. Retrieved from https://uhra.herts.ac.uk/bitstream/handle/2299/13346/906796.pdf?sequence=2&isAllowed=y

Bevan, J., Gomez, R., & Sparks, L. (2014). Disclosures about important life events on Facebook: Relationships with stress and quality of life. *Computers in Human Behavior, 39*, 246–253. doi:10.1016/j.chb.2014.07.021

Bogdanović, Z., Labus, A., Simić, K., Ratković-Živanović, V., & Milinović, S. (2015, July). Harnessing crowdvoting to support students' creativity. In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.), *EDULEARN15 Proceedings: 7th International Conference on Education and New Learning Technologies* (pp. 4318-4326). Barcelona, Spain: IATED.

Brady, K. P., Holcomb, L. B., & Smith, B. V. (2010). The use of alternative social networking sites in higher educational settings: A case study of the e-learning benefits of ning in education. *Journal of Interactive Online Learning, 9*(2), 151-170. Retrieved from http://www.ncolr.org/jiol/issues/pdf/9.2.4.pdf

Buecheler, T., Sieg, J., Füchslin, R., & Pfeifer, R. (2010). Crowdsourcing, open innovation and collective intelligence in the scientific method: a research agenda and operational framework. In H. Fellermann, M. Dörr, M. M. Hanczyc, L. L. Laursen, S. E. Maurer, D. Merkle, ... S. Rasmussen (Eds.), *Artificial Life XII - Twelfth international conference on the synthesis and simulation of living systems* (pp. 679-686). Cambridge, Massachusetts: MIT Press. Retrieved from https://archive.org/details/ArtificialLifeXII/page/n1

Chau, P. (2010). Online higher education commodity. *Journal of Computing in Higher Education , 22*(3), 177-191. DOI: 10.1007/s12528-010-9039-y

Chen, W., & Lee, K. (2013). Sharing, liking, commenting, and distressed? The pathway between Facebook interaction and psychological distress. *Cyberpsychology, Behavior, and Social Networking, 16*(10), 728–734. doi:10.1089/cyber.2012.0272

Cubillo, J. M., Sánchez, J., & Cerviño, J. (2006). International students' decision-making process. *International Journal of Educational Management, 20*(2), 101-115. DOI: 10.1108/09513540610646091

Dietrich, A., & Amrein, S. (2016). *Crowdfunding monitoring*. Switzerland: Institute of Financial Services Zug IFZ.

Doleck, T., & Lajoie, S. (2018). Social networking and academic performance: A review. *Education and Information Technologies, 23*(1), 435–465. DOI: 10.1007/s10639-017-9612-3

Dougiamas, M., & Taylor, P. C. (2003). Moodle: Using learning communities to create an open source course management system. In *Proceedings of EdMedia + Innovate Learning 2003* (pp. 171–178). Waynesville, NC: Association for the Advancement of Computing in Education (AACE).

Griesemer, J. A. (2014). Using social media to enhance students' learning experiences. *Quality Approaches in Higher Education, 3*(1), 8-11. Retrieved from http://asq.org/edu/2014/03/best-practices/using-social-media-to-enhance-students-learning-experiences.pdf

Hassan, N. H., & Rahim, F. A. (2017). The rise of crowdsourcing using social media platforms: Security and privacy issues. *Pertanika Journal of Science & Technology, 25*, 79-88. Retrieved from http://www.pertanika.upm.edu.my/Pertanika%20PAPERS/JST%20Vol.%2025%20(S)%20Oct.%202017/07%20JST(S)-0403-2017-2ndProof.pdf

Howe, J. (2006). The rise of crowdsourcing. *Wired Magazine, 14(6)*, 1-4. Retrieved from https://sistemas-humano-computacionais.wdfiles.com/local--files/capitulo%3Aredes-sociais/Howe_The_Rise_of_Crowdsourcing.pdf

Howe, J. (2009). *Crowdsourcing: How the power of the crowd is driving the future of business*. New York, NY: Random House Books.

Hung, H., & Yuen, S. (2010). Educational use of social networking technology in higher education. *Teaching in Higher Education, 15*(6), 703–714. DOI: 10.1080/13562517.2010.507307

Junco, R., Heiberger, G., & Loken, E. (2011). The effect of Twitter on college student engagement and grades. *Journal of Computer Assisted Learning, 27*(2), 119–132. DOI: 10.1111/j.1365-2729.2010.00387.x

Kennedy, G. E., & Cutts, Q. I. (2005). The association between students' use of an electronic voting system and their learning outcomes. *Journal of Computer Assisted learning, 21*, 260–268. DOI: 10.1111/j.1365-2729.2005.00133.x

Keppell, M., Au, E., Ma, A., & Chan, C. (2006). Peer learning and learning-oriented assessment in technology-enhanced environments. *Assessment & Evaluation in Higher Education, 31*(4), 453–464. DOI: 10.1080/02602930600679159

Kibble, J. (2007). Use of unsupervised online quizzes as formative assessment in a medical physiology course: effects of incentives on student participation and performance. *Advances in Physiology Education, 31*, 253-260. DOI: 10.1152/advan.00027.2007

Kross, E., Verduyn, P., Demiralp, E., Park, J., Lee, D. S., Lin, N. ... Ybarra, O. (2013). Facebook use predicts declines in subjective well-being in young adults. *PloS One, 8*(8). doi:10.1371/journal.pone.0069841

Labus, A., Despotović-Zrakić, M., Radenković, B., Bogdanović, Z., & Radenković, M. (2015). Enhancing formal e-learning with edutainment on social networks. *Journal of Computer Assisted Learning, 31*(6), 592–605. DOI: 10.1111/jcal.12108

Labus, A., Simić, K., Vulić, M., Despotović-Zrakić, M., & Bogdanović, Z. (2012). *An Application of social media in elearning 2.0*. Paper presented at the 25th Bled eConference, eDependability: Reliable and Trustworthy eStructures, eProcesses, eOperations and eServices for the Future, Bled, Slovenia (pp. 557–572). Retrieved from http://aisel.aisnet.org/bled2012/41

Macià, M., & Garcia, I. (2017). Properties of teacher networks in twitter: Are they related to community-based peer production? *International Review of Research in Open and Distributed Learning, 18*(1), 110-140. DOI: 10.19173/irrodl.v18i1.2644

Madge, C., Meek, J., Wellens, J., & Hooley, T. (2009). Facebook, social integration and informal learning at university: 'It is more for socialising and talking to friends about work than for actually doing work'. *Learning, Media and Technology, 34*(2), 141-155. DOI: 10.1080/17439880902923606

Mason, R., & Rennie, F. (2007). Using web 2.0 for learning in the community. *Internet and Higher Education, 10*(3), 196-203. DOI: 10.1016/j.iheduc.2007.06.003

McLuckie, J., & Topping, K. J. (2004). Transferable skills for online peer learning. *Assessment & Evaluation in Higher Education, 29*(5), 563–584. DOI: 10.1080/0260293041000l689144

Mesipuu, M. (2012). Translation crowdsourcing and user-translator motivation at Facebook and Skype. *Translation Spaces, 1*(1), 33–53. DOI: 10.1075/ts.1.03mes

Moogan, Y. J., Baron, S., & Harris, K. (1999). Decision-making behaviour of potential higher education students. *Higher Education Quarterly, 53*(3), 211–228 . DOI: 10.1111/1468-2273.00127

Moskaliuk, J., Kimmerle, J., & Cress, U. (2009). Wiki-supported learning and knowledge building. *Journal of Computer Assisted Learning, 25*(6), 549–561. DOI: 10.1111/j.1365-2729.2009.00331.x

Ngonidzashe, Z. (2013). Challenges and perceptions towards use of social media in higher education in Zimbabwe: a learners' perspective. *International Journal of Scientific & Engineering Research*, *4*(5), 242-249. Retrieved from https://www.ijser.org/researchpaper/Challenges-and-perceptions-towards-use-of-social-media-in-higher-education-in-Zimbabwe.pdf

Pedersen, J., Kocsis, D., Tripathi, A., Tarrell, A., Weerakoon, A., Tahmasbi, N. ... deVreede, G.-J. (2013). Conceptual foundations of crowdsourcing: A review of IS research. In R. H. Sprague, Jr. (Ed.), *Proceedings of the 46th Annual Hawaii International Conference on System Sciences* (pp. 579 - 588). Wailea, Maui, HI, USA: IEEE. DOI: 10.1109/HICSS.2013.143

Rahim, F. A., Ismail, Z., & Samy, G. N. (2014). Information privacy concerns in the use of social media among healthcare practitioners: A systematic literature review. *Advanced Science Letters*, *20*, 2176-2179. doi:10.1166/asl.2014.5659

Raut, V., & Patil, P. (2016). Use of social media in education: Positive and negative impact on the students. *International Journal on Recent and Innovation Trends in Computing and Communication* , *4*(1), 281-285. Retrieved from https://lessonnote.net/wp-content/uploads/2019/01/1455261816-12-02-2016.pdf

Recker, M., Yuan, M., & Ye, L. (2014). Crowdteaching: Supporting teaching as designing in collective intelligence communities. *The International Review of Research in Open and Distributed Learning*, *15*(4), 138-160. DOI: 10.19173/irrodl.v15i4.1785

Reeve, J. (2009). Why teachers adopt a controlling motivating style toward students and how they can become more autonomy supportive. *Educational Psychologist*, *44*(3), 159-175. DOI: 10.1080/00461520903028990

Roblyer, M., McDaniel, M., Webb, M., Herman, J., & Witty, J. V. (2010). Findings on Facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites. *Internet and Higher Education*, *13*, 134–140. DOI: 10.1016/j.iheduc.2010.03.002

Sarwar, A., & Khan, M. N. (2013). A review of trust aspects in cloud computing security. *International Journal of Cloud Computing and Services Science*, *2*(2), 116–122. DOI: 10.11591/closer.v2i2.1840

Selwyn, N. (2012). Social media in higher education. In A. Gladman, (Ed.) *The europa world of learning* (62nd edition; pp. 3-7). London, United Kingdom: Routledge.

Seoane, M., & Smink, J. (1991). *Incentives and education. A series of solutions and starategies (No. 4).* National Dropout Prevention Center, Clemson, SC. Retrieved from https://files.eric.ed.gov/fulltext/ED341920.pdf

Siribunnam, S., Nuangchalerm, P., & Jansawang, N. (2014). Socio-scientific decision making in the science classroom. *International Journal for Cross-Disciplinary Subjects in Education*, *5*(4), 1777-1782. DOI: 10.1155/2013/309894

Skaržauskaite, M. (2012). The application of crowd sourcing in educational activities. *Social Technologies, 2*(1), 67–76. Retrieved from https://www3.mruni.eu/ojs/social-technologies/article/view/145

Skiner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the shool year. *Journal of Educational Psychology, 85*(4), 571-581. DOI: 10.1037/0022-0663.85.4.571

Sloggett, B. B. (1971). Use of group activities and team rewards to increase individual classroom productivity. *Teaching Exceptional Children, 3*(2), 54-66. doi:10.1177/004005997100300201

Solemon, B., Ariffin, I., Din, M. M., & Anwar, R. M. (2013). A review of the uses of crowdsourcing in higher education. *International Journal of Asian Social Science, 3*(9), 2066-2073. Retrieved from http://www.aessweb.com/pdf-files/ijass-si-3(9)-2066-2073.pdf

Standing, S., & Standing, C. (2017). The ethical use of crowdsourcing. *Business Ethics: A European Review 2017*, 1-9. DOI: 10.1111/beer.12173

Starbird, K. (2012, April). *What "crowdsourcing" obscures: Exposing the dynamics od connected crowd work during disaster.* Presented at Collective Intelligence conference, Social and Information Networks, Computers and Society. Cambridge, MA. Forthcoming. doi:abs/1204.3342

Stiller-Reeve, M. A., Heuzé, C., Ball, W. T., White, R. H., Messori, G., van der Wiel, K. ... Kumer, V. (2016). Improving together: Better science writing through peer learning. *Hydrology and Earth System Sciences, 20*(7), 2965–2973. DOI: 10.5194/hess-20-2965-2016

Surowiecki, J. (2005). *The wisdom of crowds.* New York, NY: Anchor Books.

Tariq, W., Mehboob, M., Khan, M. A., & Ullah, F. (2012). The impact of social media and social networks on education and students of Pakistan. *IJCSI International Journal of Computer Science, 9*(4), 407-411. Retrieved from https://www.ijcsi.org/papers/IJCSI-9-4-3-407-411.pdf

Traunmueller, M., & Schieck, A. F. (2013). Introducing the space recommender system: How crowd-sourced voting data can enrich Urban Exploration in the digital Era. *Proceedings of the 6th International Conference on Communities and Technologies* (pp. 149-156). New York, NY: ACM. Doi: 10.1145/2482991.2482995

Vural, Ö. F. (2015). Positive and negative aspects of using social networks in higher education: A focus group study. *Educational Research and Reviews, 10*(8), 1147-1166. DOI: 10.5897/ERR2015.2144

Wang, C. X., & Kinuthia, W. (2004). Defining technology enhanced learning environments for pre-service teachers. In R. Ferdig, C. Crawford, R. Carlsen, N. Davis, J. Price, R. Weber, & D. A. Willis (Eds.), *Proceedings of SITE 2004—Society for Information Technology & Teacher Education International Conference* (pp. 2724–2727). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE). Retrieved from https://www.learntechlib.org/p/13252/

Wang, G., Gill, K., Mohanlal, M., Zheng, H., & Zhao, B. Y. (2013). *Wisdom in the social crowd: An analysis of quora*. Presented at the 22nd International World Wide Web Conference, Rio de Janeiro, Brazil (pp. 1341–1352). DOI: 10.1145/2488388.2488506

Waycott, J., Thompson, C., Sheard, J., & Clerehan, R. (2017). A virtual panopticon in the community of practice: Students' experiences of being visible on social media. *The Internet and Higher Education, 35*, 12-20. DOI: 10.1016/j.iheduc.2017.07.001

Yuen, S. C.-Y., & Yuen, P. K. (2008). Social networks in education. In C. Bonk, M. Lee & T. Reynolds (Eds.), *Proceedings of E-Learn 2008, World Conference* (pp. 1408–1412). Las Vegas, NV: Asscoiation of the Advancement of Computing in Education (AACE).

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Gamifying Online Tests to Promote Retrieval-Based Learning

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Abstract

Recent findings have provided strong evidence that retrieval-based learning is an effective strategy for enhancing knowledge retention and long-term meaningful learning, but it is not a preferred learning strategy for the majority of students. The present research analyzes the application of learning gamification principles in online, open-book, multiple-choice tests in order to motivate students to engage in repeated retrieval-based learning activities. The results reveal a strong positive correlation between the number of successful retrieval attempts in these tests that cover content from the course textbook, and long-term knowledge retention as demonstrated in a live, final, closed-book, cumulative exam consisting of multiple-choice, labeling, definitions, and open-ended questions covering the content of both textbook readings and lectures. The presented results suggest that online, open-book tests designed using gamification principles, even when covering partial course content and one type of questions, are an effective strategy for using educational technology to motivate students to repeatedly engage in retrieval-based learning activities and improve long-term knowledge retention, regardless of the course delivery mode.

Keywords: gamification, retrieval-based learning, multiple-choice tests, online, learning management system, learning analytics

Introduction

Regardless of course delivery mode (face-to-face, blended, or online), the challenge often encountered by the author as an instructional designer is to devise instructional strategies that motivate students to study frequently and not procrastinate. This is particularly important for student success in content-heavy courses such as first- or second-year science courses, which usually cover a broad range of declarative knowledge and numerous concepts as a foundation for further studies. Additionally, these courses are typically offered in a traditional face-to-face format and experience large enrollment numbers, the combination of which can pose a challenge for effective and efficient formative assessment and feedback, which are essential to supporting learning success. Despite the aforementioned challenges, students in these courses certainly benefit from any learning activity that can help them integrate and retain the knowledge they need to master, and they deserve the effort invested by course designers to devise such activities.

Retrieval-Based Learning

Recent findings have provided strong evidence that practicing active retrieval (recall) enhances not only long-term memory but also long-term meaningful learning, supporting the claim that these types of learning strategies could be more effective than many currently popular “active learning” strategies (Blunt & Karpicke, 2011). This confirms that what has traditionally been considered as learning—the “importing” of new information and its integration with existing knowledge—is only one aspect of the learning process, and that another equally important aspect of learning consists of the retrieval processes; specifically, those “involved in using available cues to actively reconstruct knowledge” (Karpicke, 2012, p. 158). According to Nunes and Karpicke (2015), although the idea that practicing active recall improves learning has existed for centuries, it has undergone a significant revival with increased interest owing to the integration of cognitive science research and educational practice. Nunes and Karpicke use the term “retrieval-based learning” to encompass both the instructional strategies that promote this type of learning and the fact that the process of retrieval itself enhances learning. Although there is strong evidence supporting its effectiveness, research also shows that retrieval is still not a learning strategy of choice for the majority of students, nor are they aware of its positive effects (Karpicke, 2012).

One of the main tasks of instructional designers is to identify strategies to make learning experiences effective and efficient, and to improve knowledge retention. Furthermore, they need to find ways to both extrinsically and intrinsically motivate learners to engage in learning activities that normally require significant effort and include the experience of failure. Black and Wiliam (2010) note that if they have a choice, students will avoid difficult tasks; they also point to a “fear of failure” that can be detrimental for learning success. Although making mistakes and experiencing failure are essential experiences in every learning process, “pupils who encounter difficulties are led to believe that they lack ability” (Black & Wiliam, 2010, p. 6). Motivating students to persist with repeated engagement in activities that incorporate the experience of both difficulty and failure is a real instructional design challenge, clearly articulated by Karpicke (2012) in the conclusion of his article: “The central challenge for future research will be to continue identifying the most effective ways to use retrieval as a tool to enhance meaningful learning” (p. 162).

The present research attempts to tackle this challenge and to examine ways to motivate students to engage in difficult learning activities that can result in meaningful learning and knowledge retention. The approach examined in this research is the implementation of distributed, open-book, online tests covering relevant content from the adopted textbook, in a foundational, second-year, high-enrollment, core neuroscience course. To motivate students to *repeatedly* engage in these activities, some gamification principles were used. Data analytics from Moodle, a learning management system (LMS), were used to examine student engagement patterns and retrieval success in online tests, while statistical analysis was applied to determine their correlation with long-term knowledge retention as demonstrated in a live, final, cumulative, closed-book summative assessment.

Multiple-Choice Tests for Retrieval-Based Learning

There are many ways to implement retrieval-based learning, with tests being the most researched. Smith and Karpicke (2014) investigated the effectiveness of retrieval practice with different question types (short-answer, multiple-choice, and hybrid) and concluded that retrieval practice with each of these question forms can enhance knowledge retention when compared to a study-only condition. However, short-answer questions must be graded manually, which requires more time. The learning effects are better if students receive feedback in the form of correct answers. This is also not easy to administer with short-answer questions, but it is possible with multiple-choice questions, making them a better solution if we are not able to provide efficient feedback for other question forms. Smith and Karpicke (2014) provide evidence from multiple pieces of published research (Kang, McDermott, & Roediger, 2007; McDaniel, Roedriger, & McDermott, 2007; Pyc & Rawson, 2009) that seem to indicate that the need for corrective feedback during the process of learning, along with the balance between retrieval difficulty (questions and problems that require more cognitive effort to answer, such as short-answer questions) and retrieval success (questions and problems that result in more correct answers, such as multiple-choice questions), leads to a consideration for hybrid tests (e.g., a mix of short-answer and multiple-choice questions) as likely the most effective retrieval-practice solution.

Several other studies have provided evidence for the effectiveness of multiple-choice tests as tools to promote learning (Little, Bjork, Bjork, & Angello, 2012; Smith & Karpicke, 2014; Cantor, Eslick, March, Bjork, & Bjork, 2015; Little & Bjork, 2015). According to Little and Bjork (2015), if multiple-choice tests are optimized by properly constructing competitive and plausible alternatives and developing items that assess beyond the knowledge level, they are effective for learning even non-tested information. There is a belief, though, in some parts of the education community that the “testing effect” does not apply to complex materials, but that view has been challenged by Karpicke and Aue (2015), who provide evidence from previous research that this assumption is not correct. Nunes and Karpicke (2015) remind us that the “testing effect” *is* the effect of active retrieval, which, Karpicke and Aue (2015) emphasize, has been repeatedly proven to have positive effects on meaningful learning of complex materials.

Despite previously discussed research that has provided evidence that practicing active retrieval promotes meaningful learning, according to Grimaldi and Karpicke (2014), three major application problems present challenges to the implementation of this learning strategy: 1) a lack of student awareness about the effectiveness of a study method, 2) a lack of student willingness to repeatedly retrieve material, and 3) student inability to correctly evaluate the success of their retrieval attempts. Based on research by Grimaldi and Karpicke (2014), students struggle with all three of these components necessary for success of retrieval-based learning activities. For this reason, they support the use of computer-based approaches with automated scoring and feedback to aid students in getting the most out of the available learning strategies. In the present research, a novel approach of applying gamification principles to motivate students to engage in repeated retrieval by taking online tests, while receiving automated feedback, was analyzed as a potential solution to two out of three problems outlined by Grimaldi and Karpicke (2014): a lack of student willingness to repeatedly retrieve material and student inability to correctly evaluate the success of their retrieval attempts.

Learning Gamification

When applied in the field of education, the term "gamification" typically does not refer to playing games but is "broadly defined as the application of game features and game mechanics in a nongame context" (Becker & Nicholson, 2016, p. 62). Some of the core game mechanics include the use of task levels with progressively increasing difficulty, "unlocking" subsequent levels when you reach a certain mastery skill requirement, and an experience of failure not as a deterrent, but as a natural component of the skill-building and learning process. By carefully manipulating our internal mental reward system (assisted by brain transmitters often called "pleasure chemicals," such as dopamine), game mechanics keep players "hooked" in a continuous task-failure-success upward spiral, contrary to our natural inclination to give up when the task seems unachievable or after repeated failure.

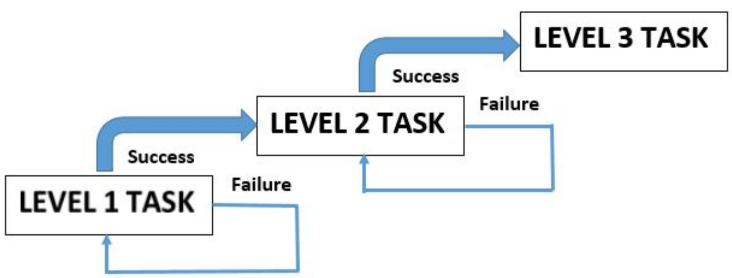

Figure 1. Typical game mechanics.

Even more surprisingly (if we are not familiar with the effects of dopamine), after achieving a goal, a player is typically looking for a bigger challenge, unconsciously hoping for the next level of intrinsic reward in a form of mental pleasure if the challenge is successfully tackled. This typical game activity structure is very conducive to learning, which naturally requires taking on challenges at a progressively increased cognitive level, so it comes as no surprise that gamification strategies are becoming more popular in education.

As suggested by Zichermann and Cunningham (2011), designers who plan a gamification system first must identify behaviours they wish to encourage. The behaviours to be encouraged in this research study were frequent and repeated engagement with (studying from) a textbook and pausing to test comprehension and knowledge retention. A typical student usually does not close a textbook after studying, voluntarily answering the questions posed at the end of each chapter, then checking for correct answers. On the

contrary, research shows that the “majority of students indicated that they repeatedly read their notes or textbook while studying,” and if they engage in any self-testing activity, “they do it to generate feedback or knowledge about the status of their own learning, not because they believe practicing recall itself enhances learning” (Karpicke, Butler, & Roediger, 2009, p. 477). Therefore, to engage students in learning activities that are not their first choice, some innovative strategies in course design must be employed.
The usual assessment approach, particularly in online and blended courses, is to design graded online tests and distribute them at a certain frequency in the course schedule. From this author’s perspective, if a face-to-face course can use a LMS, the course can be enriched by taking advantage of technological affordances in a similar way. However, when conducting online tests purely as an assessment activity, as students feel that they have no room for mistakes that can “cost” them a grade percentage, the temptation rises to look for “alternative ways” to answer questions correctly and earn a good grade. Students might try to pair up with another student to take the test, ask an expert for help, or extensively consult available resources. The desired behavior in this study was that students *repeatedly* engage with the content, on their own, with minimal consultation with outside resources. This required providing opportunities for several test attempts, allowance for mistakes without penalty, and rewards for those who follow suggestions for using the available activities in the most effective way. In essence, the goal was to transform a typical formative or summative assessment activity, a multiple-choice test, into a learning activity, and to accomplish this, some game mechanics were borrowed and implemented in online, bi-weekly tests.
The goal of the present research was to observe a variety of student-activity engagement behavioral patterns and retrieval success in bi-weekly tests, and to look for possible correlations between them and long-term knowledge retention as demonstrated by a live, final, cumulative exam.

Method

Design

This was a correlational study in which the FE test score was the Final Exam score for the student and MTL1A was the total number of mastery test Level 1 attempts. Specifically, the study examined the relationship between live Final Exam test scores, and the number of online Level 1 test attempts that students completed at the mastery level. In this context, mastery means achieving a grade of 80% or higher.

Participants

Over 200 students in a second-year core neuroscience course in an Ontario post-secondary institution were participants in this retrospective study. Ethics approval was granted to retroactively collect and examine student online activity engagement and success data from Moodle (upon completion of the term), which means that students were not aware of the study while taking the course. The class was a combination of an “in-class” cohort, and a “distance” cohort; the “in-class” cohort of students attended live lectures that were video recorded, while students in a “distance” cohort opted to watch recorded lectures (“video on demand”) at their discretion, instead of attending a live class. However, if “distance” students wanted to attend live lectures, they were encouraged to do so. Similarly, “in-class” students had the option to purchase a recording of live lectures and re-watch them at their discretion. Data were complete for 200 of 204 students who finished all required components of the course, and whose final exam test score indicated that they took the final exam. Data for the four students whose final exam test score was entered in the Moodle gradebook as “0” were removed from the research data pool because it is highly unlikely that a student who had not withdrawn from the course and who took a final exam would receive a score of “0”. The more likely explanation is that a student did not take the final exam before the grades were collected from Moodle.

Course Description

The content for the course was available to students from two main sources: the textbook and lectures. While the textbook remained as an important learning resource, live lectures supplemented the textbook in order to assist students grasp more difficult concepts. Lecture slides and required weekly textbook chapter readings were posted on the LMS, and online communication was housed in Moodle as ungraded discussion forums. In terms of graded assessment activities, all students, regardless of how they decided to attend lectures, engaged in bi-weekly online tests, and took part in live midterm and final exams. Midterm and final exams were based on the content of both the lectures and the assigned textbook chapter readings, while online tests were based solely on the content of the textbook. Moodle records student activity (e.g., when a student took a test, the answers he or she selected in multiple-choice questions, the test score earned on each test taken, the time it took the student to finish the test, etc.) and allows users with higher role privileges, such as teachers or instructional designers, to look into this information and analyze the success of instructional strategies they have implemented in the online portion of the course.

The Frequency and Structure of Online Tests

Six bi-weekly online tests were designed in Moodle. The textbook publisher provided multiple-choice, short answer, and labeling textbook review questions in a digital format, out of which more than 1,500 questions from the assigned chapter readings were selected to build a question bank for the course. The study adopted a categorization of question bank items as provided by the publisher, where all questions were assigned a cognitive difficulty level of either “easy,” “medium,” or “hard.” Although labeling questions were common in the live midterm and final exams, the version of Moodle used in this course did not allow for this type of question. Before they were entered into the question bank, they were transformed into “matching” questions (match the image with a correct label). Multiple-choice, short answer, and matching questions were used to populate a Moodle question bank, from which the bi-weekly test questions were pulled (Figure A1). Questions were then sorted based on the chapters that were covered in a two-week study period and question type in order to design two test levels: Level 1 and Level 2.

Level 1 tests consisted of 10 multiple-choice questions, each with four possible answers (one correct and three distractors) taken from designated chapter readings, where the questions were pulled randomly from a question bank in a defined pattern: four “easy,” four “medium,” and two “hard” questions per Level 1 test (Figure A2). Students would log onto the course at their preferred time during the week when the test was open and had 60 minutes to complete the Level 1 test. Access to correct answers was not provided during the test or immediately after taking the test; it was made available after the test had been closed for a week. Immediately after taking the Level 1 test, students saw their test score as a percentage out of 100%. Students could earn a maximum of 2% of the course grade by completing each Level 1 test with a 100% success rate.

The format of the exam questions impacts the level of success. Consistent with the work of Smith and Karpicke (2014), short-answer exam questions, which typically require answer construction, are usually considered more difficult in terms of retrieval, while multiple-choice questions, which require answer selection, yield more retrieval success. Hence, to enrich student learning, a hybrid model that combines multiple-choice and short-answer questions may be optimal. As Smith and Karpicke (2014) point out, "hybrid formats can be used to balance retrieval difficulty and retrieval success" (p. 799). Therefore, Level 2 tests were designed to consist of two questions of higher retrieval difficulty–typically one short answer and one labeling question–pulled randomly from a question bank for bi-weekly chapter readings. However, students had to "earn" the right to "play" the next test "level."

Gamifying Online Tests

Even when students use retrieval practice as a study strategy, according to Grimaldi and Karpicke (2014), "they do not tend to practice repeated retrieval (additional retrieval beyond recalling items once)," and they "have great difficulty evaluating the accuracy of their own responses" (p. 2). To motivate students to engage with the textbook and repeatedly practice retrieval, bi-weekly tests were designed using the following gamification principles: multiple test attempts without penalty, test levels with progressively increasing difficulty, and advancement to the next test level based on "mastery" of the previous one.

Students were only allowed to take a Level 2 test for the week if they reached a "mastery level," set as 80% or more success, on the Level 1 test. This is an example of test levels with progressively increasing difficulty and an advancement to the next test level based on the "mastery" of the previous one. To motivate students to keep trying, they were given five opportunities to achieve mastery on the Level 1 test, while only the highest Level 1 test score out of all attempts was recorded in the Moodle gradebook. This is an example of multiple test attempts without penalty. By taking a Level 1 test up to five times, students were, potentially, exposed to new questions, although some questions would repeat since they were randomly pulled from the question bank. There was no minimal time delay set in the test design, which means that students could take a Level 1 test again immediately after the previous attempt.

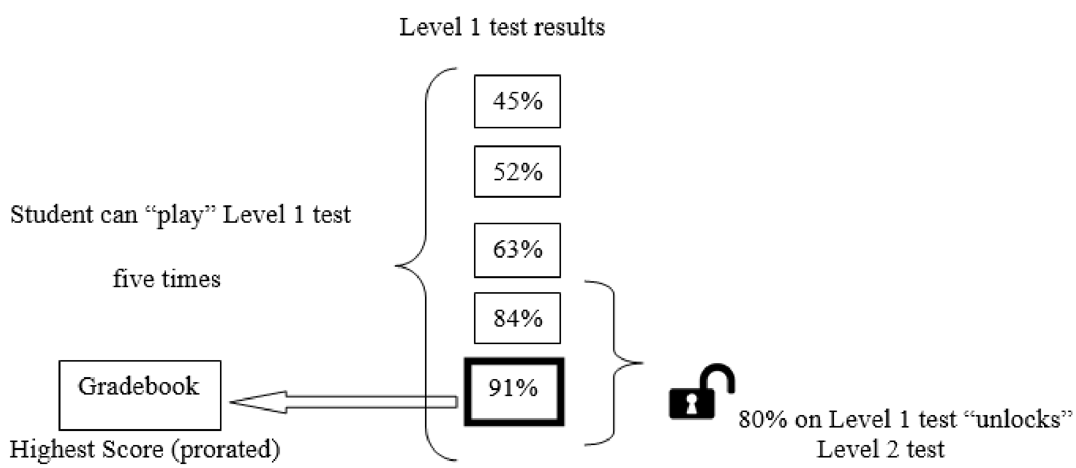

Figure 2. Online test mechanics with applied gamification principles.

Overall, to encourage students to attempt Level 1 tests more than once, several motivational and gamification strategies were used:

- Students could attempt a Level 1 test up to five times each week when the test was open.
- Out of the five available Level 1 test attempts, only the best test score was recorded in a Moodle gradebook (prorated, based on success); therefore, students could not lose a test grade if they took the Level 1 test more than once; they could only improve their grade, and get exposed to more questions, if they "played" the test more times. This approach, borrowed from games, allows for mistakes during repeated attempts, which are essential learning events.
- Upon completion of each Level 1 test, a motivational message was displayed for the students ("overall feedback" in Moodle), congratulating them if they scored high, and encouraging them to keep "playing" if they could still improve their test grade.
- If a student scored 80% or higher on a Level 1 test ("mastery level"), the Level 2 test would "unlock." Students could only take Level 2 tests once and earn up to an additional 2% of the final grade per test if they managed to score 100%, or they received a prorated grade.
- Out of six bi-weekly tests, the lowest combined score (Level 1 test best grade + Level 2 test grade) would get "dropped" by the Moodle gradebook, so that only the "best five" combined weekly test grades would be used for the final course grade calculations.
- Students were told (in class and in the course syllabus) that a selection of the test questions would be repeated in the live midterm and final exam, as an incentive to get exposed to as many questions as possible by taking Level 1 tests more than once, and "unlocking" Level 2 tests.

Table 1

Comparison Between Major Assessments in the Course

Assessment characteristic	Midterm exam and final exam	Level 1 tests	Level 2 tests
Content tested	lectures and textbook	textbook	textbook
Testing environment	live	online	online
Testing condition	closed-book	open-book	open-book
Types of questions	multiple-choice short answer definitions labeling	multiple-choice	short answer matching
% of final course grade	35% (Midterm Exam) 45% (Final Exam)	10% (6 Tests, 2% each, lowest grade "dropped")	10% (6 Tests, 2% each, lowest grade "dropped")

Distributed bi-weekly, open-book, unsupervised, graded online activities in the format of tests were worth a maximum of 20% of the course grade, while the closed-book, live midterm exam was worth a maximum of 35% of the course grade, and the closed-book, live, final cumulative exam was worth a maximum of 45% of the course grade.

Results and Discussion

Smith and Karpicke (2014) suggest that it is not only the number of times students practice retrieval that influences long-term knowledge retention but also how successful they are during the retrieval process. Therefore, we decided to examine the following research variables:

> **TL1A** (Test Level 1 Attempts) – total number of times a student attempted Level 1 online tests for the duration of the course (maximum is 30; six tests with five available attempts each)
>
> **MTL1A** (Mastery Test Level 1 Attempts) - total number of times a student reached mastery level (80% or more correct) on Level 1 online test attempts (maximum is 30; six tests with five available attempts each)
>
> **ME** (Midterm Exam test score) – live exam (percentage, maximum is 100%)
>
> **FE** (Final Exam test score) – live exam (percentage, maximum is 100%)

We first looked at the correlation between the number of Mastery Test Level 1 Attempts (MTL1A, max=30) and the Final Exam test score (FE, max=100%), for N=200.

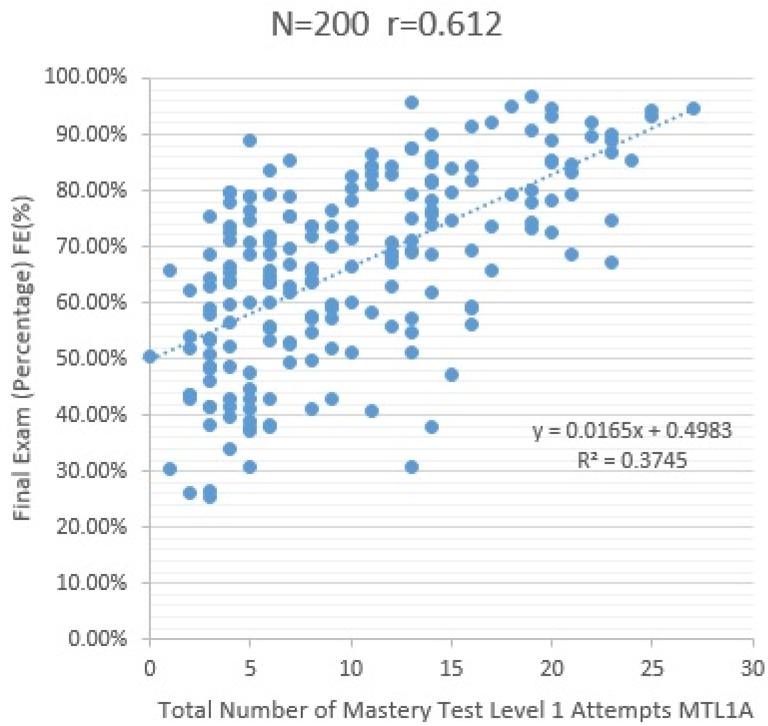

Figure 3. Scattergram showing the correlation between MTL1A and FE for N=200.

As Figure 3 indicates, there is a strong positive correlation (r = 0.612) between the number of Mastery Test Level 1 Attempts (MTL1A, max=30) and the Final Exam test score (FE, max=100%). The independent variable MLT1A explains 37.5% of the variability in the FE variable (Table A1).

For comparison, we looked at the correlation between the Midterm Exam test score (ME) and the Final Exam test score (FE):

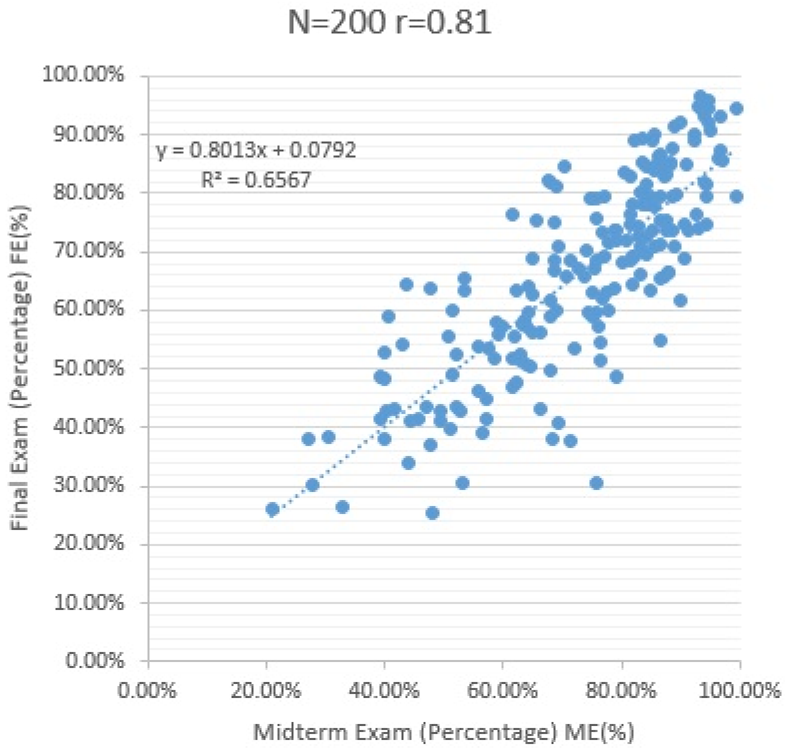

Figure 4. Scattergram showing the correlation between ME and FE for N=200.

As Figure 4 indicates, there is a strong, positive correlation (r = 0.81) between the live Midterm Exam test score (ME) and the live Final Exam test score (FE). The independent variable ME explains 65.67% of the variability in the FE variable (Table A2).

Table 2 summarizes the results of this research for the entire class (combined in-class and distance students), as well as separately for in-class and distance cohorts. The average number of times students took Level 1 test was similar across the student population, and about 20 out of 30 available attempts. Likewise, the percentage of Level 1 test attempts resulting in mastery achievement (80% or higher) was similar for both cohorts, about 50%.

Table 2

Summary of Research Findings for In-class and Distance Cohorts (Combined and Separate)

Variable\Student cohort	In-class and distance N=200	In-class only N=91	Distance only N=109

Average number of times students took Level 1 test	19.8	20.68	19.04
Average number of times students finished Level 1 tests at mastery level	10.04	10.56	9.61
Correlation between TL1A and MTL1A	r = 0.63 $R^2 = 0.40$	r = 0.59 $R^2 = 0.35$	r = 0.65 $R^2 = 0.43$
Correlation between MTL1A and FE	r = 0.61 $R^2 = 0.375$	r = 0.58 $R^2 = 0.34$	r = 0.63 $R^2 = 0.40$
Correlation between ME and FE	r = 0.81 $R^2 = 0.66$	r = 0.84 $R^2 = 0.71$	r = 0.79 $R^2 = 0.62$

The LMS Moodle allows for monitoring of student online activity and success patterns, and these patterns varied in this course. Some students reached either a mastery level or 100% during early Level 1 test attempts and stopped taking tests before they used up all five available tries. These were the students who seemed concerned only with a good course grade and "unlocking" the Level 2 test; however, they did not use all available opportunities to "play," get exposed to more questions, and test their knowledge. Other students reached Level 1 test mastery level or 100% during early test attempts but kept "playing" until they had exhausted all five attempts. It seems that these students engaged in activities not only to earn a good grade but also for practicing and learning. On the other hand, there were students who did not manage to reach mastery level during early Level 1 test attempts, but gave up early, did not use all five tries, and never managed to unlock the Level 2 test, even though the Level 1 test was open-book and they had nothing to lose (except time and some mental energy). These students did not seem willing, or able, to invest sufficient effort and time in learning activities, even if they could only gain advantages by doing so. Therefore, by randomly observing student behavior when taking Level 1 tests, we found that both the most and least successful students (based on the final course grade) engaged in a similar way with the online activities. The patterns only started to emerge when we statistically analyzed the data collected from the LMS. It was expected that success on midterm and final exams, which used the same assessment tool and testing environment, and covered the same course content sources, would highly correlate (results reveal r = 0.81, $R^2 = 0.66$ for the whole class). In addition, the results of this study indicate that the total number of times students reached mastery in Level 1 test attempts had a strong positive correlation with success on the final exam (r = 0.61, $R^2 = 0.375$). This finding provides support for previously found results which suggest that "actively attempting to retrieve and reconstruct one's knowledge is a simple yet powerful way to enhance long-term, meaningful learning" (Karpicke, 2012, p. 162). Furthermore, Level 1 tests and the final exam assessment environments were different (open vs. closed book, online vs. live), and so was the scope of content covered in these assessment events (textbook vs. textbook and lectures), as well as the type of assessment questions (multiple-choice vs. multiple-choice, labeling, and short-answer). This finding, consistent with findings of Smith and Karpicke (2014), Karpicke and Aue (2015), and Little and Bjork (2015), suggest that benefits of retrieval-based learning activity may transfer to long-term learning even when the retrieval and final assessment events are in different formats, and of different content scope. The results reveal that for the entire class, 37.5% of the variation in Final Exam test scores (FE) could be explained with a single variable, the number of Mastery Test Level 1 Attempts (MTL1A).

The logistics of this retrospective study did not allow for the collection of subjective student feedback; however, students in comparable courses who are exposed to similar online strategies that promote frequent and continuous engagement with course content often report on the positive effects those strategies have on their motivation to study regularly, as well as on their success in the course. It is important to note that students' comments are anecdotal in nature, and it will be necessary to develop more empirical methods to confirm these observations.

In the present study, there was no delay required between repeated Level 1 test attempts. Research supporting spaced learning or "repeated stimuli spaced by periods without stimuli" (Kelley & Whatson, 2013, p. 1), suggests positive effects of test spacing on long-term memory. Further research should examine if introducing a delay between two test attempts (which could be done in Moodle) would result in improved learning effects of repeatedly taking the tests as a retrieval-based learning strategy.

Conclusion

Online, open-book testing is not usually a preferred assessment option for instructors, who fear abundant opportunities for cheating, ranging from consulting notes and textbooks, and compromising the questions, to an inability to identify the person taking the test. Nevertheless, if we shift the focus from *assessment* to *learning*, then online, open-book tests have promising applications. For retrieval-based learning in the form of testing to be effective, students need to get corrective feedback in a timely manner, and online activities with automated scoring, such as multiple-choice tests, are one possible solution to this challenge. Presented findings indicate that applying gamification principles to motivate students to repeatedly engage with online tests, even if they are open-book and unsupervised, could be an effective option for supporting student learning, especially in content-heavy courses.

There are other positive consequences of taking multiple and frequent tests. Soderstrom and Bjork (2014) provide evidence that testing improves students' subsequent self-regulated study habits by making them more aware of the state of their knowledge, so they can make better decisions when regulating their further study behavior. This could have been a factor which, apart from the effects of repeated retrieval, positively affected student success on the final cumulative exam in this study. Furthermore, Agarwal, Karpicke, Kang, Roediger, and McDermott (2008) provided evidence that both open-book and closed-book tests with feedback can produce similar final performances, while students report less anxiety when preparing for open-book tests. This is another argument why open-book, online tests can be used as a powerful tool to support student learning and long-term knowledge retention.

Although there are positive effects of using multiple-choice tests for variety of purposes in education, there is an inherent challenge in the task of designing a large number of good-quality multiple-choice test items. Little et al. (2012) point out that multiple-choice exams have long been used in high-stake professional examinations and certifications, including different branches of medicine, and as a tool whose results are used to determine acceptance in highly competitive academic institutions and programs. However, the process of creating a question bank for those purposes is rather different from a typical process in an educational setting. In the world of high-stake examinations based on multiple-choice tests, significant effort by subject matter experts is put into a peer-reviewed process of constructing multiple-choice questions that have a carefully crafted stem and plausible incorrect alternatives, thus minimizing the possibility of simply "recognizing" the correct answer. The same amount of effort is rarely invested in constructing a question bank in an educational environment, even for the purpose of high-stake assessment, as it normally requires an assembly of a "writing cell" (a group of subject matter experts, usually the instructor and one or more graduate students, who are willing to invest significant time and effort in writing a required number of good quality test items after being trained on this assessment tool design and utilization). This "luxury" is rarely present in post-secondary environments, which, more often than is ideal, results in multiple-choice test items of inconsistent quality, written by course instructors who have not been adequately trained to develop effective items and conduct item analysis. This can, unfortunately, result in the poor reputation of the assessment tool. The present research examined the option of using a textbook publisher-provided question bank (even if the questions are already available to students or have been used by many institutions) by creating a version of a low-stakes formative assessment/learning tool, which gives questions a "second life," and, based on this research, a potentially very valuable one.

Despite the promising effects of the learning approaches implemented in this study, challenges for improving awareness about the effectiveness of these strategies within the teaching community remain, which brings into focus an apparent and growing need for teachers in post-secondary education to either work closely with professionals, such as instructional designers and educational developers, or to engage in professional development programs to gain necessary insight into the latest research on effective learning, and to improve skills needed to design activities that can positively affect students' learning habits and aid the processes of knowledge acquisition and retention.

Regarding the implementation of ubiquitous educational technology such as learning management systems, instead of using such systems primarily as content repositories and platforms for online discussions and assessment, this research suggests that there is a real benefit to using them in the full sense of their name: as technological tools to help students manage learning and succeed in a world with growing demands for mastering complex knowledge and skills. Another useful application of a LMS that can be derived from this research is the effective use of data analytics. Our knowledge about the learning strategies students choose when studying on their own has always been based on self-reported data, which repeatedly confirmed that students often use less efficient study strategies, such as re-reading. In this research, and for the first time, LMS enabled data analytics enabled us to gain a glimpse into student learning behaviors and habits in a "non-invasive" way by retrieving the data for students who had previously completed the course.

The challenge posed by Karpicke (2012), to identify the most effective ways to promote retrieval as a learning strategy, continues. The method described in this study is one example of concrete activities instructors can implement in their course to enhance student learning through the implementation of online retrieval-based learning activities, whether the course mode of delivery is face-to-face, blended, or online. Media might be, as Clark (1983) positioned, "mere vehicles that deliver instruction," (p. 445) but we can strive to invent new and effective ways to "drive" them, benefitting students and their learning success.

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References

Agarwal, P. K., Karpicke, J. D., Kang, S. H. K., Roediger, H. L., & McDermott, K. B. (2008). Examining the testing effect with open- and closed-book tests. *Applied Cognitive Psychology*, *22*, 861–876. doi:10.1002/acp.1391

Becker, K., & Nicholson, S. (2016). Gamification in the classroom: Old wine in new badges (Online document). Retrieved from https://mruir.mtroyal.ca/xmlui/bitstream/handle/11205/268/LEGBOOK_TWO_FINALMANUSCRIPT_112414-CH3-edited.pdf?sequence=1

Black, P., & Wiliam, D. (2010). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan*, *92*(1), 81–90. doi:10.1177/003172171009200119

Blunt, J. R., & Karpicke, J. D. (2011). Retrieval practice produces more learning than elaborative studying with concept mapping. *Science, 331,* 772. doi:10.1126/science.1199327

Cantor, A. D., Eslick, A. N., Marsh, E. J., Bjork, R. A., & Bjork, E. L. (2014). Multiple-choice tests stabilize access to marginal knowledge. *Memory & Cognition, XX,* 1–13. doi:10.3758/s13421-014-0462-6

Clark, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research, 53(4)*, 445–459. doi:10.3102/00346543053004445

Grimaldi, P. J., & Karpicke, J. D. (2014). Guided retrieval practice of educational materials using automated scoring. *Journal of Educational Psychology*, *106,* 58–68. doi:10.1037/a0033208

Kang, S. H. K., McDermott, K. B., & Roediger, H. L. (2007). Test format and corrective feedback modify the effects of testing on long-term retention. *European Journal of Cognitive Psychology*, *19,* 528–558. doi:10.1080/09541440601056620

Karpicke, J. D. (2012). Retrieval-based learning: Active retrieval promotes meaningful learning. *Current Directions in Psychological Science, 21*, 157–163. doi:10.1177/0963721412443552

Karpicke, J. D., & Aue, W. R. (2015). The testing effect is alive and well with complex materials. *Educational Psychology Review*, *27*, 317–326. doi:10.1007/s10648-015-9309-3

Karpicke, J. D., Butler, A. C., & Roediger, H. L. (2009). Metacognitive strategies in student learning: Do students practice retrieval when they study on their own? *Memory*, *17*, 471–479. doi:10.1080/09658210802647009

Kelley, P., & Whatson, T. (2013). Making long-term memories in minutes: A spaced learning pattern from memory research in education. *Frontiers in Human Neuroscience, 7, 589.* doi:10.3389/fnhum.2013.00589

Little, J. L., Bjork, E. L., Bjork, R. A., & Angello, G. (2012). Multiple-choice tests exonerated, at least of some charges: Fostering test-induced learning and avoiding test-induced forgetting. *Psychological Science*, *23*, 1337–1344. doi:10.1177/0956797612443370

Little, J., & Bjork, E. L. (2015). Optimizing multiple-choice tests as tools for learning. *Memory & Cognition*, *43*, 14–26. doi:10.3758/s13421-014-0452-8

McDaniel, M.A., Roediger, H. L., & McDermott, K. B. (2007). Generalizing test-enhanced learning from the laboratory to the classroom. *Psychonomic Bulletin & Review*, *14(2)*, 200–206. doi:10.3758/BF03194052

Nunes, L. D., & Karpicke, J. D. (2015). Retrieval-based learning: Research at the interface between cognitive science and education. In R. A. Scott & S. M. Kosslyn (Eds.), *Emerging trends in the social and behavioral sciences* (pp. 1-16). New York: John Wiley & Sons, Inc. doi:10.1002/9781118900772.etrds0289

Pyc, M. A., & Rawson, K. A. (2009). Testing the retrieval effort hypothesis: Does greater difficulty correctly recalling information lead to higher levels of memory? *Journal of Memory and Language*, *60*, 437–447. doi:10.1016/j.jml.2009.01.004

Smith, M. A., & Karpicke, J. D. (2014). Retrieval practice with short-answer, multiple-choice, and hybrid tests. *Memory*, *22*(7), 784–802. doi:10.1080/09658211.2013.831454

Soderstrom, N. C., & Bjork, R. A. (2014). Testing facilitates the regulation of subsequent study time. *Journal of Memory and Language*, *73*, 99–115. doi:10.1016/j.jml.2014.03.003

Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. Sebastopol, CA: O'Reilly Media.

Appendix A

Moodle Test Structure

CHAPTER 7
- CHAPTER 7 EASY - MCQ - How Do We Study the Brain's Structure and Functions? (10)
- CHAPTER 7 MEDIUM - MCQ - How Do We Study the Brain's Structure and Functions? (68)
- CHAPTER 7 HARD - MCQ - How Do We Study the Brain's Structure and Functions? (10)
- CHAPTERS 7,8 - SHORT ANSWER (37)

CHAPTER 8
- CHAPTER 8 EASY - MCQ - How Does the Nervous System Develop and Adapt? (10)
- CHAPTER 8 MEDIUM - MCQ - How Does the Nervous System Develop and Adapt? (80)
- CHAPTER 8 HARD - MCQ - How Does the Nervous System Develop and Adapt? (7)

CHAPTER 8 - Matching questions with images (3)

CHAPTER 9
- CHAPTER 9 EASY - MCQ - How Do We Sense, Perceive, and See the World? (13)
- CHAPTER 9 MEDIUM - MCQ - How Do We Sense, Perceive, and See the World? (73)
- CHAPTER 9 HARD - MCQ - How Do We Sense, Perceive, and See the World? (11)

Figure A1. Moodle question bank with questions sorted based on cognitive difficulty level.

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1	**Random (CHAPTER 3 EASY - MCQ - What Are the Functional Units of the Nervous System?)** (See questions)
2	**Random (CHAPTER 3 EASY - MCQ - What Are the Functional Units of the Nervous System?)** (See questions)
3	**Random (CHAPTER 4 EASY - MCQ - How Do Neurons Use Electrical Signals to Transmit Information?)** (See questions)
4	**Random (CHAPTER 4 EASY - MCQ - How Do Neurons Use Electrical Signals to Transmit Information?)** (See questions)

Page 2

5	**Random (CHAPTER 3 MEDIUM - MCQ - What Are the Functional Units of the Nervous System?)** (See questions)
6	**Random (CHAPTER 3 MEDIUM - MCQ - What Are the Functional Units of the Nervous System?)** (See questions)
7	**Random (CHAPTER 4 MEDIUM - MCQ - How Do Neurons Use Electrical Signals to Transmit Information?)** (See questions)
8	**Random (CHAPTER 4 MEDIUM - MCQ - How Do Neurons Use Electrical Signals to Transmit Information?)** (See questions)

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9	**Random (CHAPTER 3 HARD - MCQ)** (See questions)
10	**Random (CHAPTER 4 HARD - MCQ - How Do Neurons Use Electrical Signals to Transmit Information?)** (See questions)

Figure A2. Typical structure of a level 1 test in Moodle consisting of 10 questions.

Appendix B

Microsoft Excel Regression Outputs

Table A1

Regression Output for Independent Variable MTL1A and Dependent Variable FE (%) for Sample Size N=200 and Confidence Level of 95%

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.611981537							
R Square	0.374521402							
Adjusted R Square	0.371362419							
Standard Error	0.133254647							
Observations	200							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	2.105203581	2.105204	118.5576	6.13478E-22			
Residual	198	3.515846563	0.017757					
Total	199	5.621050143						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.498300776	0.017904963	27.83032	2.34E-70	0.462991876	0.533609676	0.462991876	0.533609676
X Variable 1	0.016511676	0.001516444	10.88842	6.13E-22	0.013521221	0.01950213	0.013521221	0.01950213

Table A2

Regression Output for Independent Variable ME(%) and Dependent Variable FE(%) for Sample Size N=200 and Confidence Level of 95%

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.810400479							
R Square	0.656748936							
Adjusted R Square	0.655015345							
Standard Error	0.098714757							
Observations	200							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	3.6916187	3.6916187	378.8372503	7.3928E-48			
Residual	198	1.929431443	0.009744603					
Total	199	5.621050143						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.07919749	0.030849802	2.567196075	0.010990327	0.018361142	0.140033839	0.018361142	0.140033839
X Variable 1	0.801340649	0.041170945	19.46374194	7.3928E-48	0.720150826	0.882530472	0.720150826	0.882530472

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Diversity in Video Lectures: Aid or Hindrance?

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Abstract

Media diversity within video lectures has been shown to have an effect on students who participate in both flipped classes as well as online courses. While some research claims that content delivered through multiple sources leads to more learning, contrasting research makes the claim that too much media hinders cognitive processing. The present study investigated the effects of varying levels of instructional media delivered to students (n=110) within a flipped scientific writing course to investigate the relationship between higher levels of media diversity and student performance. Results showed that more diversity led to lower levels of performance. It was also found that higher levels of media diversity correlated with higher levels of students' scanning between different forms of media, possibly contributing to the lower levels of performance. The implications of these results provide insight into the optimal level of media diversity, and on student behavior that can affect learning.

Keywords: flipped learning, Korea, multimedia, scanning, summaries, video lectures

Introduction

Video lectures are a key component to most e-learning environments and the relationship between the effective design of video lectures and other aspects of online environments needs to be examined in order to optimize the effectiveness of online learning. One method instructors have used to improve e-learning experiences is to create more diverse lecture videos that incorporate various types of media (Kim, Kwon, & Cho, 2011; Zhang, Zhao, Zhou, & Nunamaker, 2004). The effects of such diversity on student engagement and learning is a topic worth exploring. This can be done by examining how diversity in the presentation of lecture videos affects germane load, which is widely accepted to contribute to learning through increased comprehension of the course content that the videos present (Cierniak, Scheiter, & Gerjets, 2009; De Jong, 2010; Sweller, 2005; Sweller, van Merriënboer, & Paas, 1998).

Media diversity, which refers to the various audio and visual means of presenting information in online video lectures, influences student perception of video lectures and affects their cognitive processing (Kalyuga et al., 1998; Lowe, 1999; Mayer, 2014; Mayer & Moreno, 2003; Rasch & Schnotz, 2009; Schnotz & Rasch, 2005; Sims & Hegarty, 1997; Sweller, 1999; Sweller et al., 1998; van Merriënboer, 1997). However, this is still a contentious area, as some research suggests that diversity in media presentation increases germane load, while other studies have shown that such diversity can hinder the development of germane load. For instance, some studies claim that presenting the same information several times through diverse forms of media enables students to improve their comprehension of the material (Paivio, 1991; Schmidt-Weigand & Scheiter, 2011), while others claim that doing so causes a redundancy effect, leading to unnecessary cognitive processing (Kalyuga, Chandler, & Sweller, 1999; Mayer & Moreno, 2003) and decreased germane load (Sweller et al., 1998). Further to this, lecture design has been shown to influence whether or not students finish watching a video in an online class (Costley, Hughes, & Lange, 2017; Costley & Lange, 2017a).

The present study quantitatively measures student recall of the content in video lectures that contain varying degrees of media diversity. Additionally, the effect of media diversity on scanning between different media sources is investigated, which may provide more insight on the results of this study. This research differs from extant studies in the literature in that the videos examined herein contain the same lecture by the same lecturer, but with differing levels of media diversity. Tailoring the media diversity in each experimental group while maintaining the content being presented offers a clearer insight into the effects of media diversity in online lecture videos.

Literature Review

The Effects of Visual Diversity on Retention

Studies indicate that the use of visual media is beneficial for student understanding. Images and animations have been shown to facilitate the learning process so students can better comprehend the content (Salomon, 1994; Sweller & Chandler, 1994; van Gog, Ericsson, Rikers, & Paas, 2005). This improved understanding leads to better retention of information and quiz scores. The use of animated text was also shown to benefit the learning process; Luzón and Letón (2015) found that the addition of handwritten animated text to lecture videos was more helpful to the students' learning compared to cases when such text was not included. Chen and Wu (2015) point to Mayer's (2001) cognitive theory of multimedia learning and its claim that visual modalities or animations with verbal explanations have the edge over either text or narration in performance on retention tests.

Videos that show the instructor have also been shown to be more effective. For example, Day, Foley, and Catrambone (2006) found that videos where the instructor was shown led to higher retention of information and greater understanding and ability to apply the principles featured in the lecture compared to the same content presented using either audio and a slide deck created using Microsoft PowerPoint (PPT) or a PPT slide deck with transcription text. The amount of such recall improves depending on the form in which the instructor is presented (Li, Kizilcec, Bailenson, & Ju, 2016). For example, Pi, Hong, and Yang (2017) state that more knowledge is achieved when the image of the instructor is small – in their study, defined as "8.4% of the space of the video lecture" (p. 347).

Some research suggests that instructors should use caution, particularly under certain conditions, when adding visual media such as animation or simulated pictures. While visuals are widely acknowledged to have a facilitating effect (Lowe, 1999; Rasch & Schnotz, 2009; Salomon, 1994; Schnotz & Rasch, 2005; Sims & Hegarty, 1997; Sweller & Chandler, 1994; van Gog et al., 2005), some studies have shown that the inclusion of visuals may not always be beneficial to learning (Rasch & Schnotz, 2009; Schnotz & Rasch, 2005). For instance, it has been stated that the use of images and animations often leads to superfluous cognitive processing for students who are able to comprehend the content without the use of such visuals (Rasch & Schnotz, 2009; Schnotz & Rasch, 2005). Schnotz and Rasch (2005) point out that the use of such visuals can reduce germane load for learners who do not require them to comprehend the information because of unnecessary mental processing.

Abrupt changes within the lecture video can also be problematic, as some have suggested that sudden transitions or scene changes be avoided when creating online lectures (Fanguy, Costley, & Baldwin, 2017; Kim et al., 2014). Other studies have cautioned against the improper use of videos that show the instructor. While Kizilcec, Bailenson, and Gomez (2015) maintain that there are advantages to showing the professor speaking in a lecture video and that students prefer this presence (Kizilcec, Papadopoulos, & Sritanyaratana, 2014), the former state that continuous use of this type of video may actually lead to cognitive overload, as student are forced to over-rely on their working memory while focusing on the instructor, particularly when the instructor directs their attention to particular points in the lecture.

Visual Diversity and Germane Load

Cognitive load theory can provide a framework with which to understand multimedia instruction and its effects on students. According to cognitive load theory, when instruction is unnecessarily complicated or confusing, students may experience extraneous cognitive load, which can impede learning (Leppink, Paas, van der Vleuten, van Gog, & van Merriënboer, 2013; Sweller et al., 1998). Extraneous load can be defined as the amount of cognitive effort required by ineffective instruction that does not help to achieve the learning objective (De Jong, 2010). A key concern when designing multimedia instruction is cognitive overload, which occurs when a learner engages in cognitive processing that exceeds their useable cognitive capacity (Mayer & Moreno, 2003). Ideally, instruction should be designed to increase levels of germane cognitive load in students (Kolfschoten, Lukosch, Verbraeck, Valentin, & Vreede, 2010; Sweller et al., 1998). Germane load contributes to learning directly and reflects the learner's attempt to construct schema to improve comprehension of relevant information. Furthermore, germane load has been shown to strongly influence a student's likelihood to maintain focus within a learning environment (Sweller et al., 1998). To increase the level of germane load, extraneous load must be reduced so that a greater portion of the learner's available cognitive capacity can be devoted to mental processes relevant to the learning task (Cierniak et al., 2009; Leppink et al., 2013; Schmeck, Opfermann, van Gog, Paas, & Leutner, 2015). To do so, instruction should be presented in a format that can be easily understood by learners (Bruner, 2009).

Diversity in the presentation of media influences student perception of video lectures and affects their cognitive processing (Kalyuga et al., 1998; Mayer & Moreno, 2003; Lowe, 1999; Mayer, 2014; Sims & Hegarty, 1997; Rasch & Schnotz, 2009; Schnotz & Rasch, 2005; Sweller, 1999; Sweller et al., 1998; van Merriënboer, 1997). A number of empirical studies add support to the theoretical claims that diverse presentation of visual media increases germane load by enabling greater comprehension of the information being presented. Day et al. (2006) found that more audio and visual diversity in lessons led to increased levels of understanding and recall, as shown in post-test retention scores and indicated levels of comprehension. A study by Kim et al. (2011) indicated that perceived learning increased when students were exposed various integrated media such as images, graphics, audio, and video clips. Other studies claim that presenting the same information several times through diverse forms of media enables students to improve their comprehension of the material (Paivio, 1991; Schmidt-Weigand & Scheiter, 2011). Zhang, Zhou, Briggs, and Nunamaker (2006) provide empirical evidence that germane load increased with the total diversity of media. The results of the study showed that learners who experienced both auditory and visual delivery (PPT slides and video with audio) achieved improved learning outcomes compared to those who received only visual delivery (PPT slides and lecture notes). Cheon and Grant (2012) found that a metaphorical interface containing pictorial form as well as text can enhance germane load and positively affect learning, while Costley and Lange (2017b) found that overall, there was a positive relationship between diversity of media used in lectures and germane load. These results support the idea that total media diversity helps to increase student levels of germane load with regard to information that is presented in e-learning lectures.

Other research suggests that instructors should use caution, particularly under certain conditions, when adding visual media such as animation or simulated pictures. While visuals are widely acknowledged to have a facilitating effect (Lowe, 1999; Sims & Hegarty, 1997; Schnotz & Rasch, 2005; Rasch & Schnotz, 2009; Salomon, 1994; Sweller & Chandler, 1994; van Gog et al., 2005), some studies have shown that the facilitating effect may not always increase levels of germane load (Schnotz & Rasch, 2005; Rasch & Schnotz, 2009). For instance, it has been stated that the use of images and animations often leads to superfluous cognitive processing for students who are able to comprehend the content without the use of such visuals (Rasch & Schnotz, 2009; Schnotz & Rasch, 2005). Other studies claim that repeating the same information through several forms of media causes a redundancy effect, leading to unnecessary cognitive processing (Kalyuga et al., 1999; Mayer & Moreno, 2003) and decreased germane load (Sweller et al., 1998).

Visual Diversity and the Split-Attention Effect

When viewing lecture videos, learners may engage in a number of *lecture behaviors* such as pausing the video, rewinding and rewatching, skipping ahead, increasing video playing speed, averting one's eyes from screen for more careful listening, scanning one's eyes between text and images, and temporarily turning off the sound in order to focus on a visual or text. While these lecture behaviors may seem advantageous, as they enable learners to control the pace and flow of information (Schwan & Riempp, 2004), such forms of control may also impede comprehension. For example, Caspi, Gorsky, and Privman (2005) show that even brief pauses during the viewing of an instructional video disrupted the context of the lecture. In addition, splitting attention between media sources in an instructional video may increase extraneous cognitive processing (Kizilcec, Bailenson, & Gomez, 2015; Mayer & Moreno, 2003). A physical manifestation of attention splitting is scanning one's eyes back and forth between two types of media (e.g., visuals and text).

Research suggests that multimedia instruction is more effective when it contains change-of-pace elements and a variety of visual media (Barker & Benest, 1996; Brecht, 2012). However, instructors must be careful in how they present visual media to avoid overloading the visual channel, which can invoke the *split-attention effect*. The split-attention effect occurs when learners are required to divide their focus among several sources of media in order to understand the learning material (Ayres & Sweller, 2005; Mayer & Moreno, 1998; Sorden, 2005). This splitting of learner attention represents an increase in extraneous load, which impedes learning. For example, Chen and Wu (2015) found that instructional videos that showed lecture slides and the instructor's face in separate windows on the screen caused the split-attention effect, as students mentioned in follow-up interviews that they felt burdened by the need to scan their eyes between the two windows. However, Chen and Wu (2015) did not report a split-attention effect for participants who were shown videos that pictured the lecturer and slides in the same video window. These findings suggest that physical separation of visual content may lead to the split-attention effect, as viewers need to scan their eyes back and forth between media content, which in turn may increase extraneous load.

The Present Study

Previous research has already examined the relationship between media diversity and its effectiveness in learning (Mayer & Moreno, 2003; Mayer 2014; Rasch & Schnotz, 2009; Schnotz & Rasch, 2005; Sweller et al., 1998; van Merriënboer, 1997). However, past studies are inconsistent in findings regarding the diversity of media in lecture videos. Some claim that the diversity actually has a negative effect on germane load at particular parts of the lecture (Chandler & Sweller, 1991; Kizilcec et al., 2015; Mayer & Moreno, 2003; Rasch & Schnotz, 2009; Schnotz & Rasch, 2005; Sweller et al., 1998). However, Costley and Lange (2017b) found that overall, there was a positive relationship between diversity of media used in lectures and germane load. Therefore, it is worthwhile to investigate whether the increase in specific types of media diversity leads to better performance in students, as represented by germane load and quiz scores. Additionally, it would be useful to investigate whether varying levels of media diversity affects levels of students' scanning between different media sources, which may provide more insight into the effects on performance. In particular, this paper examines the effects of four types of media use included with talking-head presentations: on-screen text, visuals (i.e., photographs, figures, and tables), the instructor's handwriting on the screen (also known as "Khan-style"), and summaries given by a guest lecturer. The findings of this study will be useful to instructors in e-learning who want to understand whether specific types of media aid students in learning.

Research Hypotheses

The present study will test the following research hypotheses:

H1: Students in experimental conditions with higher levels of diversity will have higher quiz scores.

H2: Students in experimental conditions with higher levels of diversity will have higher levels of germane load.

H3: Students in experimental conditions with higher levels of diversity will exhibit more scanning behavior.

Methods

Experimental Procedures

In the present study, our goal was to assess how diversity in media presentation in online lecture videos would affect student perceptions and recall in the graduate-level course *Scientific Writing* (CC500) at the Korea Advanced Institute of Science and Technology (KAIST) in Daejeon, South Korea. The course was taught in an "inverted" or "flipped" format; students were required to watch lecture videos and take online quizzes for homework while also meeting with professors and fellow classmates once per week, face-to-face, in a brick-and-mortar classroom. In the present study, we examine five of the 56 total videos that constitute the lecture content of the course. The five videos included in this study were reproduced in four different styles with regard to media diversity, with each style corresponding to one of four treatment groups. In Treatment Group 1, students were provided a video series that was prepared with an instructor delivering a lecture in front of PPT slides featuring a simple black background with white text on the screen; Treatment Group 2 received the same type of lectures but also included the addition of visuals, such as photographs, figures, and tables; Treatment Group 3 also received the same type of lecture as in Treatment Group 2, but this time with the addition of instances of Khan-style writing with a pen on a glass panel in front of the instructor; and finally, for Treatment Group 4, the same type of lecture was given as in Group 3, but each video contained mid and final summaries that were delivered by a "guest" instructor who was also seated in a "coffee shop" environment projected in the background rather than standing in front of PowerPoint slide contents. Screenshots of the aforementioned Treatment Groups can be seen in Figures 1-4 below.

Figure 1. A screenshot of a Treatment Group 1 video featuring a lecturer presenting in front of a slide background showing only text and no other visuals (low diversity).

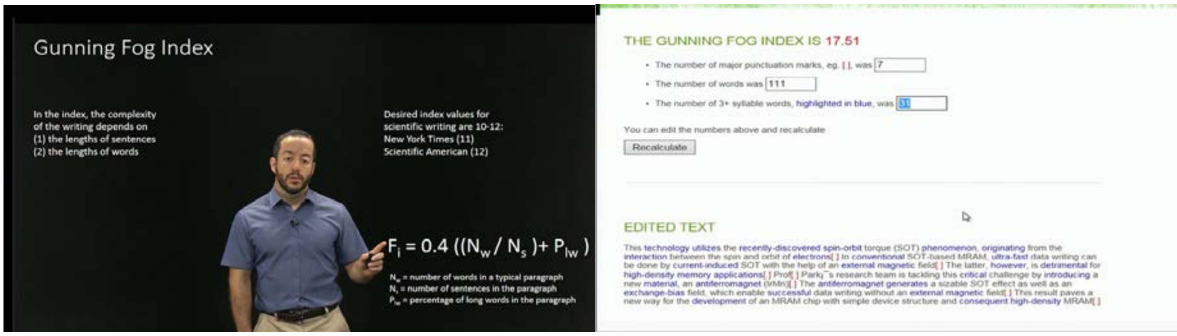

Figure 2. (Left) A still from a Treatment Group 2 video lecture (medium low diversity). (Right) A second still from the same Treatment 2 video featuring an addition visual not shown in Treatment 1.

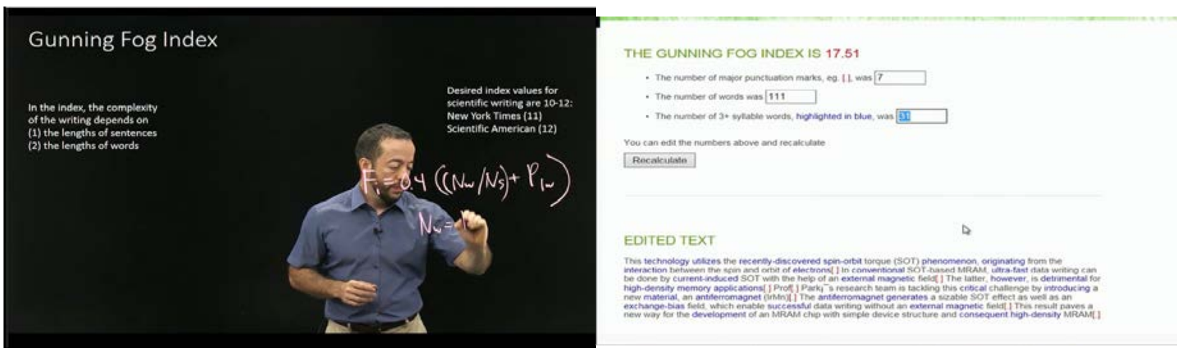

Figure 3. (Left) A still from the Treatment Group 3 video lecture (medium high diversity) that features the same text on the slide background as in the Treatment 1 and 2 versions along with Khan-style writing by the instructor. (Right) The Treatment Group 3 version of the video lecture includes the same visual shown in the Treatment 2 version.

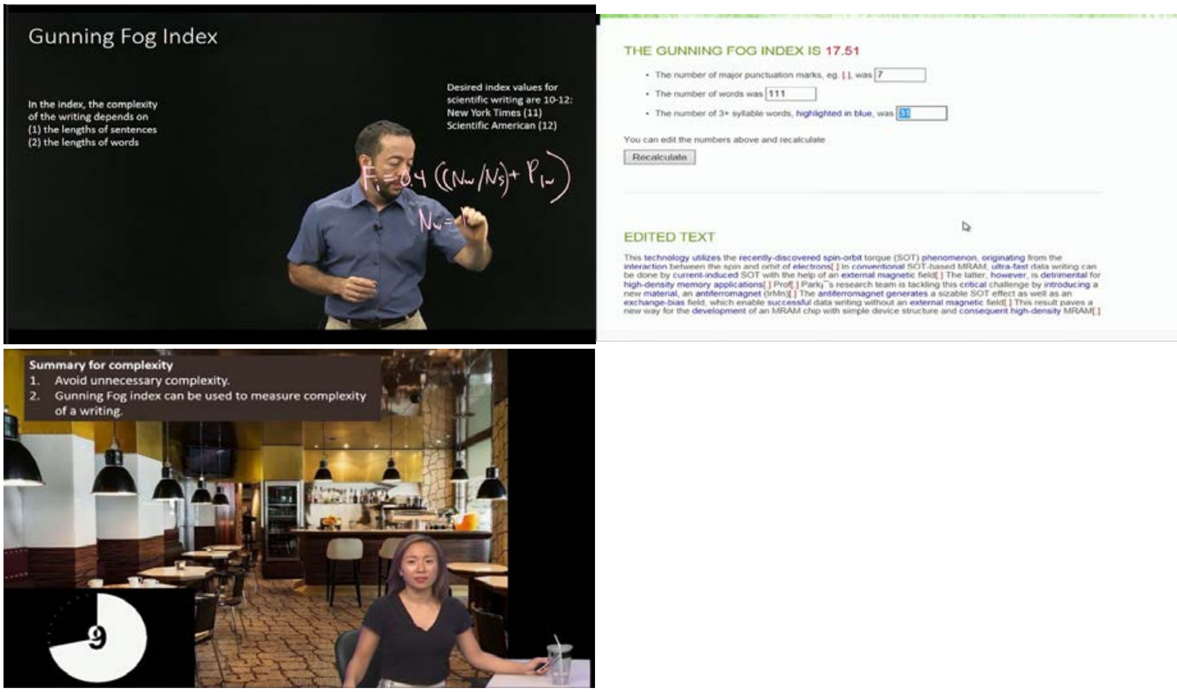

Figure 4. (Upper left) Treatment Group 4 (high diversity) features the same background, Khan-style writing, and (Upper right) visual as in Treatment Group 3. (Lower left) An additional still of a guest lecturer summary included in the Treatment Group 4 version but not in other treatment versions of the video.

A total of 110 students were divided up into four treatment groups, with between 20 and 31 students in each group. The respective videos were posted on the school's learning management system in Week 4 and were available to watch at the students' leisure. Once the videos were viewed, students took a multiple-choice quiz online, which they could access at any time during the seven-day video viewing period. Students were required to complete this test before the next face-to-face, brick-and-mortar classroom meeting day. The quiz was used to measure the students' comprehension and recall of the contents from the videos. During the respective brick-and-mortar classroom meeting, students were asked to fill out a survey that involved a 10-point Likert-type scale to assess the videos. Survey forms were assessed, and quiz data was taken from the online learning management system for the course.

Participants and Context

The present research was conducted at KAIST, a large university located in Daejeon, South Korea. The majority of students at KAIST specialize in STEM fields. As of 2013, the student population of KAIST was 11,175, with 60% of students exclusively at the graduate level (Korea Advanced Institute of Science and Technology [KAIST], 2014b). Most of the students are male (80%), with international students comprising 5% the total student population (KAIST, 2014b). Nearly all courses at KAIST are conducted in English, although the vast majority of KAIST students are non-native English speakers. KAIST provides a variety of online and blended courses, including Massive Open Online Courses (MOOCs) provided through Coursera, institution-level online courses through the CyberKAIST program, as well as the Bridge-Program for prospective freshmen, and global- and institutional-level flipped courses through iPodia and Education 3.0, respectively (Korea Advanced Institute of Science and Technology [KAIST], 2014a).

Participants in the present study were enrolled in classes that were offered as part of KAIST's Education 3.0 program. The Education 3.0 initiative was started in 2012 with the aims of reducing the amount of traditional lecturing in KAIST courses and enabling students to participate in more communicative and interactive learning activities through a flipped classroom environment (Horn, 2014). In 2014, a total of 5% of all classes were given in Education 3.0 format at KAIST, with an objective of increasing the percentage to 30% by 2018 (Horn, 2014).

As a requirement for graduation, graduate students at KAIST must be able to compose articles that are publishable in scientific journals. To assist them in this goal, KAIST offers *Scientific Writing* (CC500), a course that teaches students how to communicate their research in English through writing. The course is given in English, and enrollment is generally capped at 20 student per class. In the present study, eight sections of Scientific Writing were included in the experiment. Of the potential 135 total participants, 25 were removed from the study due to not completing all the requirements for inclusion in the study. This left a total of 110 valid responses, of which 29 were female and 81 were male. The oldest participant was 45, and the youngest was 22, with a mean age of 27. The eight selected sections of Scientific Writing were taught as part of KAIST's Education 3.0 program, and as such, were delivered in a flipped format.

Measures

Student took a quiz that consisted of 20 questions and covered topics given in four video lectures. The quiz was available online, and students could take it at any time during the one-week video viewing period (week 5 of the course). The quiz consisted of multiple-choice questions, with some of the items permitting only one answer choice and others allowing one or more possible answer choices. For the latter, partial credit was given when a correct option was chosen, but no credit was awarded when an incorrect answer option was chosen. All quiz items were written by the course instructors and were aimed at making the students demonstrate that they were able to apply the concepts covered in the lecture videos. For example, if a student viewed a video about how to integrate numbers into their writing, they would see a multiple-choice question asking them to evaluate whether particular instances of writing with numbers were correct. The quiz was worth 5% of the total course grade.

To take a look at the germane load of these students, four items were selected from Leppink et al.'s (2013) research on measuring cognitive load. Specifically, the four items chosen in this study were:

1. The lecture really enhanced my understanding of the topic.
2. The lecture really enhanced my knowledge and understanding of the of the class subject.
3. The lecture really enhanced my understanding of the concepts associated with the class subject.
4. The lecture really enhanced my understanding of concepts and definitions.

However, this research uses slightly different wording than Leppink et al.'s (2013) –this study uses the word "lecture" instead of the original "activity"– in order to focus the items more specifically on the video lectures as they were used. The Cronbach's alpha for the germane load construct was .926 and the Cronbach's alpha for the extraneous load construct was .919, which is acceptable for this type of research. To further understand student behavior while they were watching the videos, the survey described above included one Likert-type item to respond to: “I had to scan my eyes back and forth between the text and the graphs/images in the videos I watched.” This item as with the germane load construct was scored between 1 and 10.

Results

To get an overall picture of the main variables used in this study and the relationships between them, descriptive statistics were calculated and the variables were correlated with each other (Table 1). There were four different categories for the experimental conditions, while *scanning* and *germane load* ranged between 1 and 10. Scanning had a mean of 4.62, and germane load had a mean of 7.52. The *quiz score* variable had a range of 1.76 to 10, with a mean score of 7.43. The experiment condition variable was positively correlated with scanning (.250), but negatively correlated with quiz score (-.295) and germane load (-.231). All of the relationships between the experimental condition and the other variables were statistically significant. Quiz score also had a negative relationship with scanning (-.257), which was statistically significant, though quiz score did not have a statistically significant relationship with germane load (-.018).

Table 1

Descriptive Statistics and Correlations Between the Main Variables

	N	Min	Max	Mean	*SD*	Experiment condition	Scan	Quiz score	Germane load
Experiment condition	110	1	4	NA	NA	1			
Scan	110	0	10	4.62	2.56	.250**	1		
Quiz score	110	1.76	10	7.43	.90	-.295**	-.257**	1	
Germane load	110	1	10	7.52	1.95	-.231*	-.149	-.018	1

Note. * p = < .05; ** p = <.01

The correlations between the experimental condition and dependent variables give some insight into the effect of the levels of diversity on scanning, quiz score, and germane load. As can be seen in Table 2, for scanning, the low diversity group had the lowest mean (4.06), followed by medium low diversity (4.13), medium high diversity (4.38), with high diversity having the highest mean scanning score (5.90). However, in respect of quiz score and germane load, high diversity had the lowest mean (6.79), followed by medium high diversity (7.23), then medium low diversity (7.54), with low diversity having the highest levels of quiz score (8.40). Germane load followed a similar pattern to quiz score though low diversity and medium low diversity were similar (7.95, 7.96), followed by medium high diversity (7.39), with high diversity having the lowest levels of germane load.

Table 2

Main Variable Means by Experiment Condition

	N	Scanning	Quiz score	Germane load
Low diversity	21	4.06	8.40	7.95
Medium low diversity	32	4.13	7.54	7.96
Medium high diversity	30	4.38	7.23	7.39
High diversity	27	5.90	6.79	6.79

The data from Table 2, is visually represented below in Figure 5. This shows the trends discussed in the preceding paragraph, and shown in Table 2. As the levels of diversity increase from low, to medium low, to medium high, and finally to high, both germane load and quiz score decrease, and scanning increases.

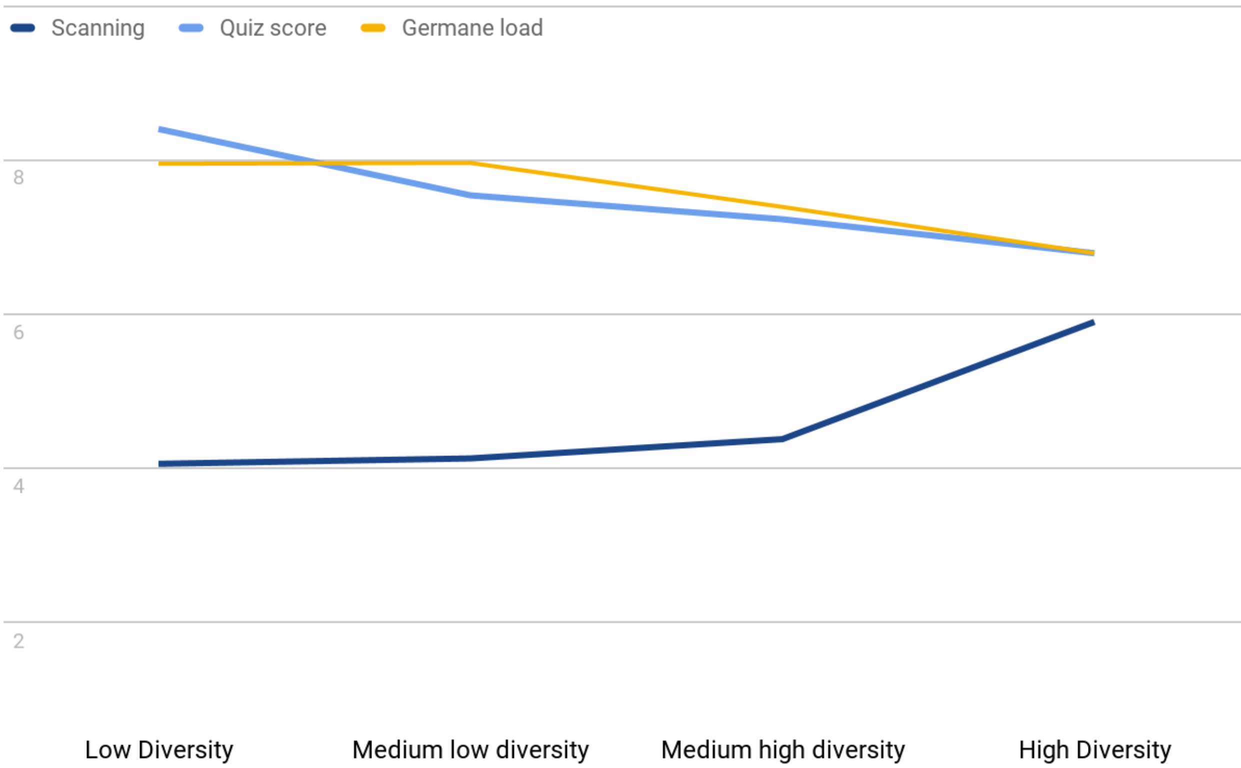

Figure 5. Main variable means by experiment condition.

To establish if the differences in relationships seen in Table 2 are statistically significant, one-way ANOVA was used. As can be seen in Table 3, the between-group difference for both scanning (p = .02) and quiz score (p = .02) were statistically significant. However, the between-group differences for germane load were not statistically significant (p = .09).

Table 3

One-Way ANOVA Results for the Main Variables Used in this Study

		Sum of squares	Mean square	F	Sig.
Scanning	Between groups	60.616	20.205	3.279	.024
	Within groups	653.166	6.162		
	Total	713.782			
Quiz score	Between groups	8.087	2.696	3.593	.016
	Within groups	79.528	.750		
	Total	87.615			
Germane load	Between groups	24.880	8.293	2.269	.085
	Within groups	387.501	3.656		
	Total	412.382			

Discussion

The results of the present study show that as diversity increased from the lowest to the highest level, the rate of students scanning their eyes between contents on the screen increased, while germane load and recall both decreased. Contrary to Hypothesis 1, students' quiz scores showed an inverse relationship with the amount of diversity of media within the lecture videos. These findings are unlike those of Costley and Lange (2017b), who found that lecture videos containing a wider variety of media resulted in students recalling more of the instructional content. However, their study relied upon self-reported levels of recall rather than qualitative analysis, so it is uncertain whether these perceived levels of retention would have been demonstrated in actual test scores. At a glance, the findings of the present study seem to contradict those of Day et al. (2006), who found that increased diversity in lessons resulted in increased comprehension and recall in post-test retention scores and self-reported levels of understanding. However, in Day et al.'s study, there was only one experimental condition (out of a total of four) in which the video showed a lecturer speaking on screen with PPT slides, while all four experimental conditions in the present study contained these features. As Day et al. do not mention Khan-style on-screen handwriting or summaries, it is likely that the most diverse "Video + Audio + PPT" experimental condition in Day et al.'s study was most similar to the low and mid-low diversity conditions in our own study, negating the apparent contradiction.

Likewise, germane load was relatively higher in the low and mid-low diversity groups, at 7.95 and 7.96, respectively, than in the mid-high and high diversity groups, at 7.39 and 6.79, respectively, contrary to our expectation indicated in Hypothesis 2. The present results contradict those of a number of studies that have shown that diversity in lecture videos is beneficial to student learning. For example, the results of Zhang et al., (2006) showed that the learning process is enhanced for learners exposed to both auditory and visual delivery (PPT slides and video with audio) compared to those who viewed only visual delivery (PPT slides and lecture notes). However, this apparent contradiction with the present results can be explained when we consider that the low diversity condition of the present study was already more diverse than the "PPT slide + video and narration condition" since the former showed the instructor speaking while the latter did not. Featuring the instructor in the low diversity condition of the present study is likely to have benefitted student learning, as Kizilcec, Papadopoulos, and Sritanyaratana (2014) indicated the importance of seeing the instructor in such videos, since the instructor can provide social cues and emphasis through gestures and body language. Taking this point into account along with the results of the present study, it may be that online lessons that contain both audio and video represent the lower bound of media diversity for effective online lessons that lead to increased germane load and recall. Other studies have suggested that lecture videos were more effective when containing “strong presentation of relief and change-of-pace elements,” including changes in the video or audio stimulus, modifications to the background or setting, or dramatic transitions between various parts of the video (Brecht, 2012). Barker and Benest (1996) suggested that the inclusion of multimedia contents is beneficial since doing so may prevent students from losing focus. Although such studies indicate that it is beneficial to increase media diversity, they do not identify an upper bound on the level at which diversity is helpful in achieving desirable learning outcomes and improved recall. The results of the present study offer insight into where that upper bound might lie: the most effective experimental condition involved an instructor speaking in front of PPT slides containing text only. In the present study, the addition of images, figures, tables, Khan-style writing, and summaries given by a guest lecturer yielded diminishing returns in terms of germane load and quiz scores. Students in the high diversity experimental condition exhibited the lowest germane load and quiz scores and the highest rate of eye scanning behavior by a significant margin. In addition to the high level of media diversity in this group of videos, the mid- and end-point summaries may have induced the redundancy effect (Sweller et al., 1998), as students were exposed to the same information more than once in a different manner. This redundancy may have led to additional cognitive processing and reduced germane load.

In the most diverse conditions in the present study, students increasingly scanned their eyes back and forth between contents, which was in agreement with our hypothesis. As noted by Sweller et al. (1998), perhaps the split-attention effect that causes this scanning behavior is a sign of cognitive overload, as students were unable to fix their gaze and attention on just one part of the screen while viewing the lecture. As scanning increased with the amount of diversity in the videos, it is plausible that students found the diversity in the videos to overwhelming and unhelpful. This result may help to explain why germane load and quiz scores decreased as media diversity was increased.

Conclusion

As online lecture videos are a major component of flipped and online courses, it is important to consider the most effective ways to deliver content through this medium. Lecture videos should deliver the course contents in a meaningful, memorable, and engaging way that adds to the learning experience of the course. The present results are important in that they contradict the findings of a number of studies that suggest that diversity of media is beneficial in online lecture videos. In the present study, increased diversity led to decreased germane load and recall, and increased instances of students scanning their eyes back and forth between contents on the screen. Based on these results, it seems reasonable to conclude that there is an upper bound to how much diversity is useful and productive in online lecture videos and that above this threshold, diversity may become a detriment to student attention and learning. The present results lead one to consider whether there is a “Goldilocks zone” in the diversity of media in online lecture videos, where content is presented in an engaging way that is beneficial to learning without creating extraneous load or the redundancy effect. Considering that Day et al. (2016) found decreased student performance on recall tests with videos containing relatively less media diversity than our low diversity condition, and that our low diversity condition led to the highest quiz scores and reported levels of germane load, a possible conclusion is that the most effective videos will contain a level of media diversity similar to the low or low-mid diversity conditions, where an instructor speaks in front of slides containing text and possibly a few visuals such as images, figures, and tables. Such findings may be useful to instructors who are designing lecture videos for MOOCs, flipped, or any other type of e-learning environment.

The present study provides a starting point in answering the question, "How much diversity of media is too much in online lecture videos?" The fact that the highest level of diversity examined in this study caused a significant decrease in student germane load and recall, and a significant increase in scanning behavior, should give course designers pause when considering how much media diversity to include in a lecture video. The present work provides a valuable counterexample to numerous studies in the literature that suggest that increased media diversity is beneficial to student learning. In this regard, moderation in media diversity may be a useful guiding principle.

References

Ayres, P., & Sweller, J. (2014). The split-attention principle in multimedia learning. In Mayer, R.E.(Ed.), The Cambridge handbook of multimedia learning (pp. 206-226). Cambridge University Press. https://doi.org/10.1017/CBO9781139547369.011

Barker, P. G., & Benest, I. D. (1996). The on-line lecture concept-a comparison of two approaches. *IEE Colloquium on Learning at a Distance: Developments in Media Technologies* (pp.9/1-9/7). London, UK: IET. https://doi.org/10.1049/ic:19960882

Brecht, H. D. (2012). Learning from online video lectures. *Journal of Information Technology Education: Innovations in Practice*, *11*, 227-250. https://doi.org/10.28945/1712

Bruner, J. S. (2009). *The process of education*. Cambridge: Harvard University Press.

Caspi, A., Gorsky, P., & Privman, M. (2005). Viewing comprehension: Students' learning preferences and strategies when studying from video. *Instructional Science*, *33*(1), 31-47. https://doi.org/10.1007/s11251-004-2576-x

Chandler, P., & Sweller J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction*, *8*(4), 293-332. https://doi.org/10.1207/s1532690xci0804_2

Chen, C. M., & Wu, C. H. (2015). Effects of different video lecture types on sustained attention, emotion, cognitive load, and learning performance. *Computers & Education*, *80*, 108-121. https://doi.org/10.1016/j.compedu.2014.08.015

Cheon, J., & Grant, M.G. (2012). The effects of metaphorical interface on germane cognitive load in web-based instruction. *Educational Technology Research and Development*, *60*(3), 399-420. https://doi.org/10.1007/s11423-012-9236-7

Cierniak, G., Scheiter, K., & Gerjets, P. (2009). Explaining the split-attention effect: Is the reduction of extraneous cognitive load accompanied by an increase in germane cognitive load? *Computers in Human Behavior*, 25(2), 315–324. https://doi.org/10.1016/j.chb.2008.12.020

Costley, J., Hughes, C., & Lange, C. (2017). The effects of instructional design student engagement with video lecture at cyber universities. *Journal of Information Technology Education: Research 16*, 189 - 207. https://doi.org/10.28945/3728

Costley, J., & Lange, C. (2017a). Video lectures in e-learning: effects of viewership and media diversity on learning, satisfaction, engagement, interest, and future behavioral intention. *Interactive Technology and Smart Education 14*(1), 14-30. https://doi.org/10.1108/ITSE-08-2016-0025

Costley, J., & Lange, C. (2017b). The effects of lecture diversity on germane load. *International Review of Research in Open and Distributed Learning 18*(2). https://doi.org/10.19173/irrodl.v18i2.2860

Day, J. A., Foley, J. D., & Catrambone, R. (2006). Investigating multimedia learning with web lectures

(GVU Technical Report; GIT-GVU-06-25). doi: http://hdl.handle.net/1853/13141

De Jong, T. (2010). Cognitive load theory, educational research, and instructional design: some food for thought. *Instructional Science, 38*(2), 105-134. https://doi.org/10.1007/s11251-009-9110-0

Fanguy, M., Costley, J., & Baldwin, M. (2017). Pinch hitter: The effectiveness of content summaries delivered by a guest lecturer in online course videos. *International Review of Research in Open and Distributed Learning*, *18*(7). https://doi.org/10.19173/irrodl.v18i7.3208

Horn, M. (2014, March 17). KAIST doesn't wait for change in Korea, Pioneers 'Education 3.0' (Blog post). *Forbes*. Retrieved from http://www.forbes.com/sites/michaelhorn/2014/03/17/kaist-doesnt-wait-for-change-in-korea-pioneers-education-3-0/#5ae890b01a06

Kalyuga, S., Chandler, P., & Sweller, J. (1998). Levels of expertise and instructional design. *Human Factors: The Journal of Human Factors and Ergonomics Society*, *40*(1), 1-17. https://doi.org/10.1518/001872098779480587

Kalyuga, S., Chandler, P., & Sweller, J. (1999). Managing split-attention and redundancy in multimedia instruction. *Applied Cognitive Psychology*, *13*(4), 351-371. https://doi.org/10.1002/(sici)1099-0720(199908)13:4%3C351::aid-acp589%3E3.0.co;2-6

Kim, J., Guo, P. J., Seaton, D. T., Mitros, P., Gajos, K. Z., & Miller, R. C. (2014). Understanding in-video dropouts and interaction peaks in online lecture videos. In *Proceedings of the First ACM Conference on Learning@ Scale Conference.* (pp. 31-40). New York, NY: ACM. https://doi.org/10.1145/2556325.2566237

Kim, J., Kwon, Y., & Cho, D. (2011). Investigating factors that influence social presence and learning outcomes in distance higher education. *Computers & Education*, *57*(2), 1512–1520. https://doi.org/10.1016/j.compedu.2011.02.005

Kizilcec, R. F., Bailenson, J. N., & Gomez, C. J. (2015). The instructor’s face in video instruction: Evidence from two large-scale field studies. *Journal of Educational Psychology*, *107*(3), 724-739. https://doi.org/10.1037/edu0000013

Kizilcec, R. F., Papadopoulos, K., & Sritanyaratana, L. (2014). Showing face in video instruction: Effects on information retention, visual attention, and affect. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 2095-2102). ACM. https://doi.org/10.1145/2556288.2557207

Kolfschoten, G., Lukosch, S., Verbraeck, A., Valentin, E., & de Vreede, G. J. (2010). Cognitive learning efficiency through the use of design patterns in teaching. *Computers & Education*, *54*(3), 652-660. https://doi.org/10.1016/j.compedu.2009.09.028

Korea Advanced Institute of Science and Technology. (2014a). Center for excellence in teaching and learning. Retrieved from http://www.kaist.edu/html/en/edu/edu_030405.html

Korea Advanced Institute of Science and Technology. (2014b). Student handbook. Retrieved from http://www.kaist.edu/html/en/campus/campus_0508.html

Leppink, J., Paas, F., Van der Vleuten, C. P., Van Gog, T., & Van Merriënboer, J. J. (2013). Development of an instrument for measuring different types of cognitive load. *Behavior Research Methods*, *45*(4), 1058-1072. https://doi.org/10.3758/s13428-013-0334-1

Li, J., Kizilcec, R., Bailenson, J., & Ju, W. (2016). Social robots and virtual agents as lecturers for video instruction. *Computers in Human Behavior*, *55*, 1222-1230. https://doi.org/10.1016/j.chb.2015.04.005

Lowe, R. K. (1999). Extracting information from an animation during complex visual learning. *European Journal of Psychology of Education*, *14*(2), 225– 244. https://doi.org/10.1007/bf03172967

Luzón, J. M., & Letón, E. (2015). Use of animated text to improve the learning of basic mathematics. *Computers & Education*, *88*, 119-128. https://doi.org/10.1016/j.compedu.2015.04.016

Mayer, R. E. (2001). *Multimedia learning*. New York: Cambridge University Press. Retrieved from http://steinhardtapps.es.its.nyu.edu/create/courses/2015/reading/Betrancourt.pdf

Mayer, R. E. (2014). Cognitive theory of multimedia learning. In R.E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (2nd ed., pp. 43-71). Cambridge: Cambridge University Press. https://doi.org/10.1017/cbo9781139547369.005

Mayer, R. E., & Moreno, R. (1998). A split-attention effect in multimedia learning: Evidence for dual processing systems in working memory. *Journal of Educational Psychology*, *90*(2), 312-320. https://doi.org/10.1037//0022-0663.90.2.312

Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38*(1), 43-52. https://doi.org/10.1207/s15326985ep3801_6

Paivio, A. (1991). Dual coding theory: Retrospect and current status. *Canadian Journal of Psychology*, *45*(3), 255-287. https://doi.org/10.1037/h0084295

Pi, Z., Hong, J., & Yang, J. (2017). Does instructor's image size in video lectures affect learning outcomes? *Journal of Computer Assisted Learning*, *33*(4), 347-354. https://doi.org/10.1111/jcal.12183

Rasch, T., & Schnotz, W. (2009). Interactive and non-interactive pictures in multimedia learning environments: Effects on learning outcomes and learning efficiency. *Learning and Instruction, 19*(5), 411-422. https://doi.org/10.1016/j.learninstruc.2009.02.008

Salomon, G. (1994). *Interaction of media, cognition, and learning: An exploration of how symbolic forms cultivate mental skills and affect knowledge acquisition*. Mahwah, NJ: Lawrence Erlbaum Associates. https://doi.org/10.4324/9780203052945

Schmeck, A., Opfermann, M., van Gog, T., Paas, F., & Leutner, D. (2015). Measuring cognitive load with subjective rating scales during problem solving: Differences between immediate and delayed ratings. *Instructional Science*, *43*(1), 93-114. https://doi.org/10.1007/s11251-014-9328-3

Schmidt-Weigand, F., & Scheiter, K. (2011). The role of spatial descriptions in learning from multimedia. *Computers in Human Behavior, 27*(1), 22-28. https://doi.org/10.1016/j.chb.2010.05.007

Schnotz, W., & Rasch, T. (2005). Enabling, facilitating, and inhibiting effects of animations in multimedia learning: Why reduction of cognitive load can have negative results on learning. *Educational Technology Research and Development*, *53*(3), 47-58. https://doi.org/10.1007/bf02504797

Schwan, S., & Riempp, R. (2004). The cognitive benefits of interactive videos: learning to tie nautical knots. *Learning and Instruction*, *14*(3), 293-305. https://doi.org/10.1016/j.learninstruc.2004.06.005

Sims, V. K., & Hegarty, M. (1997). Mental animation in the visuospatial sketchpad: Evidence from dual-task studies. *Memory & Cognition*, *25*(3), 321– 332. https://doi.org/10.3758/bf03211288

Sorden, S. D. (2005). A cognitive approach to instructional design for multimedia learning. *Informing Science: The International Journal of an Emerging Transdiscipline, 8*, 263-280. https://doi.org/10.28945/498

Sweller, J. (1999). *Instructional design in technical areas*. Camberwell, Australia: ACER Press.

Sweller, J. (2005). Implications of cognitive load theory for multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 19–30). Cambridge: Cambridge University Press. https://doi.org/10.1017/cbo9780511816819.003

Sweller, J., & Chandler, P. (1994). Why some material is difficult to learn. *Cognition and Instruction, 12*(3), 185–233. https://doi.org/10.1207/s1532690xci1203_1

Sweller, J., Van Merriënboer, J. J., & Paas, F. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, *10*(3), 251–296. https://doi.org/10.1023/A:1022193728205

van Gog, T., Ericsson, K. A., Rikers, R. M., & Paas, F. (2005). Instructional design for advanced learners: Establishing connections between the theoretical frameworks of cognitive load and deliberate practice. *Educational Technology Research and Development*, *53*(3), 73–81. http://doi.org/10.1007/BF02504799

van Merriënboer, J. J. (1997). *Training complex cognitive skills*. Englewood Cliffs, NJ: Educational Technology Publications.

Zhang, D., Zhao, J. L., Zhou, L., & Nunamaker, J. F., Jr. (2004). Can e-learning replace classroom learning? *Communications of the ACM*, *47*(5), 75–79. https://doi.org/10.1145/986213.986216

Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker, J. F., Jr. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information & Management, 43*(1), 15-27. https://doi.org/10.1016/j.im.2005.01.004

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The Offline Nature of Online Community: Exploring Distance Learners' Extracurricular Interactions

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Abstract

Despite the importance of interpersonal contact to students' sense of community, little is known about how online students form relationships outside of class. Drawing on interviews with 20 students from one online doctoral program, I explore the ways in which distance learners create community outside of class. In the case study I explore how students use social media and group texting apps to develop relationships with peers. I also explore how online students connect in-person at study groups and sporting events. Lastly, I consider the ways in which a three-day, in-person orientation helped online students connect on and offline. Findings indicate that online students' perceptions of community were not limited to their in-class experiences. In addition to their in-class interactions, online students were impacted by their extracurricular interactions in digital and physical spaces.

Keywords: community, online learning, social presence, face-to-face interaction, orientation

Introduction

In their most recent report, which utilizes federal data from 4,700 institutions, Allen and Seaman (2017) found that 29.7% of all students had taken at least one distance course, and 14.3% were in fully online programs. Graduate students represent 20% of the online student population (Allen & Seaman, 2017). In this paper, I explore the factors that contribute to a students' sense of community in one online graduate program. The growth in the number of students enrolled in online graduate programs and the relative lack of literature on their experiences makes this topic worthy of inquiry (Berry, 2017a).

Literature Review

When the first online programs developed nearly 30 years ago, they were thought to be a novelty that would support a small set of learners (Whiteside, Garrett, Swan, 2017). Over time, online programs have continued to expand and diversify. In their 2016 report on online programs, Allen and Seaman wrote, "When more than one-quarter of higher education students are taking a course online, distance education is clearly mainstream," (p. 3). Online programs offer distinct benefits to students and to universities. For students, online programs provide the opportunity to access high-quality curriculum at any time, from any place (Ortagus, 2017). For universities, online programs offer the opportunity to increase revenue and expand educational access (Christensen & Eyring, 2011). As a result, more than 40% of universities consider expanding online enrollment as central to their strategic plan (Allen & Seaman, 2016).

Despite the benefits of online learning to students and to schools, online programs face a significant challenge – attrition (Angelino, Williams & Natvig, 2007). Though there are no numbers available on nationwide retention in online programs, researchers estimate that online attrition may be 10-20% higher than attrition in face-to-face programs (Angelino, Williams & Natvig, 2007; Bawa, 2016; Ivankova & Stick, 2007).

There are many reasons why a student may withdraw from an online program. Academic difficulty, issues with motivation, and challenges with learning technologies can influence the decision to leave an online program (Lee, Choi, & Kim, 2013). Lack of social interaction is also a key factor in the choice to leave an online program (Ke & Hoadley, 2009). Students may leave online programs because they struggle with making friends and receiving social support in distance programs (Hart, 2012).

Research on students in traditional, face-to-face programs suggests that students who develop positive relationships with peers are less likely to depart from an academic program prematurely and that students who feel they are a part of a community are less likely to withdraw from their studies (Tinto, 1997). A community is a supportive social group, where participants develop feelings of membership, influence, fulfillment of needs, and shared emotional connection (McMillan & Chavis, 1986; Rovai, 2002). In a learning community, students work collaboratively towards shared academic goals and provide each other with a sense of social and emotional support (Yuan & Kim, 2014). Academically, a sense of community is associated with increased participation and deeper engagement (Tinto, 1997). A sense of community is also associated with decreased isolation, improved stress management, and greater overall wellbeing (Pyhältö, Stubb, & Lonka, 2009).

A sense of community is beneficial for online students as well (Rovai, 2003); Liu, Magjuka, Bonk, and Lee (2007) argue that a sense of community is associated with perceived learning for online students. In a mixed methods case study of an online MBA program, they found that students who felt a sense of community were more likely to feel feelings of engagement, learning, and satisfaction. Sadera, Robertson, Song, and Midon (2009) similarly found a strong correlation between engagement in an online community and academic success. For online students, classroom experiences play a significant role in the development of peer relationships and a sense of community (Garrison, 2016). Instructors can use pedagogical practices to help create learning communities (Berry, 2017b), and icebreakers and group activities can help students learn about their peers and develop positive relationships (Shackleford & Maxwell, 2012).

Research on online academic communities has mostly focused on students' experiences in online classrooms (Garrison, 2016). A meta-analysis of 42 studies of online communities by Ke and Hoadley (2009) revealed that more research needs to be done on online students' extracurricular experiences. In this study, I explore distance learners' experiences outside of class, in both online and offline settings. While researchers have explored how students in face-to-face environments have utilized technology, particularly social media, to facilitate in-person interactions (Boyd & Ellison, 2007; Ellison, Steinfield, & Lampe, 2007), few researchers have considered how students in fully online academic programs use technology to connect in-person. In a longitudinal study of online learners, Conrad (2005) found that in-person meetings strengthened students' online interactions. Haythornthwaite (2006) similarly found that in-person meetings helped online students develop connections and build rapport. This study seeks to fill the need for more contemporary research on online students' extracurricular interactions on and offline.

Theoretical Framework

I use social presence theory to explore online students' extracurricular interactions. Social presence is a way to understand the feelings of connection and closeness that may develop in virtual environments (Short, Williams, & Christie, 1976; Whiteside et al., 2017). Researchers have long thought that computer mediated communication created a degree of "transactional distance," where users felt communication was distant, impersonal, and disconnected (Gunawardena & Zittle, 1997). As communications tools developed, it became increasingly possible for web users to communicate quickly and to use audio and video to connect more personally (Whiteside et al., 2017). New technologies allowed web users to reduce transactional distance through immediacy, the ability to respond quickly to other web users (Lowenthal, 2010). Users could send verbal cues, like personalized responses and praise, and nonverbal cues like smiles and eye contact. In connecting more quickly and personally, web communication became more authentic, and relationships were more likely to form (Lowenthal, 2010).

Social presence theory, then, describes the warm, sociable, and personal interactions that lead to interpersonal relationships in distance learning environments (Whiteside et al., 2017). Social presence can be cultivated in a variety of ways (Garrison, Anderson, & Archer, 2010). For example, instructors can cultivate social presence by facilitating opportunities for dialogue and collaboration. Students can cultivate social presence by sharing personal information with peers and sending personalized messages to colleagues (Garrison et al., 2010). Students can also cultivate social presence through honesty and collaboration (Bolliger & Inan, 2012).

Frequent, positive contact and interpersonal attraction are prerequisites to building relationships in a virtual environment (Garrison, 2016). As social presence is cultivated, students are more likely to develop feelings associated with a sense of community (Kreijns, Kirschner, & Vermeulen, 2013).

Methodology

Research Question

This paper emerged from a larger study where the research question was "How do students in an online doctoral program define and experience community?" The research question guiding this specific paper is "What extracurricular spheres, networks, and relationships impact students' sense of community in an online doctoral program?"

Setting for the Study

This study was conducted in an online Doctorate in Education program at the University of the West (a pseudonym). The three-year interdisciplinary program focused on education leadership. Students in the program were midcareer professionals, and came from a variety of different sectors, including education, government, business, and health care. At the time of the study the program was in its second year, and had 160 students enrolled. The cohort was ethnically diverse, and consistent with the gender breakdown of the program, 60% of the students interviewed were female, and 40% were male. Students met twice weekly in a synchronous virtual classroom. Data for the study were collected from students in their first and second year of the academic program.

The Case Study

To explore online doctoral students' sense of community, I used qualitative methods. Qualitative methods allow for researchers to prioritize participants' perspectives in data collection and analysis (Merriam, 2014). Since online students' perspectives have been underrepresented in higher education literature, it is important for researchers to capture their unique perspectives.

Data Collection

Findings for this paper were generated primarily from interviews conducted with 20 students in the online program. The interviews were semi-structured and lasted approximately 45 minutes each. The interviews focused on several topics, including definitions of community, experiences of connection and closeness within the online program, and classroom and extracurricular experiences of community. Interviews were semi-structured, beginning with a protocol based on the aforementioned topics, but I also followed up on with themes and topics that the students raised during the interviews. I also asked the students to add information that was not covered in the interview, to make sure that I captured the students' perspectives as well as disconfirming cases of community.

Prior to conducting interviews, I conducted 60 hours of observation of video footage of online courses and analyzed the six message boards attached to these courses. I used what I found in video and message boards to inform the process of selecting students to interview and sought participants based on their participation in the online classrooms. Dawson (2008) and Rovai (2003) both found that students who participate more frequently in online classes have a greater sense of community. After observing video footage and analyzing message boards, I was able to get a rough approximation of the students who spoke and shared most and least frequently in the online classes. I solicited participants at both ends of the spectrum to get a range of experiences, reaching theoretical saturation after interviewing 10 students from the first cohort and 10 students from the second cohort.

Collecting data from the online classrooms also allowed me to understand the nature of the community in the online program. In interviews, I was able to ask students about specific social interactions and the ways in which in-class experiences impacted their out-of-class community. While this data does not factor explicitly into this paper, gathering it was important for enhancing my understanding of the online experience.

Data Analysis

To analyze the data, I used Braun and Clark's (2006) approach to thematic analysis. I began with a set of codes drawn from the literature on community (McMillan & Chavis, 1986) and social presence (Garrison, 2016; Whiteside et al., 2017), and after analyzing the data using these codes, I identified new codes that emerged from data. These codes referred to spaces of connection (i.e., football games, libraries, orientation), ways of connection (i.e., online, offline, in class, extracurricular), and modes of communication (i.e., phone calls, emails, social media, and texting). Themes that held across interviews were used to build the case study.

Limitations

While there are no national numbers on enrollment in online doctoral programs specifically, data suggests that graduate students, including masters and doctoral students, represent 20% of the online student population (Allen & Seaman, 2017). Focusing on online doctoral students is a niche population within a relatively small group of students. Another limitation of this work is the role that the in-person orientation played on students' interactions. While the program was fully online, the initial in-person meeting was a catalyst for further offline interaction. It is difficult to disentangle the impact of an initial in-person meeting on the learning community that subsequently formed.

Findings

Data suggests that the online community was just as robust outside of the classroom as it was inside of the classroom. Inside of the classroom, I observed students joking, giving advice, and sharing personal experiences. Students shared in interviews that they were having similar experiences outside of the classroom. According to students, there were three main types of extracurricular interaction in the online program: checking in through texting and calling, bonding through social media and mobile apps, and providing social support through face-to-face interaction. In the paragraphs that follow, I describe how these types of interaction impacted students' sense of community. I begin by describing the orientation, a catalyst for the online community.

Orientation: The Foundation of the In-Person Community

Students described the community in the online doctoral program as a thriving, engaged, and interactive social group. In interviews, students indicated that the orientation played a critical role in increasing their familiarity with peers and creating the context for community. The program at the University of the West required students to meet once annually for a three-day, in-person orientation. At orientation, students learned how to use the virtual classroom and to access support services, including financial aid and the library. The orientation included shared lunches and dinners, and unstructured social time. The in-person meetings helped the online doctoral students bond as a group; June describes it this way:

> In my (online) Master's program, I don't think I saw any of my classmates face-to-face because there was a ton of people. That is one of the things I really like about this program...even though you see some people virtually, we get to see them face-to-face. At the orientation we saw the education building, we had classes in there. We spent most of our time at the hotel there on campus and it was again an opportunity to live the campus life but then the most important part of it was we got to gel a little bit more as a cohort. Being able to put the faces to the names and getting to experience the classes as well was great.

In connecting with peers at orientation, some of the online students found that they desired more consistent engagement. Andre, a second-year student, describes his experience this way: "We all enjoyed the orientation...we wished there were more. Through our social media we are trying to set up unofficial immersions every semester because I think everybody wants to connect on a more personal level."

For Andre, and for others, the orientation played a key role in helping online students reduce transactional distance and increase social presence. By providing online students with a space for sustained, positive engagement with peers, the orientation helped create a foundation for the community that formed inside and outside of class. In the paragraphs that follow, I explore other ways that online students interacted outside of class, and the impact of these interactions on students' sense of community.

Checking in Through Texting and Calling

Online programs are often described as lacking intimacy and interaction (Whiteside et al., 2017). This perspective contrasts with the experiences of students in the online doctoral program at the University of the West. In this program, students were part of a thriving, highly interactive social group. Eighteen of the 20 students had at least one friend in the program with whom they spoke with weekly through phone, email, and text message. Marcus, a second-year student in the program, described his colleagues as "reaching out with every form of communication." There were many reasons that students in the online program called and texted each other. In interviews, students said that they would call peers to review assignments, ask questions, and vent about the program. One particular theme that held across interviews was that students were using text messages and phone calls to "check in" with peers in the online program. In a check in, a student would send a brief message to a peer to ask about their peers' academic progress and emotional well-being. Kayla, a first-year student, said "we text to keep the morale up." Marcus said, "We check in, to make sure people know they are not alone."

Through checking in, students provided their peers with academic and social support. Lena, a second-year student with a chronic illness, noted that her peers would often call or text her to inquire about her health. When she was particularly ill, Lena's peers would notify the professor and work together to provide her with additional academic support. Lena described her experiences this way:

> I get sick pretty frequently in the program. My friends in the program always call me. They always make sure my assignments are turned in. My professors are amazing with helping me out and understanding, so the level of support I've received has been amazing. I can't even point to a word that describes how they support me in this program...I would not be able to do it without my classmates.

Through checking in, students cultivated two core components of social presence—immediacy and intimacy. In checking in, students were able to give and receive almost immediate support from peers. The nature of their conversations was typically intimate, as students shared details of academic, personal, and professional challenges. Checking in also helped students cultivate different components of community. In sharing this information frequently, students were able to develop feelings of trust and shared emotional connection. Over time, students were able to fulfill each other's needs by providing academic and emotional support to address personal challenges. Karen, a first-year student, described it this way: "It really is a community in the sense that everybody has each other's back. Everyone helps each other and everyone responds to each other's need for help." For Karen and for others, the feelings of trust, shared emotional connection, and fulfillment of needs contributed to students' sense of community in the online program.

Deepening Bonds Through Social Media and Mobile Apps

According to student interviews, more than half of the members of each cohort were in a private Facebook group. Students used the group to share pictures from orientation, memes about the doctoral experience, and questions about the online program. By providing an opportunity to regularly interact with peers, Facebook was an important vector for developing social presence. However, the most beneficial element of the Facebook group appeared to be its' ability to provide a space for students to provide social and emotional support at a distance. Here is how Juan describes these benefits:

> Most of us knew someone who did doctoral work later in life. But now via Facebook I have 60 friends who know exactly what I am going through. Not only are we all doing doctorates, we are in the same program at the same point in life.

For Juan, the Facebook group provided a space to share the unique challenges associated with graduate school. The sharing that took place online provided a sense of camaraderie and community for students in the online program. Andre describes it this way:

> I find our community is built through commiseration. People complain about something and everyone kind of agrees. That is not all that we talk about in our social media group...but it is a part.

> For example, someone posted a syllabus from one of the courses and one of the responses from me was "omg there are weekly quizzes?" So people piled on, liked it, and said "omg I hate those things!" I think that's how community is built in that environment.

Not all students used Facebook, and not all students engaged with the group the same way. Still, for students who did not connect through social media, knowing that their classmates were interacting in that way gave them a sense of support. William, a second-year student who did not use social media said "I don't do much of social media but I know that I could reach out to any classmate at any time and get an answer back the same day."

For students that connected through social media, Facebook use strengthened their sense of community in several ways. By creating a digital space outside of class where students could interact socially with peers, it helped students develop a group identity and a sense of belonging. In this space, students shared positive experiences, including pictures and jokes about the doctoral experience. Through this shared digital space, students could also share resources, answer questions, and coordinate events. By providing a space for students to fulfill academic and social needs, the Facebook group strengthened online students' sense of community.

Mobile Apps in the Online Program

Several students in the online doctoral program also used mobile group messaging apps, like Whatsapp and GroupMe, to communicate with peers. In interviews, it was common for students to participate in text groups of two to five peers. Within the smaller groups, students would have more personal conversations with peers. Keshia described the level of intimacy in the group chats:

> We have been in the program for two years. People have had babies, people have gotten divorced, and have gotten married. We constantly reach out to one another during those times, whether it's good or bad. If someone's like five minutes late to class we text them, like, "Hey, what's going on? Are you sick? Do I need to let the professor know?" We really take care of each other.

For Keshia, using these apps helped strengthen students' social presence. The immediacy of communicating with peers through mobile media strengthened feelings of closeness. The intimate nature of mobile communication also strengthened students' sense of community.

Juan said that group texting via mobile apps allowed for a deeper level of extracurricular engagement than participation in the Facebook group.

> You are not going to complain about how you hated the last class on the cohort Facebook page...through WhatsApp you have more personal conversation. ...The scope and the audience you are presenting it to means that you are going to present in different ways with different level of vulnerability.

Like the Facebook group, the group messaging apps also contributed to online doctoral students' sense of community. The texting groups were much more exclusive, and users shared more personal content in these spaces. As Juan notes, whereas students are more likely to police themselves in a group including the entire cohort, group messaging apps lend themselves to more authentic conversation and venting. Group apps provided greater intimacy for communication. In using the apps, students cultivated social presence with peers, as they developed greater familiarity with peers and increased camaraderie. Over time, these feelings contributed positively to their sense of community.

Providing Social Support Through In-Person Meetings

While many students chose to do the online programs for personal or logistical issues (i.e., late work schedules or a desire for more flexibility), several students found themselves visiting the main campus more than they intended. A small contingent of students formed a weekly study group that met in the library of the main campus, a topic I discussed in a previous paper. In this group, four to nine students would meet weekly in the library to study, peer edit papers, and provide social support to each other. This group developed into a robust subcommunity within the online program. Students provided significant academic support, and also gathered socially for events off campus.

Online students' in-person interactions were not only academic in nature, nor were they limited to small groups of students. During their first year in the program, about one quarter of the cohort (20 students) met up to attend a football game at the main campus. The trip developed from an idea students' shared through social media and in phone conversations. Building on their desire to recreate their orientation experience, students decided to organize a group trip to a football game at the main campus. Lena, a student who traveled across the country to attend the football game, said doing so was a valuable experience.

> It was really fun (to attend the football game together). It was a chance for us to see each other and hang out outside of class instead of having to be together in orientation. There was a chance to really feel like we were a part of the campus and a part of the University of the West family. ...To be able to buy paraphernalia and to walk across campus, to wear our sweatshirts. It made us feel like a part of the campus community and like we are all Warriors, a part of the University of the West *family* instead of just University of the West students.

From Lena's perspective, attending the football game together enhanced social presence by making the online experience more real. Students were able to interact with their peers in a relaxed, fun environment, and also strengthen their connections to the program, to the school, and to each other. By meeting in person, the online students dramatically reduced transactional distance and increased feelings of closeness. Social presence was further strengthened by the fact that many students brought their family members to the football games. June described the impact of meeting online peers at the football game:

> We are of a generation where we appreciate getting together face-to-face. Most of us are in our 40s and 50s so this was a great opportunity for us to connect live instead of on the computer. We were able to ask about family...we met a couple of our classmates' family members at the football game. It was kind of fun that way.

For June, attending the football game together provided another layer of intimacy in her relationship with peers. This sense of closeness contributed to her sense of community. Attending the football game also enhanced the students' sense of community in other ways. In meeting in person, students were able to strengthen feelings of membership to a cohesive social group. This meeting reflected a great deal of influence, as peers were able to motivate each other enough to devote the time and money to this extracurricular experience. Students were able to develop an enhanced shared emotional connection through meeting in person. This connection fulfilled social needs to learn more about peers and develop a connection to the academic program and university as a whole. For the 20 students in the first cohort who attended the football game together, this social event contributed positively to their sense of community.

Barriers to Online Community

There is a tendency in educational literature to present communities as utopias (Christensen & Eyring, 2011). There is also a tendency to present community as a binary, where it is either present and thriving or totally absent (Harrell, 2010). More recent research suggests that there are gradients to community, and that participation can vary (Berry, 2017c). Students in this study also suggested that there were some limitations to how they participated in the online learning community outside of class. The main barriers students identified were lack of time, infrequent social media use, and lack of resources to travel to in-person events. In juggling work, school, and personal lives, several students indicated that it was not possible to connect too frequently with peers outside of class. Still, these students felt a sense of membership in the community, and felt that they could access social and academic support from peers at any time. Only two of the students interviewed suggested that they did not feel connected to the community at all, yet these students also said that they were too busy to connect with peers. However, on the whole, most students were eager, proactive, and engaged with at least some component of the community in the online doctoral program.

Discussion

Researchers have previously suggested that there may be some overlap between technology users' online and offline experiences. Ellison, Steinfield, and Lampe (2007) have found that Facebook friends can help provide social media users with social capital that can be beneficial on and offline. Boyd and Ellison (2007) have reflected on how social media users have sought to create connections between their online and offline networks. Madge, Meek, Wellens, and Hooley (2009) have written about how students have used social media to support and maintain newly forming academic relationships. While this literature has proved instructive, it is centered on undergraduate students in in-person programs. In this study, I provide insight into how doctoral students in an online program connect on and offline. The findings have important insight into where, how, and why community might be cultivated in an online graduate program.

Where Community is Cultivated

The findings of this study challenge traditional notions that communities are contained to one space. By contrast, this data suggests that online students can connect across multiple spaces. Researchers exploring online learning environments must bear in mind the fact that students' interactions in multiple contexts can impact their sense of community. Focusing too narrowly on students' experiences in online classrooms can obscure their experiences in other spaces.

More significant than the number of extracurricular sites for interaction in the online program is the dynamic interplay between interactions in these spaces. Many of the online doctoral students in the study navigated between online and offline spaces, going between them to meet various academic and social needs. Students met in person for an orientation, and then continued coursework online. They engaged with each other through social and mobile media, seeking to extend relationships that were forming in the classroom. When they needed more extended social interaction, they met in person again. Education researchers should continue to consider the academic, social, and emotional effects of shifting between online and offline spaces.

Why Community is Cultivated

Data from this study suggests that online doctoral students desire peer interaction and are intentional about seeking it out. Students were keenly aware that a distance program offered reduced opportunities for social interaction. Unlike in a traditional program where you might bump into peers in the cafeteria or in the hallway, casual interactions were not generally a part of the online experience. As a result, students were intentional about engaging with peers. Students suggested in interviews that as distance learners, it was important to create social support networks within the academic program. Over time, students began to feel that these networks could not only help them navigate their coursework, but also they could provide social and emotional support for dealing with professional and personal challenges. Students in the online doctoral program relied on each other as a means of support for managing full-time work and full-time school. In making efforts to engage with peers weekly, they fostered the immediacy that creates social presence. Online students also ensured that they had a robust social network that could be leveraged for support at any time. Investing in community was an intentional act designed to help lessen anxiety over social isolation.

How Community is Cultivated

The community in the online program developed organically, but not spontaneously. The residential orientation, which included three days of in-person meetings, was a catalyzing event that informed the development of the learning community. By meeting in person, students developed a rapport that they were eager to cultivate throughout the academic program. While meeting in person lent nicely toward informal interaction, it was not the simple meeting of peers that contributed to the students' sense of community. This particular orientation, which included a mix of academic and social events, as well as unstructured time, provided opportunities for prolonged engagement and personal interaction. The opportunity to get to know peers early on was critical in helping establish social presence, which informed the learning community.

The orientation was developed by faculty and staff to prompt the formation of the learning community; however, subsequent initiatives to create and maintain community were student-led. Students in the online program were proactive and developed academic and social experiences to meet their needs. When students wanted in-person socialization, they initiated meetups to do so. When students desired additional personal interaction, they created texting groups to connect with peers. The sites that sustained the online community were student-generated, student-led, and responsive to needs that emerged over the course of the program. Such a model of community formation challenges thinking that suggests that communities form in a linear fashion and solely in response to inputs by faculty and staff. Online learning communities can be fluid and responsive, changing in nature to students' needs and efforts.

Given its dynamic nature, researchers cannot impose rigid notions of where, how, and why online community occurs. Online communities are dynamic, contextual, and are influenced by many factors. Communities are not bound to one physical space or type of communication medium. Rather, students determine where community occurs and how it is cultivated across many spaces.

Conclusion

In this paper I have explored online students' extracurricular interactions in one online doctoral program. Findings suggest that online students can have thriving communities outside of the classroom, on and offline. In this case study, students interacted outside of the classroom in three primary ways – checking in through texting and calling, strengthening bonds through social and mobile media, and intentionally meeting face-to-face. These interactions helped students establish social presence and contributed to a sense of community in the online program.

Findings from this study suggest that online academic communities can span multiple sites and planes. Researchers and practitioners who limit their inquiry of online students' experiences to their experiences in virtual classrooms are missing critical opportunities for interaction. By continuing to explore distance learners' extracurricular experiences, researchers and practitioners will be better able to engage and retain distance learners.

References

Allen, I. E., & Seaman, J. (2016*). Online report card: Tracking online education in the United States.* Babson Survey Research Group.

Allen, I. E., & Seaman, J. (2017). *Digital compass learning: Distance education enrollment report.* Babson Survey Research Group.

Angelino, L. M., Williams, F. K., & Natvig, D. (2007). Strategies to engage online students and reduce attrition rates. *Journal of Educators Online, 4*(2), 1-14.

Bawa, P. (2016). Retention in online courses. *SAGE Open, 6*(1). Retrieved from http://sgo.sagepub.com/content/6/1/2158244015621777.full

Berry, S. (2017a). *Exploring Community in an Online Doctoral Program: A Digital Case Study* (Doctoral dissertation). Retrieved from Proquest. Retrieved from https://search.proquest.com/docview/1910863435?accountid=14704

Berry, S. (2017b). Building Community in Online Doctoral Classrooms: Instructor Practices that Support Community. *Online Learning Journal*. Retrieved from https://olj.onlinelearningconsortium.org/index.php/olj/article/view/875/265

Berry, S. (2017c). Student support networks in online doctoral programs: Exploring nested communities. *International Journal of Doctoral Studies*, 12, 33-48. Retrieved from http://www.informingscience.org/Publications/3676

Bawa, P. (2016). Retention in online courses exploring issues and solutions – A literature review. *SAGE Open*, *6*(1), 1-11. doi: 10.1177/2158244015621777

Bolliger, D. U., & Inan, F. A. (2012). Development and validation of the online student connectedness survey (OSCS). *International Review of Research in Open and Distance Learning, 13 (3),* 41– 65. doi: https://doi.org/10.19173/irrodl.v13i3.1171

Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, *13*(1), 210-230. doi: 10.1111/j.10836101.2007.00393.x

Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101.

Christensen, C., & Eyring, H. (2011). *The Innovative University: Changing the DNA of Higher Education from the Inside Out*. San Francisco, CA: Jossey-Bass.

Conrad, D. (2005). Building and Maintaining Community in Cohort-Based Online Learning. *Journal of Distance Education, 20*(1), 1-20.

Dawson, S. (2008). A study of the relationship between student social networks and sense of community. *Educational Technology & Society*, *11*(3), 224-238. Retrieved from https://www.jstor.org/stable/jeductechsoci.11.3.224

Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook "friends:" Social capital and college students' use of online social network sites. *Journal of Computer-Mediated Communication*, *12*(4), 1143-1168. doi: 10.1111/j.1083-6106.2007.00367.x

Garrison, D. R. (2016). *E-learning in the 21st century: A framework for research and practice.* New York: NY. Routledge.

Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Education*, *13*(1), 5-9. doi: 10.1016/j.iheduc.2009.10.003

Gunawardena, C. N., & Zittle, F. J. (1997). Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *The American Journal of Distance Education*, *11*(3), 8-26. doi: 10.1080/08923649709526970

Harrell, D. F. (2010). Designing empowering and critical identities in social computing and gaming. *CoDesign*, *6*(4), 187-206.

Hart, C. (2012). Factors associated with student persistence in an online program of study: A review of the literature. *Journal of Interactive Online Learning*, *11*(1), 19-42. Retrieved from https://www.ncolr.org/jiol/issues/pdf/11.1.2.pdf

Haythornthwaite, C. (2006). Facilitating collaboration in online learning. *Journal of Asynchronous Learning Networks*, *10*(1), 7-24. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.104.2245&rep=rep1&type=pdf

Ivankova, N. V., & Stick, S. L. (2007). Students' persistence in a distributed doctoral program in educational leadership in higher education: A mixed methods study. *Research in Higher Education*, *48*(1), 93. Retrieved from https://www.learntechlib.org/p/76216/

Ke, F., & Hoadley, C. (2009). Evaluating online learning communities. *Educational Technology Research and Development*, *57*(4), 487. doi: 10.1007/s11423-009-9120-2

Kreijns, K., Kirschner, P. A., & Vermeulen, M. (2013). Social aspects of CSCL environments: A research framework. *Educational Psychologist*, *48*(4), 229-242. doi: 10.1080/00461520.2012.750225

Lee, Y., Choi, J., & Kim, T. (2013). Discriminating factors between completers of and dropouts from online learning courses. *British Journal of Educational Technology*, *44*(2), 328-337. doi: 10.1111/j.1467-8535.2012.01306.x

Liu, X., Magjuka, R. J., Bonk, C. J., & Lee, S. H. (2007). Does sense of community matter? An examination of participants' perceptions of building learning communities in online courses. *Quarterly Review of Distance Education*, *8*(1), 9. Retrieved from https://www.learntechlib.org/p/106720/

Lowenthal, P. R. (2010). The evolution and influence of social presence theory on online learning. In *Online education and adult learning: New frontiers for teaching practices*.113-128. IGI Global.

Madge, C., Meek, J., Wellens, J., & Hooley, T. (2009). Facebook, social integration and informal learning at university:'It is more for socialising and talking to friends about work than for actually doing work'. *Learning, Media and Technology*, *34*(2), 141-155. doi:10.1080/17439880902923606

McMillan, D. W., & Chavis, D. M. (1986). Sense of community: A definition and theory. *Journal of Community Psychology*, *14* (1), 6-23. doi: 10.1002/15206629(198601)14:1<6::AIDJCOP22900140103>3.0.CO2-I

Merriam, S. B. (2014). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

Ortagus, J. C. (2017). From the periphery to prominence: An examination of the changing profile of online students in American higher education. *The Internet and Higher Education*, *32*, 47-57.doi: 10.1007/s11162-018-9495-1

Pyhältö, K., Stubb, J., & Lonka, K. (2009). Developing scholarly communities as learning environments for doctoral students. *International Journal for Academic Development*, *14* (3), 221-232. doi: 10.1080/13601440903106551

Rovai, A. P. (2002). Building sense of community at a distance. *The International Review of Research in Open and Distributed Learning*, *3*(1). Retrieved from https://www.learntechlib.org/p/49515/

Rovai, A. (2003). In search of higher persistence rates in distance education online programs. *The Internet and Higher Education*, *6*(1), 1-16. doi: 10.1016/S1096-7516(02)00158-6

Sadera, W. A., Robertson, J., Song, L., & Midon, M. N. (2009). The role of community in online learning success. *Journal of Online Learning and Teaching*, *5*(2), 277.

Shackleford J., & Maxwell, M. (2012). Contribution of learner–instructor interaction to sense of community in graduate online education. *Journal of Online Learning and Teaching*, *8*(4). Retrieved from http://jolt.merlot.org/vol8no4/shackelford_1212.htm

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. Hoboken, NJ: John Wiley & Sons.

Tinto, V. (1997). Colleges as communities: Taking research on student persistence seriously. *The Review of Higher Education*, *21*(2), 167-177.

Whiteside, A. L., Garrett, D. A., & Swan, K. (Eds.). (2017). *Social presence in online learning: multiple perspectives on practice and research*. Retrieved from https://ebookcentral.proquest.com

Yuan, J., & Kim, C. (2014). Guidelines for facilitating the development of learning communities in online courses. *Journal of Computer Assisted Learning*,*30*(3), 220-232. doi: 10.1111/jcal.12042

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Online Teacher and On-site Facilitator Perceptions of Parental Engagement at a Supplemental Virtual High School

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Abstract

Just as they have in face-to-face courses, parents will likely play an important role in lowering online student attrition rates, but more research is needed that identifies ways parents can engage in their students' online learning. In this research we surveyed and interviewed 12 online teachers and 12 on-site facilitators regarding their experiences and perceptions of parental engagement. Guided by the Adolescent Community of Engagement framework, our analysis found that teachers and facilitators valued parents' engagement when parents advised students on course enrollments, nurtured relationships and communication with and between students, monitored student progress, motivated students to engage in learning activities, organized and managed students' learning time at home, and instructed students regarding study strategies and course content when able. Teachers and facilitators also identified obstacles that parents faced when attempting to engage in their children's online learning as well as obstacles that teachers and facilitators encountered when they attempted to support parents.

Keywords: parental engagement, online learning, student engagement, virtual schooling, online teachers, on-site facilitators

Introduction

K-12 students are increasingly enrolling in online courses. Most enrollments occur in the upper grades and most of those enrollments are used to supplement traditional coursework (Evergreen Education Group, 2017). It is also becoming increasingly clear that K-12 online courses have significantly higher attrition rates than those found in face-to-face courses (Freidhoff, 2017). Roblyer, Freeman, Stabler, and Schmeidmiller (2007) explained that students' ability to complete an online course has less to do with their ability to learn course content and "appears to depend more on motivation, self-direction, or the ability to take responsibility for individual learning" (p. 11).

Online programs commonly rely on parents to provide the support that is difficult or impossible for their teachers to provide at a distance. However, parental engagement in online courses can vary greatly, and the quality and quantity of parental support that students receive is a major concern for online teachers (Larkin, Brantley-Dias, & Lokey-Vega, 2015). As a result, some online programs require local schools to provide students with an on-site facilitator who works with students face-to-face (Borup, 2018). Although an engaged on-site facilitator can alleviate some of the burden placed on parents, a facilitator is not meant to eliminate parental involvement. Little research has attempted to identify how parents should engage in their students' online courses, and the research that does exist tends to focus on full-time programs where parents assume a high level of responsibility because students take all or most of their courses from home (Borup, 2016; Hasler Waters & Leong, 2014). As a result, little is known regarding how online teachers, on-site facilitators, and parents in supplemental online programs share support responsibilities. We addressed this need by interviewing successful online teachers and on-site facilitators regarding their perceptions and experiences related to parental engagement and the obstacles they and parents encountered. Specifically, our research addressed the following questions:

1. Based on online teacher and on-site facilitator perceptions and experiences, what are parents' responsibilities when their students are enrolled in a supplemental online course with on-site facilitator support?

2. Based on online teacher and on-site facilitator perceptions and experiences, what are the obstacles that parents face when attempting to fulfill their responsibilities in online courses?

Literature Review

In this section we will first review parental engagement frameworks. Next, we will review the literature examining the levels and impact of parental engagement on student performance.

Parental Engagement Framework

Researchers examining parental engagement in online courses have sought guidance from more established frameworks created in face-to-face learning environments, mainly Epstein's (1995) and Hoover-Dempsey and Sandler's (1995, 2005) frameworks of parental engagement (see Black, 2009; Hasler Waters, 2012; Liu, Black, Algina, Cavanaugh, & Daswon, 2010). These frameworks proved helpful in collecting and analyzing data, but ultimately were inadequate in describing parental engagement in online courses and generalizations across online and face-to-face courses should be avoided. As a result, Borup, West, Graham, and Davies (2014) used research on parental engagement in online settings to critically examine the parental engagement frameworks established in traditional environments and to identify several types of parental engagement as described in their Adolescent Community of Engagement (ACE) framework. Borup and his colleagues (Borup, 2016; Borup, Stevens, & Hasler Waters, 2015) then conducted case studies examining parent engagement at a full-time online charter high school that helped further refine the framework. The following summarizes the types of parent engagement identified in Borup et al.'s (2014) original article and two subsequent case studies (Borup, 2016; Borup et al., 2015):

1. Organizing and managing: Helping students organize their home learning environments and manage their time.

2. Instructing: Answering students' content-related questions when able, helping them develop study/learning skills, providing preliminary feedback on their work, and assisting when technological issues arise.

3. Facilitating interactions: Supporting students' attempts to interact with the content and others (i.e., online teacher, on-site facilitator, and peers) by:

    a) Advising and mentoring students in their enrollment decisions and in setting long-term educational goals.

    b) Nurturing caring relationships and working to open lines of communication with the online teacher and on-site facilitator.

    c) Monitoring student progress and performance.

    d) Motivating students to more fully engage in learning activities and thereby progress in the course.

The authors of the ACE framework acknowledged "that there are several types of learning models, each requiring different levels of teacher, parent, and peer engagement" and that "differing learner models will also place varying emphasis on parent engagement" (Borup et al., 2014, p. 23). The case studies conducted in a full-time online school have proven insightful, but it is also important to examine parental engagement in supplemental online programs where students also receive support from an online teacher and on-site facilitator.

While the ACE framework focused on the types of parental engagement, Hoover-Dempsey and Sandler's (1995, 2005) framework of parental engagement provided insights into why parents choose to be involved in their students' learning. They identified three primary factors that contribute to parental engagement behaviors: (1) parents' motivational beliefs; (2) the types of invitations parents receive from their student and others; and (3) parents' perceived ability, availability, and energy to help (Hoover-Dempsey & Sandler, 1995, 2005). While the three factors outlined above were developed in face-to-face environments, they appear generic enough to also apply to online environments, although they have yet to be applied in those settings. However, it is important to note that parents' motivational beliefs and their abilities to actually engage in their students' online learning are likely different when they are facilitating online courses than they would be in face-to-face settings, especially when parents have limited understanding and experiences with online courses. As a result, it is important to understand why and how parents choose to be involved in their students' learning within the context of online courses.

Parental Engagement: Levels and Impact

Researchers have found a large variance in the levels of parental engagement in their students' online courses. Litke's (1998) case study was the first to document this phenomenon when he categorized three types of parents:

- Absentee: Parents who were largely uninvolved in their students' learning.
- Supporters: Parents who regularly asked their students and occasionally the teachers regarding student progress, then increased their involvement when difficulties were identified.
- Participatory: Parents who maintained a high level of engagement throughout the semester by closely checking grades, supervising learning activities, tutoring frequently, and actually working side-by-side with their students.

More recently, Borup, Graham, and Davies (2013) surveyed 79 parents at a full-time online charter high school regarding the average number of minutes they spent each week interacting with each course instructor and student regarding the online course work. On average, these parents reported spending an average of 86 minutes (*SD*=74.3) interacting with their students and 9.1 minutes (*SD*=14.2) interacting with the course teacher—both with high standard deviations from the mean (Borup et al., 2013).

While schools commonly have policies that require teacher-parent communication, the policies tend to emphasize contacting parents when students' performance had decreased, rather than maintaining a high level of communication throughout the semester (Cavanaugh et al., 2009). Research has also found that both parents and teachers expect the other to do more to support student learning (Hasler Waters & Leong, 2014). As a result, online programs should better establish parental engagement expectations and provide parents with information regarding the types of support required.

Whereas qualitative research has indicated that parents have a positive impact on student engagement, findings from quantitative correlational research have been mixed. More specifically, Black (2009) and Borup et al. (2013) both failed to consistently find significant positive correlations between levels of parental engagement and several online course outcomes. In fact, in some cases levels of parental engagement were actually negatively correlated with course outcomes, although these negative correlations were not statistically significant. These researchers warned against a simplistic conclusion that parents do not meaningfully impact students' learning outcomes in online courses, because the lack of significant correlations could have been the result of other factors. For instance, Borup et al. (2013) stated, "If a large portion of parental interaction occurred in reaction to poor student performance, the correlation that results from examining a large group of students could mask the true benefit of parental involvement on individual student learning" (p. 52). Research in face-to-face settings has found that not all types of parental engagement equally impacted learning outcomes (McNeal, 2012; Wilder, 2014). McNeal (2012) and Wilder

(2014) recommend examining specific types of parental engagement rather than total parental engagement. An obstacle to following McNeal's recommendation is that little research has worked to identify specific types of parental engagement in online courses—especially in supplemental programs that provide on-site facilitator support.

Methods

Research Setting

Michigan Virtual (MV), a large state-run virtual school, was selected as the setting for this research. During the 2015-2016 academic year MV enrolled 8,710 students who accounted for 19,098 individual course enrollments (Freidhoff, 2017). The large majority of MV students enrolled in online courses as a way to supplement their face-to-face courses. Section 21f of Michigan Public Act No. 60 (2013) required the local brick-and-mortar school to provide students enrolled in online courses with an on-site facilitator, referred to as a "mentor," who must be "available for assistance to the pupil" and "monitor the pupil's progress in the course" (p. 5-O-A-1). Online teachers were charged with "determining appropriate instructional methods for each pupil, diagnosing learning needs, assessing pupil learning, prescribing intervention strategies, reporting outcomes, and evaluating the effects of instruction and support strategies" (Michigan Department of Education, 2014, 5-O-D-2). MV also provides a parent guide that explains the roles of the online teacher and on-site facilitator and advises parents to create a study space for the student, prepare for technological issues, review the syllabus with the student, define expectations, set incentives and punishments, help the student establish a learning routine, and monitor progress weekly in the learning management system (Michigan Virtual, 2017).

Participants and Data Collection

Using MV student pass rate data from the previous academic period, we identified schools with above average student pass rates (80% or higher) and then sampled 12 schools across the state (four urban, four suburban, four town, and four rural). The on-site facilitator with the highest student load at each of the 12 schools was then sampled for participation. All of the participating on-site facilitators were full-time employees of the local school districts with student loads ranging between 15 and 300, with an average of 95 students (SD=79.6). Seven focused only on their facilitator responsibilities, and the other five divided their time facilitating online students' learning with other teaching or administrative responsibilities. It is also important to note that 11 of the facilitators required the majority of their online students to attend a daily lab. The only exception was a vice principal who required students to only attend a weekly lab but commonly met with students in his office during the week.

On-site facilitators provided names of three online teachers who they believed were particularly effective in working with students. We then sampled 12 online teachers (giving preference to the teachers with multiple recommendations and sampling online teachers across the content areas taught) who then completed a survey and participated in two 50-60 minute interviews similar to those given to on-site facilitators. Of the participating online teachers, only nine taught online (eight full-time and one part-time).

All online teacher and on-site facilitator participants completed a survey that asked general demographic and workload information before asking participants to list the responsibilities assumed by the online teacher, on-site facilitator, and parents. Participants then ranked the provided responsibilities in order of importance. Each participant then participated in two 50-60 minute interviews for a total of 48 interviews. The interviews allowed participants to expand on their survey responses and share experiences related online teacher, on-site facilitator, and parent responsibilities.

Data Analysis

The interview transcripts were sent back to the participants who checked them for accuracy. The first interview analysis focused on online teacher and on-site facilitator responsibilities. The results of that analysis can be found at (Borup & Stimson, 2019). The analysis for this article focused specifically on parental responsibilities. More specifically, before a statement was coded, it was compared to all previous coded statements, a practice Glaser (1965) called the "basic, defining rule for the constant comparative method" (p. 439). Similar categories were then grouped together. The groupings were guided by the elements of parental engagement identified in the ACE framework. However, we were careful not to limit the groupings and were also attentive to categories not previously identified by the framework. One researcher coded the online teacher interviews, and another researcher coded the on-site facilitator interviews. The research team met frequently throughout the analysis to review the coded statements and discuss the category groupings. When there were disagreements, we discussed them until the issues were resolved and everyone was in agreement.

Findings

When referring to a specific participant, we changed the name and placed either (F) or (T) next to the name to indicate if that person were a facilitator or a teacher. Facilitators and teachers found that the actual levels of engagement could vary greatly across parents. Rick (T) explained that "parents are either completely all in" or "you never even hear from that parent the whole semester." Although on-site facilitators and online teachers acknowledged that "some students are incredibly motivated" and "don't really need their parents to cheerlead or support or do anything," they also agreed that parents were "incredibly helpful" for the large majority of their students and that many of their students would "end up failing the course" if their parents were not involved. In general, on-site facilitators and online teachers found that parental engagement was not as high as they believed it should be and "wish[ed] that parents would be more involved." However, Lisa (F) found that while parental "involvement is minimal," parents usually got involved when there was an immediate need.

Facilitators and teachers believed that when a facilitator was highly involved and consistently met with students, the need for parental engagement was lower than if facilitators only met with the student sporadically. In fact, facilitators tended to agree that when online students attended a daily lab, parents' needed level of engagement was similar to when students were learning in a traditional face-to-face course. Inversely, Devon (T) explained that when students are learning primarily from home with little face-to-face contact with their facilitator, the parents "are the ones who are doing the things that [the facilitator] would normally do."

On their surveys, teachers and facilitators listed specific parental responsibilities that we then coded and categorized (see Table 1). In their interviews, teachers and facilitators elaborated on their survey responses and shared potential obstacles that parents encountered when attempting to fulfill their responsibilities. In doing so, teachers and facilitators reinforced the themes that were identified in the survey responses with some exceptions. For instance, advising students on their online course enrollment was listed as a parental responsibility by only one survey respondent but became an important theme in the interview analysis.

Table 1

Survey Analysis Results of the Listed Parent Responsibilities

Responsibility	**Facilitators (n=)**	**Teachers (n=)**	**Avg. Rank**	***SD***	**Example quote**
Motivating	9	8	2.14	0.95	"Motivating student if they fall behind."
Monitoring	11	5	1.72	0.77	"Keep track of their student's progress in their course by looking at their grades."
Nurturing Communication	7	8	2.20	1.01	"Maintain communication with student and [facilitator] regarding their child's online course."
Managing	2	3	1.35	0.93	"Keep the students on pace to complete the course."
Instructing	2	3	1.90	0.89	"Provide support when appropriate, tutoring."
Organizing	3	1	1.38	0.75	"Provide a space in the home that is conducive for learning while working on the computer."
Modeling	1	1	4	1.41	"Be role model for their child."
Advising	0	1	1	Na	"Be informed of their student's enrollment."

Advising

Teachers and facilitators believed that parents could be an important partner when advising students regarding online course enrollments. In practice, however, teachers and facilitators believed that parents "need to be so much more involved in all of the kids' course selections than they are." In fact, online teachers commonly shared experiences of reaching out to parents who were unaware that their student was even enrolled in an online course. Angela (T) stated that it was a significant problem and that "a good portion of our parents don't even know their student is taking an online class." Rick (T) believed that parental lack of awareness regarding their students' online course enrollments was one of the "biggest recurring themes" and caused "a frustrating situation" for both parents and teachers.

Even when parents advised their students regarding course enrollments, they often lacked the necessary understanding of online learning to provide recommendations that were in students' best interest. For instance, Caitlyn (F) found that "A lot of times, parents have blinders" and "only see what they want to see" in regards to their students' capabilities, so they end up "pushing or allowing" their students to enroll in an online course regardless of the student's abilities or readiness. Kay (F) stated that parents' misconceptions about online courses are to be expected because parents have "never been in one before." Facilitators and teachers also found that many parents falsely assumed that "online learning is just easier than face-to-face [courses]" and are "surprised at how difficult the work may be and how much time a student will have to spend trying to learn it."

In an attempt to overcome these misconceptions, online teachers provided orientation materials that facilitators would then supplement before sending them home for students and parents to sign and return. Caitlyn (F) found that this resulted in "a really long letter because there's so much information," and Kay would "always wonder how many parents read them [before signing]." Facilitators found that it was "really hard" to overcome parents' misconceptions and some, such as Tanner (F), wished to have a "parent night" specifically for online courses.

Nurturing Relationships and Communication

Facilitators and teachers believed that parents "nurturing and caring" for their students was foundational to their ability to positively impact their students' learning because they would have the "student's ear." Teachers and facilitators also recognized that the inverse could be true, and "some students feel that, 'Hey, if my mom and dad doesn't care if I'm successful, why should I care?'"

Teachers added that parents should respond to teacher inquiries as well as proactively contact them when the need arises. Teachers found that only a few parents actually contacted them directly. Kandice (T) concluded that "a lot of parents don't know that I'm somebody that they can reach out to." Simply contacting parents proved challenging for teachers because they were dependent on local schools to provide them with accurate parental contact information at the time of registration—a responsibility that schools commonly failed to fulfill. When teachers did not have accurate contact information for parents, they worked with the local facilitator to relay messages to the parent. However, even facilitators found that their parent communication was "a mixed bag." Kay (F) stated, "I have some [parents] who are involved and some that I never hear from. So I always wonder, 'Are you getting my emails? Are you there? Is there anybody on the other end?'"

Monitoring Student Progress

Once students were enrolled in an online course, facilitators and teachers agreed that "parents should be logging into their student's online class and monitoring their student's progress." Caitlyn (F) argued that in online courses parents actually "need to be a more active partner in monitoring how their kids are doing" compared to face-to-face courses, because online students tend to have more flexibility in their learning pace. Samantha (F) shared that "teenagers aren't always looking ahead and paying attention to where they are...and could easily lose track and get [in] over their head."

At the start of the semester parents and students were provided with pacing guides that listed all of the course assignments that were also viewable in the gradebook. However, teachers and facilitators identified several obstacles that prevented many parents from regularly doing so. First, the grade book for the online courses was not integrated with the local school system's online gradebook, and some parents were "not willing to go and sign-on to two different [portals] just to see their student's grade." Second, there was not a parent portal with a student progress dashboard. Instead parents had to use students' login information to access the course and then navigate to the gradebook, which may prove difficult for some parents. Furthermore, facilitators experienced that some parents found it difficult to interpret students' progress and grades because of the self-paced nature of most of the online courses. As a result, Casey (F) recommended to parents that they tell their students, "Hey, pull up your online class, and can you show me where you're at." However, even when students showed parents the gradebook, parents relied somewhat on the student to interpret the scores, and students were not always truthful. Dana stated, "The parents believe them, which they probably shouldn't." Dana (F) believed that ideally parents would have access to a "parent portal" that would display students' progress in relation to the pacing guide so that parents could easily "see their progress and be able to say, 'What a minute. This says you should be here by October 21.'"

Due to these obstacles, the interviewed teachers and facilitators commonly contacted parents to inform them of their students' grades—especially when students were underperforming. All teachers were required to provide parents with progress reports twice during the semester. The facilitators also regularly sent additional progress reports home to parents. Amanda (F), who sent home progress report emails every couple of weeks when students were behind, explained, "I send home more communication than a [face-to-face] teacher would just so that no student, no parent can say they were not informed." Dana (F) similarly sent home progress reports "every Friday if they're getting below a C" so that parents would start "paying attention a little bit more." However, Kay (F) found the "system for emailing parents [to be] horrible" because if the counselors did not enter in the correct parent email at registration, facilitators had no way to enter it in themselves and had to send emails individually. Kay (F) found that she had to personally email many of her parents, which took "an entire day." However, even after all that effort she still thought to herself, "I wonder, 'Are you opening this?" As a result, Tanner (F) stated, "If they're in danger of failing we'll make calls home and try to get their parents involved that way."

Motivating

When parents became aware of students' underperformance, facilitators and teachers expected them to motivate their students to become more engaged in learning activities. Teachers found that parents' regular physical presence made them especially important "to help motivate or drive their son or daughter to be successful." At a minimum, teachers and facilitators believed that parents should set high expectations on "day one" of the semester and give students an "extra push" when they failed to meet those expectations. Daphnie (T) added that parents should be "constantly celebrating" their students' successes and work to establish "a celebratory atmosphere for successful students."

When expectations and encouragement proved insufficient, teachers and facilitators recommended that parents use rewards and punishments to motivate their students. Overall, facilitators and teachers were more aware of parent punishments than rewards. Punishments typically involved "grounding" or removing privileges such as "keys to their truck" or "their phone." Facilitators found that these types of punishments were "fantastic" and highly effective. Although facilitators could not use the same punishments as parents, Kay (F) found that with parent support she was able to add additional punishments. "I just had a parent who said, 'Can you please give my student a detention every day this week so that he stays after every day this week.'"

Organizing and Managing

Teachers and facilitators believed that parents should organize and manage students' learning activities at home and manage their learning schedule to ensure an on-time course completion. Kandice (T) explained that many students had to learn from home because in "some schools, the students are only in the computer lab one hour a week, which is not enough time." Samantha (F) required her students to attend a daily lab but still found that "it's hard for some kids to keep up" and they "have to do some work at home." Carl (F) added that even when students attended a daily lab, it could be difficult to perform some tasks because the lab was "not always that free of interruption."

Providing "a nice quiet place for students to work" at home was not enough, and teachers and facilitators explained that parents should also help to ensure students stay on task because "kids can be easily distracted" when working online. Luke (F) summarized "You can provide the best workspace in the world, but I think it's good from time to time to check in and see what kids are doing."

Facilitators and teachers also acknowledged that some parents were unable to provide students with the resources or stability they needed at home. Amanda (F) stated, "You'd be surprised how many do not have the Internet or do not have a computer at home." Devon (T) added that some students only had "slow Internet" that was insufficient to efficiently complete learning activities from home. Lynda (F) added that at times students had to work "at the library, Grandma's house, an aunt's house" so they could "stick to that schedule."

Instructing

Teachers and facilitators believed that parents could potentially provide students with important content support. Sabrina (T) shared, "Inevitably, a student is going to be working on their computer at night, and have a question, and not understand, and they might ask their parent. Sometimes the parent can answer the question, and sometimes they can't." However, teachers and facilitators agreed that for most parents "their child has surpassed their knowledge level." Tanner (F) found only "a handful of parents that are highly educated and can sit down with a student and work on some of these online classes." Teachers and facilitators were not concerned that parents were unable to provide content support because "everything is very clear" in the course, and "instructors have been more than happy to work with kids one-on-one." Kandice (T) added "even if you're not great at math, you can sit down and help your kid try to get through the math assignment" when students require more immediate assistance. Rick (T) explained that even if parents cannot assist with content related questions, "It's extremely helpful that the parent help with the reading, writing, and grammar."

Although parental assistance on assignments was valued by teachers and facilitators, Angela (T) stressed that some parents were "almost hand holding the student through the entire course" instead of helping the student develop independent learning skills. Three facilitators also suspected that some parents were actually doing the work for their students.

Discussion and Implications

Guided by the ACE framework (Borup et al., 2014), this research examined online teacher and on-site facilitator perceptions and experiences regarding parental engagement in a large supplemental online program. Previous research has largely focused on parental engagement in full-time programs where parents were tasked with facilitating students' online learning at home. While parental engagement is especially important in full-time programs (Liu et al., 2010), most online students enroll in only one or two online courses to supplement their face-to-face programs (Evergreen Education Group, 2017). Research in full-time programs can provide insights into parental engagement in supplemental programs, but the authors of the ACE framework explained, "Differing learner models will also place varying emphasis on parent engagement. For instance, some full-time online programs require students to work from home, placing a greater need for parental monitoring, organizing, and instructing" (Borup et al., 2014, p. 23).

Similar to research in full-time programs, online teachers and on-site facilitators interviewed for this research agreed that the needed level of parental engagement was dependent on student attributes and background. Additionally, this research found that on-site facilitators were able to alleviate some of the burden that would otherwise have been placed on parents. In fact, 11 of the 12 facilitators who participated in this research meet with the large majority of their students daily in a lab setting. As a result, they believed that parents' responsibilities were similar to that of a face-to-face course. However, online teachers did not find daily lab attendance to be typical across all of their students and found parents needed to fulfill more of a facilitator role when their students were not regularly working with a facilitator at school. Because all of the facilitators in this research were highly engaged in their students' learning, additional research is needed to examine parental engagement in supplemental programs with less involved facilitators or no facilitators at all.

While some parents were overly engaged—even to the point of possibly doing some of their students' work—in general parents were under engaged in their students' online learning. Online administrators, teachers, and facilitators should seek strategies that effectively increase the support students receive from their parents. In this research, online teachers and on-site facilitators identified several obstacles to full parental engagement including parents' being unaware that their students were taking an online course, parents' lack of understanding of the online learning model used in the program, and the use of an online gradebook that was separate from the gradebook used at the brick-and-mortar school. Online teachers and on-site facilitators also encountered obstacles when they attempted to support parents in their responsibilities. For instance, online teachers commonly lacked accurate contact information and relied on facilitators to relay messages to parents. While it was easier for on-site facilitators to obtain accurate parent contact information, they could not update contact information in the system and instead had to email progress reports to those parents individually, which could prove to be a tedious and time consuming process. We recommend that programs require accurate parental email addresses and phone numbers at the time of registration. We also recommend establishing permissions that would allow online teachers and on-site facilitators to update incorrect contact information.

Online programs should work to create tools that support parents in their monitoring efforts. In this research, parents had to log into the course using their student usernames and passwords and then navigate to the gradebook. Even if parents were able to access the gradebook, online teachers and on-site facilitators found that the self-paced nature of the courses made it difficult for parents to interpret their students' overall grades and recognize when students were not maintaining adequate pace in the courses. We recommend that online programs provide a parent portal with a dashboard that clearly communicates important student performance and progress information. While previous researchers have described or advocated for similar dashboards for teachers (Borup, Graham, & Drysdale, 2014; Adams Becker, Freeman, Giesinger Hall, Cummins, & Yuhnke, 2016; Dickson, 2005; Rice & Carter, 2016; Zhang & Almeroth, 2010) and students (Patrick, Kennedy, & Powell, 2013), additional attention needs to be paid to parent dashboards. While teacher dashboards are becoming more common, they can be ignored when poorly designed (Murphy et al., 2014). As a result, when designing parent portals and dashboards, designers should work closely with parents to ensure that they are designed in a way that will prove helpful for the intended stakeholders.

More difficult than providing tools and resources to parents are efforts to ensure parents actually fulfill their responsibilities. Hoover-Dempsey et al. (2005) explained that parents' engagement in their students' learning is dependent on how they perceive their own roles and responsibilities. They added that parents construct their roles socially through "experiences over time with individuals and groups related to schooling. These often include the parents' personal experiences with schooling, prior experience with involvement, and ongoing experiences with others related to the child's schooling (e.g., teachers, other parents)" (Hoover-Dempsey et al., 2005, p. 108). For face-to-face courses, parents have a wealth of experiences and models that have helped them envision what their engagement should be. In contrast, parents' experiences with online learning is limited—both as parents and students—and may lack models and opportunities to construct their roles for engaging in their students' online learning. Hoover-Dempsey et al. (2005) explained that "because it is socially constructed, parents' role construction for involvement is subject to change" (p. 108). As a result, online programs should thoughtfully provide parents with materials and supports that will help them overcome misconceptions and gain the understanding they need to effectively engage in their students' online learning.

Hoover-Dempsey and Sandler (1995, 2005) added that parents' decisions to engage in their students learning can be influenced by specific invitations. Surprisingly, online teachers in this research found that some parents were unaware that their students were even enrolled in an online course. Interviewed on-site facilitators commonly sent home a packet of orientation materials, and some even required parents to sign and return a form acknowledging they had read the packet. However, facilitators believed that the amount of information was overwhelming and ignored by many parents. As a result, some facilitators wished they could have a face-to-face orientation event with parents. Similar synchronous online events may reach additional parents who require additional flexibility. While a face-to-face or synchronous online event at the start of the semester may prove helpful for parents, programs should also explore ways that parents can also be invited to engage in their students' learning throughout the semester.

Lastly, Hoover-Dempsey and Sandler (1995, 2005) explained that outside demands on parents' time can prevent them from engaging in their students' learning even when they understand their responsibilities and are motivated to fulfill them. As a result, providing a regular place and time to learn with an engaged facilitator is especially important for student populations where parental engagement has been persistently low, including students whose parents have limited formal education (Al-Matalka, 2014) and/or who have lower socioeconomic status (SES) (Alghazo & Alghazo, 2015). Furthermore, facilitators in this research found that students struggled to complete work at home when they had no or slow Internet access. Rose, Smith, Johnson, and Glick (2015) stated that while online learning can "be a critical tool in our search for equitable education across all aspects of our public education system…without proper planning, virtual schools could perpetuate or even exacerbate disparities in our system" (p. 71-72). School administrators should carefully consider each student's needs when deciding the types of supports required to create a successful online environment. When high parental engagement is unlikely, we recommend providing students with a time and place where their learning can be regularly supported by an engaged facilitator.

Conclusion

As online course enrollments grow, it is important to better understand how parents can help their students be successful in online courses. Previous research has focused on parental engagement in full-time online programs where students learn primarily at home. However, parental engagement is likely different in supplemental online programs—especially when students are provided with an on-site facilitator. Our analysis of interviews with online teachers and on-site facilitators found that the level of parental engagement required could be reduced by a highly engaged facilitator. However, even with a highly engaged facilitator, parents had important responsibilities in their students' effective online learning. Participants in this research found that parents commonly had misconceptions regarding their responsibilities and in some cases were unaware that their students were even enrolled in an online course. Online programs should work with parents before and after registration to ensure that they understand and are willing to fulfill their responsibilities. The lack of parent resources and online portal also made it difficult for parents to fulfill their responsibilities.

The findings from this research should be understood within the context it was conducted. While not generalizable, the findings from this research may prove insightful to others seeking to understand and improve parental engagement in other online programs. Building on this research, others should seek to conduct more generalizable research. Future researchers should also collect data directly from parents to better understand their perceptions and the obstacles they encounter when attempting to engage in their students learning. While obtaining parental research participation has proven difficult in supplemental online programs (Oviatt, Graham, Borup, & Davies, 2018), parents can provide unique insights into strategies that may help improve learning outcomes.

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References

Adams Becker, S., Freeman, A., Giesinger Hall, C., Cummins, M., & Yuhnke, B. (2016). *NMC/CoSN Horizon Report: 2016 K-12 Edition*. Austin, TX: The New Media Consortium. Retrieved from http://cdn.nmc.org/media/2016-nmc-cosn-horizon-report-k12-EN.pdf

Alghazo, Y., & Alghazo, R. (2015). The effect of parental involvement and socioeconomic status and elementary students' mathematics achievement. *Journal of Social Sciences and Humanities*, *1*(5), 521–527. doi: 10.3389/fpsyg.2018.00952

Al-Matalka, F. I. M. (2014). The influence of parental socioeconomic status on their involvement at home. *International Journal of Humanities and Social Science*, *4*(5), 146–154. Retrieved from http://www.ijhssnet.com/view.php?u=http://www.ijhssnet.com/journals/Vol_4_No_5_March_2014/15.pdf

Borup, J. (2016). Teacher perceptions of parental engagement at a cyber high school. *Journal of Research on Technology in Education*, *48*, 67-83. doi: 10.1080/15391523.2016.1146560

Borup, J. (2018). On-site and online facilitators: Current and future direction for research. In K. Kennedy & R. Ferdig (Eds.), *Handbook of research on K-12 online and blended learning (2nd ed.;* pp. 423-442). ETC Press. Doi:10.1184/R1/6686813

Borup, J., Graham, C. R., & Davies, R. S. (2013). The nature of parental interaction in a virtual high school setting. *American Journal of Distance Education*, *27*, 40-55. doi: 10.1080/08923647.2013.754271

Borup, J., Graham, C. R., & Drysdale, J. (2014). The nature of online teacher engagement at an online high school. *British Journal of Educational Technology*, *45*, 793-806. doi: 10.1111/bjet.12089

Borup, J., Stevens, M., & Hasler Waters, L. (2015). Student and parent perceptions of parental engagement at an online charter high school. *Online Learning*, *19*(5). Retrieved from https://olj.onlinelearningconsortium.org/index.php/olj/article/view/699

Borup, J. & Stimson, R. (2019). Online teachers' and on-site facilitators' shared responsibilities at a supplemental virtual secondary school. *American Journal of Distance Education*, *33*(1). doi: 10.1080/08923647.2019.1554984

Borup, J., West, R. E., Graham, C. R., & Davies, R. (2014). The adolescent community of engagement framework: A lens for research on K-12 online learning. *Journal of Technology and Teacher Education*, *22*, 107-129. Retrieved from https://www.learntechlib.org/primary/p/112371/

Black, E. W. (2009). *An evaluation of familial involvements' influence on student achievement in K-12 virtual schooling*. University of Florida, Gainesville, FL. https://doi.org/3367406

Cavanaugh, C., Barbour, M., Brown, R., Diamond, D., Lowes, S., Powell, A., ... Van der Molen, J. (2009). *Research committee issues brief: Examining communication and interaction in online teaching*. Vienna, VA: iNACOL. Retrieved from http://www.inacol.org/research/docs/NACOL_QualityTeaching-lr.pdf

Dickson, W. P. (2005). *Toward a deeper understanding of student performance in virtual high school courses: Using quantitative analyses and data visualization to inform decision making*. Naperville, IL: NCREL/Learning Point Associates. Retrieved from http://www.mivu.org/LinkClick.aspx?fileticket=I5uq2DZ7Y%2BI%3D&tabid=373

Epstein, J. L. (1995). School/family/community partnerships. *Phi Delta Kappen*, *76*(9). https://doi.org/10.2307/2967352

Evergreen Educational Group. (2017). *Keeping pace with K-12 online learning 2016*. Evergreen Education Group. Retrieved from http://www.kpk12.com/wp-content/uploads/EEG_KP2016-web.pdf

Freidhoff, J. R. (2017). *Michigan's K-12 virtual learning effectiveness report 2015-16*. Lansing, MI: Michigan Virtual University. Retrieved from http://media.mivu.org/institute/pdf/er_2016.pdf

Glaser, B. G. (1965). The constant comparative method of qualitative analysis. *Social Problems*, *12*(4), 436–445. Retrieved from http://www.jstor.org/stable/798843

Hasler Waters, L. (2012). *Exploring the experiences of learning coaches in a cyber charter school: A qualitative case study* (Doctoral dissertation, University of Hawaii at Manoa, Honolulu). Retrieved from https://scholarspace.manoa.hawaii.edu/handle/10125/100883

Hasler Waters, L., & Leong, P. (2014). Who is teaching? New roles for teachers and parents in cyber charter schools. *Journal of Technology and Teacher Education*, *22*(1), 33–56. Retrieved from https://www.learntechlib.org/primary/p/112373/

Hoover-Dempsey, K. V., & Sandler, H. M. (1995). Parental involvement in children's education: Why does it make a difference? *Teachers College Record*, *97*(2), 311–331. Retrieved from https://www.tcrecord.org/Issue.asp?volyear=1995&number=2&volume=97

Hoover-Dempsey, K. V., & Sandler, H. M. (2005). *Final performance report for OERI Grant # R305T010673: The social context of parental involvement: A path to enhanced achievement*. Washington, D.C. Retrieved from http://www.vanderbilt.edu/peabody/family-school/Reports.html

Hoover-Dempsey, K. V, Walker, J. M. T., Sandler, H. M., Whetsel, D., Green, C. L., Wilkins, A. S., & Closson, K. (2005). Why do parents become involved? Research findings and implications. *The elementary school journal*, *106*(2), 105–130. doi: 10.1086/499194

Larkin, I. M., Brantley-Dias, L., & Lokey-Vega, A. (2015). Job satisfaction, organizational commitment, and turnover intention of online teachers in the K-12 setting. *Online Learning*, *20*(3), 26–52. Retrieved from https://olj.onlinelearningconsortium.org/index.php/olj/article/view/986

Litke, D. (1998). Virtual schooling at the middle grades: A case study résumé. *The Journal of Distance Education*, *13*(2), 33–50. Retrieved from http://www.ijede.ca/index.php/jde/article/view/145/386

Liu, F., Black, E., Algina, J., Cavanaugh, C., & Dawson, K. (2010). The validation of one parental involvement measurement in virtual schooling. *Journal of Interactive Online Learning*, *9*(2), 105–132. Retrieved from https://www.learntechlib.org/p/109414/

McNeal, R. B. (2012). Checking in or checking out? Investigating the parent involvement reactive hypothesis. *Journal of Educational Research*, *105*(2), 79–89. doi: 10.1080/00220671.2010.519410

Michigan Public Act No. 60. (2013). Retrieved from http://www.legislature.mi.gov/docu- ments/2013-2014/publicact/htm/2013-PA-0060.htm

Michigan Virtual. (2017). *Parent guide to online learning* (5th ed.). Retrieved from https://mvlri.org/wp-content/uploads/2017/03/parentguide_508.pdf

Murphy, R., Snow, E., Mislevy, J., Gallagher, L., Krumm, A., & Wei, X. (2014). *Blended learning report*. Michael & Susan Dell Foundation. Retrieved from https://1k8hc03ylh05464h1122sxwb-wpengine.netdna-ssl.com/wp-content/uploads/2016/01/MSDF-Blended-Learning-Report-May-2014.pdf

Oviatt, D. R., Graham, C. R., Borup, J., & Davies, R. S. (2018). Online student use of a proximate community of engagement in an independent study program. *Online Learning*, *22*(1), 223–251. doi: 10.24059/olj.v22i1.1153

Patrick, S., Kennedy, K., & Powell, A. (2013). *Mean what you say: Defining and integrating personalized, blended, and competency education*. International Association for K-12 Online Learning. Retrieved from http://www.inacol.org/wp-content/uploads/2015/02/mean-what-you-say.pdf

Rice, M. F., & Carter, R. A. (2016). Online teacher work to support self-regulation of learning in students with disabilities at a fully online state virtual school. *Online Learning*, *20*(4), 118–135. Retrieved from https://olj.onlinelearningconsortium.org/index.php/olj/article/view/1054

Roblyer, M. D., Freeman, J., Stabler, M., & Schneidmiler, J. (2007). *External evaluation of the Alabama ACCESS initiative phase 3 report*. Eugene, OR: International Society for Technology in Education. Retrieved from http://accessdl.state.al.us/2006Evaluation.pdf

Rose, R. M., Smith, A., Johnson, K., & Glick, D. (2015). Ensuring equitable access in online and blended learning. In T. Clark & M. K. Barbour (Eds.), *Online, blended, and distance education in schools: Building successful programs* (pp. 71–83). Sterling, VA: Stylus Publishing.

Wilder, S. (2014). Effects of parental involvement on academic achievement: A meta-synthesis. *Educational Review*, *66*(3), 377–397. https://doi.org/10.1080/00131911.2013.780009

Wolcott, H. F. (1994). *Transformative qualitative data: Description, analysis, and interpretation*. Thousand Oaks, CA: Sage Publications.

Zhang, H., & Almeroth, K. (2010). Moodog: Tracking student activity in online course management systems. *Journal of Interactive Learning Research*, *21*(3), 407–429. Retrieved from https://www.learntechlib.org/primary/p/32307/

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From Finding a Niche to Circumventing Institutional Constraints: Examining the Links Between Academics' Online Networking, Institutional Roles, and Identity-Trajectory

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Abstract

Academics are increasingly encouraged to use social media in their professional lives. Social networking sites are one type of tool within this; the ability to connect with others through this medium may offer benefits in terms of reaching novel audiences, enhancing research impact, discovering collaborators, and drawing on a wider network of expertise and knowledge. However, little research has focused on the role of these sites in practice, and their relationship to academics' formal roles and institutions. This paper presents an analysis of 18 interviews carried out with academics in order to discuss their online networks (at either Academia.edu or ResearchGate, and Twitter) and to understand the relationship between their online networks and formal academic identity. Several strategies underpinning academics' use of the sites were identified, including: circumventing institutional constraints, extending academic space, finding a niche, promotion and impact, and academic freedom. These themes also provide a bridge between academic identity development online and institutional roles, with different priorities for engaging with online networks being associated with different career stages.

Keywords: digital identity, academic identity, digital scholarship, social networking sites, CMC, higher education

Introduction

Social media is increasingly playing a role in the professional lives of academics. While this can include use of mainstream generic social media tools (such as Facebook and Twitter), platforms have also been developed specifically for academics. The two largest academic social networking sites (ASNS) are Academia.edu and ResearchGate (Van Noorden, 2014). However, the role that ASNS play is not well defined and despite the potential benefits of social media there has been little focus on how they are being used in practice, and the relationship between social media and the formal social context of academia.

Through analysis of the technical affordances of ASNS, the following main functions for academics have been identified: collaboration, dissemination and communication, document and information management, online persona and identity management, and impact measurement (Espinoza Vasquez & Caciedo Bastidas, 2015). All are tied to a formal academic identity to some extent, in two main ways. First, contrasting pressures and responsibilities at different stages of an academic career may prioritise different aspects of using the sites, and second, ASNS require profiles as a virtual representation of the self (Hogan & Wellman, 2014). In contrast to generic social media, where anonymity and pseudonymity are common (Ellison, 2013), the identity expressed through ASNS must be relatable to an academics' offline persona in order to enjoy the benefits in their professional life.

Profile formats on ASNS has provided a ready source of data for exploring identity in terms of user characteristics at large scale. Demographic information required by profiles typically includes subject area, institution and job position, and may also include publication history, connections, and other information such as participation in discussions through the site. Web scraping and large-scale analysis of this information has been used to address questions about the extent of uptake of services by different demographic groups, and whether this reflects existing academic hierarchies.

Several such studies have focused upon Academia.edu as a data source (Almousa, 2011; Menendez, de Angeli & Menestrina, 2012; Thelwall & Kousha, 2013). In terms of disciplinary differences, Almousa (2011) reported that academics in Anthropology and Philosophy were more active than those in Chemistry or Computer Science. Thelwall and Kousha (2013) examined differences in terms of gender, as females have been shown to have an advantage in social media more generally, although female philosophers were found to have fewer Academia.edu profile views than males. This approach was extended to Law, History, and Computer Science, which revealed a mixed picture (Thelwall & Kousha, 2013).

In relation to job position, postdoctoral researchers emerged as the most active, uploading more material and following others (Almousa, 2011). Menendez et al. (2012) found that more senior academics were more proliferate in a range of profile characteristics than more junior academics. Across all three studies, graduate students were consistently found to have the lowest levels of use or profile completion (Almousa, 2011; Menendez et al., 2012; Thelwall & Kousha, 2013).

Menendez et al. (2012) also found that levels of use follow hierarchies in terms of university ranking and country development. Thelwall and Kousha (2015) follow up on the theme of whether ASNS preserve existing hierarchies in the context of ResearchGate. ResearchGate metrics were found to correlate with university ranking scores, and while some countries are disproportionately using the site (examples include Brazil and India), others are not (notably China and Russia; Thelwall & Kousha, 2015).

Although ASNS profiles are a ready source of demographic information, this may represent an impoverished view of academic identity online. Quantifying profile characteristics captures the product, but not the process, of identity construction and the dynamics that shape it. Academics are constrained in their definition of identity on ASNS as the profile fields are set by the technical design of the platform (Kimmons, 2014). The studies reviewed here focus upon a single platform, while academics are likely to construct their identity in different ways across the range of online tools that they use in relation to their academic practice (Veletsianos, 2016).

Large scale analysis of profiles identifies trends, but the academics' own perspectives are required to understand the processes involved, and this is lacking in the context of ASNS. Considering the experiences of trainee teachers with generic social networking sites (SNS), Kimmons and Veletsianos (2014) discuss how their professional and personal identities are played out online, and the challenges of tensions between them. Manca and Ranieri (2016) surveyed academics' levels of personal, professional, and teaching use of a range of social media platforms. ASNS use was found to be lower in relation to teaching compared to personal or professional uses. Teaching experience is reported to be related to the level of personal use of the sites, while age was correlated with professional use. Gender was found to be an important factor, with females demonstrating higher personal, professional, and teaching uses of ASNS (Manca & Ranieri, 2016).

Doctoral students and early career researchers (ECRs) have been identified as a group whose work and professional goals align well with the potential benefits of social media. Esposito (2014) focuses upon the role of social media in the transition from doctoral students to ECRs, drawing parallels with McAlpine and Akerlind's concept of identity-trajectory (2010) as a way of conceptualising academic identity development. Academic identity-trajectory has three components; the intellectual, networking, and institutional strands. The intellectual strand "represents the contribution an individual has made and is making to a chosen intellectual field through scholarship"; the networking strand "represents the range of local, national and international networks an individual has been and is connected with"; and the institutional strand "represents each person's relationships, responsibilities and resources wherever they are physically located" (McAlpine & Akerlind, 2010, p.139-143).

Social media and SNS may be at odds with formal institutional structures in a number of ways, such as not aligning with traditional indicators of academic worth and career progression (Fransman, 2013; Gruzd, Staves & Wilk, 2011), or carrying risks of challenging power dynamics and structures (Stewart, 2015). Stewart's (2015) study of Twitter-active academics emphasises the development of academic identities and networks as individuals rather independent of formal institutions. The link between professional academic identity development facilitated by social media, mediated by different platforms, and the relationship between academic identity online and the existing literature on academic identity development more generally requires further clarification.

This study contributes to an understanding of the relationship between academics' online networks and formal institutional roles. In doing so, the findings will help academics understand what they may gain from engaging with online social networks. The following research questions guided the study:

- What processes do academics perceive to shape their online social networks?
- Does the structure and/or role of the network differ in nature according to academic career trajectories?

Methods

The study used a mixed methods social network analysis approach (Dominguez & Hollstein, 2014; Edwards, 2010), comprising co-interpretive online interviews to explore and discuss network structures with participants. Earlier phases of the project had used a survey and quantitative network analyses; the full study can be found in Jordan (2017).

Interview participants were invited to take part from a sample of 55 academics (stratified to include a range of job positions and subject areas) who had been included in the quantitative network analysis phase, which examined their ego-networks on ASNS (Academia.edu or ResearchGate) and Twitter (Jordan, 2019). The decision to sample pairs of platforms and include Twitter was informed by the findings of a recent large-scale survey undertaken by Nature Publishing Group. The survey data showed disciplinary preferences between Academia.edu and ResearchGate (Jordan & Weller, 2018). Participants' Twitter networks were also included in the data collection, despite not being a specifically ASNS, as previous research highlighted that academics use it for a wider range of active scholarly purposes (Van Noorden, 2014). The sample of participants for interviews was stratified to include a range of job positions and subject areas (see Table 1). Two participants were invited per each combination of job position and subject area, for a total of 18 interviews. Note that the participants were assigned pseudonyms alphabetically in the order in which interviews were carried out; while the pseudonyms will be used when presenting quotes in the discussion, initials are given in the table (for example, H denotes "Harriet").

Table 1

Pseudonym Initials Assigned to Interview Participants, Cross Tabulated by Job Position and Discipline

		Job position			
		Professor	**Lecturer**	**Researcher**	**Graduate student**
Discipline	Humanities	O	N, P	C	I
	Natural Sciences	H, M	A, D	G, K	E
	Social Sciences	L	F, R	Q, B	J

Participants' networks had been analysed using Gephi (Bastian, Heymann, & Jacomy, 2009). The Sigma.js exporter (Hale, 2012) was used to create interactive versions of the networks which were shared with the participants ahead of the interviews. Each took place online via Skype; screen sharing was used so that both the interviewer and participant could see the network under discussion. Both audio and screen video were recorded during each interview. The technical setup of the interviews is illustrated in Figure 1.

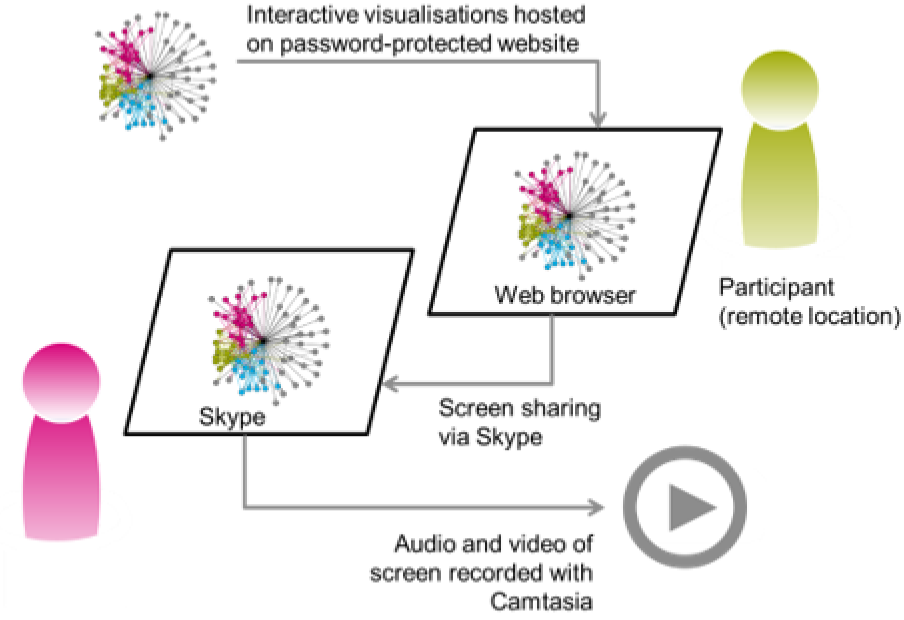

Figure 1. Technical setup for the online co-interpretive interviews.

The interviews were semi-structured (Wengraf, 2001), using a pre-planned interview schedule which was also shared with the participants in advance. The interviews were fully transcribed by the researcher to gain a greater level of familiarity with the data. The transcription data was used to annotate structure in the network graphs, and the discussions were analysed to understand instances where academics voiced explanations and personal reasons for their connections and use of the sites. The discussions were analysed using a grounded theory approach (Strauss & Corbin, 1998), undertaken using qualitative research analysis software (NVivo).

Open coding was first used to begin to identify common themes, following the participants' own phrases and using constant comparison throughout the process. A sense of theoretical saturation (Morse, 2007) became apparent after the ninth interview during the analysis. During the second phase, open codes were combined into emergent categories, which were then reapplied to a new set of the transcripts to ensure consistency. Finally, the emergent categories underwent axial coding into themes (Strauss & Corbin, 1998). To assess the reliability of the analysis, the coding scheme was applied by a second coder to half the transcripts. Cohen's Kappa was calculated and gave a value of 0.59 (Cohen, 1960), which can be considered a fair to good (0.40 to 0.75) level of agreement (Fleiss, 1981). The resulting coding scheme is shown in Figure 2.

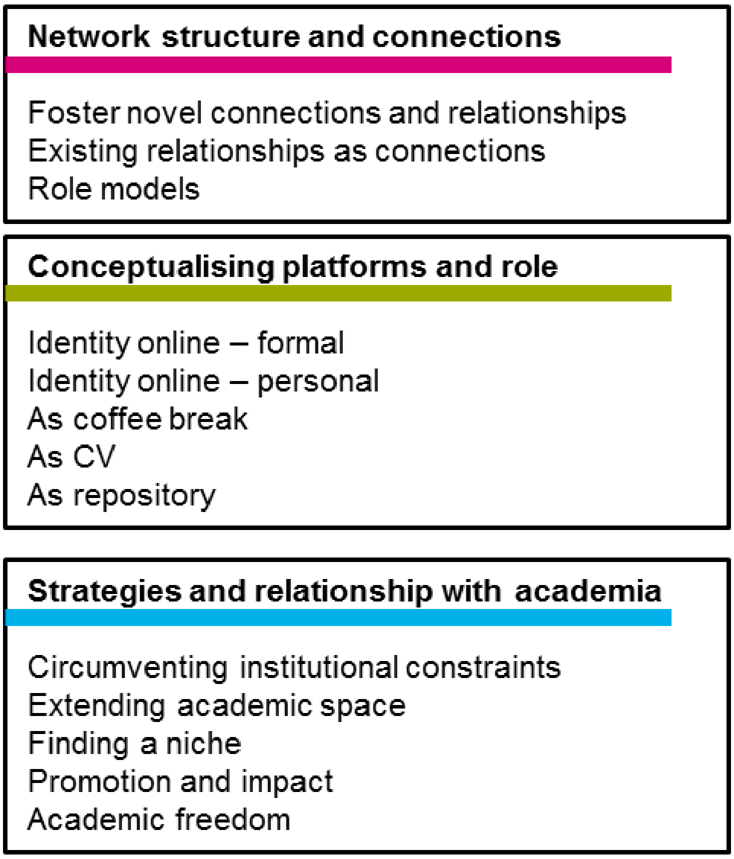

Figure 2. Emergent themes from the qualitative analysis.

Results

The third level of the coding scheme (Figure 2), "strategies and relationship with academia," is the focus of this paper. While the first two levels focused on the structural characteristics of participants' networks and differences between how academics conceptualise different sites, the third level extended the analysis to why participants use the sites and how it fits with their formal academic roles. The themes include: circumventing institutional constraints, extending academic space, finding a niche, promotion and impact, and academic freedom. The results will be presented in two sections reflecting the research questions, and the themes will be discussed in detail with illustrative quotes.

Strategies of Network Use and Their Relationship With Formal Roles and Academia

The theme "circumventing institutional constraints" is directly related to the formal institution with which academics are affiliated, illustrating a strategic use of the tools to cultivate an online academic profile independent of controls on institutional web pages or repositories. The theme relates particularly to use of ASNS (Academia.edu or ResearchGate), rather than Twitter. For example, Harriet has an institutional webpage, but it is subject to editing restrictions: "I periodically do and don't have editing rights over my [University] page, so I use my Academia.edu page as the place where my publications are available if somebody wants to find them."

Institutions may be keen to populate their repositories with publications, but uploading is often via a gatekeeper. ASNS therefore provide the perception of increased personal control and efficiency. Nicola describes her experience uploading personal content:

> It's not ideal but I'm currently in the process at [University] of getting all my stuff on to [University]'s research portal which is so clunky...so because uni repositories can be so useless, I think Academia[.edu] can be valuable in that sense because no-one's going and checking to see if you really are allowed to have that article PDF online.

"Extending academic space" relates to ways of using online networks to develop or maintain a profile as an academic beyond the boundaries (conceptually or physically) of their current role. Twitter was highlighted particularly in order to maintain research agendas and connections that are not a formal part of teaching-dominated roles. As Rachael explains, online identity is notably important to extend one's professional network:

> I worked at [University A] for six years as a fellow so I was a PhD student but I was also a faculty member, and so I felt very heavily connected to [University A]. [University B], although I'm a lecturer, ...my online identity is actually quite distinct from my role at [University B].

For Pippa, Twitter has proved to be an effective way of maintaining a connection to her professional role and as a way of overcoming barriers in terms of time and physical location. In relation to part-time working, caring responsibilities, and the geographical location of her institution, Twitter provided a means for Pippa to maintain her objectives for all:

> I feel slightly disconnected from my home university, and Twitter is a semi-substitute for that. There's sort of meetings and training that I don't go to at work, but I sort of have a sense of stuff that's going on out there in the higher education world, from Twitter.

This theme also includes examples where academics have used online networks (particularly Twitter) in order to create multiple online identities, representing not only their personal identity, but those of their projects, groups, and departments. Isaac could not recall exactly how many Twitter identities he has, which include accounts related to personal interests, political satire accounts, and academic project accounts. Carol, David, and Oliver also highlight accounts that they manage or co-manage for academic projects. David uses Tweetdeck to manage several professional accounts and streams that he is responsible for, including his department's Twitter feed, his research group, and the Twitter account for a specialist interest society group that he volunteers with.

The "extending academic space" theme also includes emerging practices around Twitter as a research site in itself. For example, Emily joined Twitter in 2011, as part of her doctoral research, to discover links to individuals and blogs from an otherwise hard to reach population. Kieran uses Twitter in a similar way, but adopts an observational role and is cautious about the potentially negative consequences of being drawn into online discussions. While this has been an integral part of Emily's doctoral work, other participants also view Twitter as a research site but in less formal terms. For example, Nicola uses Twitter to monitor developments in the industry related to her research topic, and Pippa has used Twitter to monitor world events in real time, and crowdsourced photos for her book.

The idea of SNS playing an important role in constructing an academic identity came through very strongly, with notions of "finding a niche" being viewed as particularly important for doctoral students by academics at all levels. Now PhD students, Isaac and Jacob both started to cultivate their online identities during Master's courses. Jacob explains:

> I started using [Academia.edu] because...I just thought it would be interesting, finding out what other academics were doing, sharing my work a bit, 'cos when I started the [Master's degree] that was when I started thinking about what research I really wanted to do, and where I wanted to place myself as an academic. So [a] part of that process is sort of identifying your niche, and letting people know that you're there.

Reflecting on when they set up their ASNS and Twitter profiles, Kieran and Quentin (now a postdoctoral researcher and lecturer, respectively) also note that these activities were undertaken when they were still students. Quentin perceives that, increasingly, the need to form an online academic identity begins at the undergraduate level.

> I've found there's an increasing trend on Academia.edu of kind of people doing undergraduate degrees and Master's degrees are using it, I think quite a lot of students they get to university, they get an Academia.edu profile and they look up people from the same institution, lecturers, or researchers, and they just kind of build their own connections that way so it's quite interesting that it seems to have shifted further back along the career path and education.

Emily described her Academia.edu account as a "portable repository," emphasising its role as a space which is defined but can travel with her. Although Emily does not intend to stay in academia post-doctorate, she is likely to keep using Twitter because she has created "a personal brand" there, although this may depend on her future employer:

> It's your personal brand, you are, it's a very public way of saying these are the things I'm interested in and this is my perspective on them. You can tell very clearly the politics of someone if they use it in that way, and I think it really depends on where I work.

Post-doctorate, academic online networking takes a different role in negotiating interdisciplinary fields and transitions. For example, Carol moved from a Humanities-based field for her PhD into a Social Science-based field as a postdoctoral researcher. Her network structures include communities from both fields and her high ego betweenness centrality indicating that she is acting as a broker between otherwise disparate communities. While he remains in his home discipline of Geography, Kieran is looking to find different ways of focusing his work, for example through engaging with Science and Technology Studies, and he has consciously sought out connections in the field within his Academia.edu network. Postdoctoral researchers are still liminal in relation to formal academic structures, and online networks can provide a persistent space for hosting a formal academic identity. Nicola explains:

> While I was on the job market...the uni didn't have a good website and because I was temporary I certainly wasn't getting much more than my name and photo on the website, no research portal or anything because I was just teaching staff, so Academia[.edu] was important then because at least if someone Googled me they would find me.

In relation to "promotion and impact," the ability to track metrics adds to the appeal of ASNS. This is linked to mechanisms for promotion and perceived demonstrations of the value of academic work. The interviews suggest that this theme is of particular concern for mid-career academics, looking to secure permanent or more senior positions. Gillian describes how the act of uploading new publications to ResearchGate helps "to make myself searchable, REFable, that sort of thing."

Promoting her work was a key motivation for Pippa in joining Academia.edu and Twitter, as she was in the process of writing a book and wanted to promote it through her online networks. She also wanted to be able to use evidence from the platforms as part of a promotion case. Pippa describes her use of Academia.edu:

> I wanted to use it as part of a promotion application. I wanted to be able to say look, this is where my work's read, and how interested people around the world are in my work, and then I've found the more general benefits of it.

While ASNS do readily provide metrics, whether ASNS or Twitter are actually more effective at disseminating research and achieving impact is not clear. For example, Lucy and Jacob hold contrasting views on the value of Twitter in this respect. Lucy explains that

> I think Twitter is probably much less effective at disseminating my own research than ResearchGate and Academia.edu, so mainly Twitter for me is just about the transmission of mainly professional information.

While Jacob feels that

> In the Social Sciences it is as valuable, and really as desirable, for a tweet to be read by a non-academic as it is to be read by an academic...so if I'm on Academia[.edu] and I write something like that, it's like shouting into a cul-de-sac.

The "academic freedom" theme may also relate to differences in network structures observed according to job position, with professors and PhD students having the largest Twitter networks (Jordan, 2017). At the transition from PhD student to postdoctoral researcher (either within or outside of academia), participants indicated a perceived reduction in freedom to network. For example, Beth remarked that while active networking was viewed as being part of a PhD student's experience, she doesn't feel that networking is part of her role as a postdoctoral researcher working on another academic's project. Jacob has always used Twitter in a personal capacity as well as professional; however, starting a teaching post in his department alongside finishing his PhD has impacted his views on tweeting.

> Since I've felt myself in a position of responsibility, I've tried to be less weird, at least before 6pm, and I enforce that as a rule on myself, assuming that's working hours. But I know a lot of people who have two accounts, a personal and a work account, or go one way or the other.

While awareness of Twitter as a public space, attendant potential hazards and practices to decide what should or shouldn't be mentioned on the platform were referred to by the majority of participants, there were indications that more senior academics may feel more at ease expressing opinions, being more integrated into their professional communities. Frances explains that

> I would also be a bit cautious about expressing a controversial opinion, but mostly because I don't want to end up in the middle of some Twitter nastiness. But I doubt that that would ever happen because within my community it's just people who know me...if they don't know me, they'll know someone who has worked with me.

The Role of the Network and Academic Career Trajectories

The interviews uncovered a disciplinary element in terms of the types of communities which academics become part of on different platforms. While communities are more frequently defined by institutional relationships on ASNS, subject areas and specific research topics defined communities more frequently on Twitter (Jordan, 2017). The interviews support the notion of Twitter communities as being representative of the subject areas in which academics are embedded. This mirrors differentiation of academics' identity between formal, hierarchy-preserving, and institutional-focused identity on institutional homepages (Hyland, 2011) and disciplinary-focused online identity through personal webpages (Hyland, 2013).

Results across all phases of the study give a stronger indication of differences in how online networks are used and conceptualised at different career stages. This illuminates how the three strands of identity-trajectory (intellectual, institutional, and networking; McAlpine & Akerlind, 2010) are reflected in academics' professional use of social media, and extends and complements frameworks of social media use that have focused upon PhD students and ECRs (Esposito, 2014). The frequency of different codes according to job categories of interview participants are summarised in Table 2.

Table 2

Matrix Coding Query of Themes According to Job Position, Shown as a Percentage of Participants Within Each Job Position

	PhD student (n = 3)	**Researcher (n = 5)**	**Lecturer (n = 6)**	**Professor (n = 4)**
1.1 Foster novel connections and relationships	67	60	33	100
1.2 Existing relationships as connections	67	100	100	75
1.3 Role models	33	20	50	50
2.1 Academic identity online - formal	100	60	67	100
2.2 Academic identity online - personal	100	40	67	100
2.3 As coffee break	33	0	0	25
2.4 As CV	67	20	50	0
2.5 As repository	67	20	17	75
3.1 Circumventing institutional constraints	33	0	17	75
3.2 Extending academic space	33	40	83	50
3.3 Finding a niche	100	100	33	25
3.4 Promotion and impact	33	20	50	25
3.5 Academic freedom	67	40	50	50

The network analyses revealed differences according to platform in terms of job position. While their average network size on ASNS was the smallest compared to other groups, doctoral students have larger networks than mid-career academics (researchers or lecturers) on Twitter (Jordan, 2017). This may indicate that Twitter provides a more ready space for students to create online professional networks than ASNS.

In relation to understanding the processes behind network construction, the theme of "finding a niche" reflects the higher reciprocity and agreement within networks playing a role in career development. Codes relating to finding a niche were raised in interviews by all of the PhD students and researchers, in contrast to a third of lecturers and a quarter of professors. The importance of finding a niche and building an academic identity for doctoral students mirrors findings from Esposito (2015), who identified strategies in her study of doctoral students of weaving and splitting professional identities across different platforms, and choosing what to share online carefully. The present study reinforces this finding, and also extends it by finding that the issues persist further in academic careers too. Researchers often recalled starting their networks during their recent graduate studies, and their use has continued into their postdoctoral careers. Kieran describes his motivations for using social networking in graduate school:

> I think [started using Twitter] must've been during my Master's degree or the first year of my PhD...it was about that move to develop an online profile, 'cos I very much see my Twitter account as a professional thing, if you like, it's a space for my academic identity.

All of the researchers included in the interview sample were postdoctoral researchers, having completed their doctorates in recent years, working on research projects, and not employed on permanent contracts. As such, researchers showed similarly high levels of agreement with survey items (Jordan & Weller, 2018) in relation to career development (discussed previously in relation to doctoral students), and is reflected in the interviews in a continued desire to find a niche, such as in Beth's interview:

> On Twitter people seem to specialise in particular things that they tweet about, and I am currently just sort of tweeting about this that and the other and not really anything in particular. ...I need to find my niche.

The survey response and interviews show a slightly different character to "finding a niche" for researchers (Jordan & Weller, 2018). With a greater level of research experience behind them compared to doctoral students, promoting their research rather than themselves personally is viewed as more important at the post-doctorate level, with many researchers agreeing with the survey items "sharing authored content" and "raising the profile of your work in the research community." It is also notable that while they share the need to find a niche and secure permanent jobs, this was not raised by doctoral students, which may reflect findings that doctoral students are reluctant to share research for a combination of reasons, including awareness of what is permitted by publishers and influenced by their supervisors' views on the legitimacy of openness in scholarly practice (Carpenter, Wetheridge, & Smith, 2010). However, a perception that researchers face compromises in relation to their freedom to network and use social media was alluded to, through the "academic freedom" theme. Emily's interview illustrates this:

> There's a lot more freedom at a university, and then being a student you get a lot more freedom again. ...It's your responsibility, you're the one who's putting the information out there, you're the one who deals with the consequences.

The lecturers included in the sample held permanent academic appointments, two of the six being in senior positions (Frances and Pippa). Lecturers still agreed with two of the careers-related survey items already discussed. Additionally, lecturers and professors showed a greater level of agreement with the survey item "I use social networking sites to support my teaching activities" (Jordan & Weller, 2018). In the interviews, "promotion and impact" and "extending academic space" were both most prevalent in the lecturers' category. The interviews explain that these are priorities for lecturers, in order to maintain an active profile as a researcher in the face of heavy teaching loads.

The theme of "circumventing institutional constraints" was a key motivation for professors to use ASNS. This was frequently borne out of a desire to improve access and dissemination to their research publications, and as Lucy describes, is coupled with restrictions on the speed, ease, and criteria for depositing items in their institutional repositories.

> It is a little bit slower to get papers up on the institutional repository, particularly now with the new REF guidelines that everybody has to be open access. ... With ResearchGate I can get a paper up there within seconds; with our institutional repository, it may be days, weeks, [or] months.

Discussion and Conclusions

Through co-interpretive interviews around their social network structures on two of the main types of social media platforms used professionally by academics, this study has provided an enhanced understanding of the roles that online networks can play in relation to formal academic identities. Furthermore, it also illuminates how the roles of online networks can be subject to different pressures and priorities in relation to different academic career stages. The findings advance research in this field in two main ways: first, by providing further empirical evidence of how digital scholarship is enacted in practice, through the particular technological lens of SNS (practices associated with ASNS not having been examined by existing studies); and second, by examining the reasons and strategies behind academics' use of SNS to bridge the gap between their online identities and formal institutional roles.

In addressing the first research question, five themes were identified in relation to how and why academics developed and explained their online network structures in relation to their roles as academics. The five themes included circumventing institutional constraints, extending academic space, finding a niche, promotion and impact, and academic freedom. The themes build upon previous work on academics' use of Twitter (Ahmad Kharman Shah, 2015) and the purposes for which academics use ASNS and Twitter (Van Noorden, 2014). The strategic themes identified here present a level of abstraction above these individual practices as to why academics use online networks in the ways that they do and is of practical value to academics who do not currently use social media in their professional lives.

The second question, which guided the study, concerned whether the structure and role of online networks showed different characteristics according to academic career trajectories. The benefits of online networking are frequently cast as being of particular value to more ECRs, while the significance for more senior academics remains under explored. Conversely, the social network structures fostered by ASNS favour existing hierarchies (Hoffmann, Lutz, & Meckel, 2015; Jordan, 2014), and academic seniority may be related to levels and purposes of use of social media platforms (Manca & Ranieri, 2016). The results here provide further detail and insight into the role online networks play at different career stages, which has both practical implications and furthers theoretical links with academic identity-trajectory as expressed online. Given the embeddedness of the more senior academics within professional subject communities and desire for academics to follow role models, it is important for the benefits to be examined across whole career trajectories. This will enable academics at any career stage to make better informed decisions about their adoption of social media and give ECRs and students a wider range of academic role models, to make further key connections within professional communities explicit.

The three strands of identity-trajectory (McAlpine & Akerlind, 2010) provides a way of conceptualising the role of online networks in relation to academic work. The *networking strand* is explicitly related to the perceived use of doctoral students in relation to network building and actively seeking connections to others within their field. Researchers leverage the *intellectual strand* through their use of the sites to promote the profile of their research and experience. Aware that maintaining an active profile as a researcher is key to further promotion within the academy but at odds with teaching-heavy roles, lecturers exploit their networks in order to do so, drawing upon their resources accrued through existing networking and overcoming barriers created by the *institutional strand* of their identity. The role of professors is interesting because although the size and embeddedness of their position within networks reflects an accomplished networking strand, their use of the sites is in contrast with the other categories. Despite being more secure in their formal positions within home institutions, professors are not empowered to freely control their online identity through their institutions and use of online networks (particularly ASNS) provides a way of circumventing this, inflecting the institutional strand through an online lens.

While the analysis extends and complements previous work that has focused upon doctoral students and ECRs, there are also some limitations due to the practical constraints of the sample. In order to ensure that a range of positions across academic career trajectories were represented, the sampling strategy focused upon those which fell into particular categories of job position (doctoral students, researchers, lecturers, and professors). This purposefully excluded potential participants who did not fit within these categories, such as para-academics, and those between formal academic roles and institutional affiliations. Online networks could be of greater importance to academics who support multiple identities in this sense (such as being a lecturer and doctoral student at the same time), (Bennett & Folley, 2014). Further follow-up work with academics working outside of formal academic roles and beyond the higher educational institutions in the UK context would be valuable.

The qualitative approach used here was exploratory in nature and provided insight into the nuanced ways in which academics' online networks relate to formal identity trajectory. While measures were taken to ensure validity of the study, the sample is relatively small. A confirmatory, survey-based study could be undertaken to build upon the study and test the results within a larger sample. Considering multiple platforms (ASNS and Twitter) is also both a strength and limitation of the present study. Further work is currently underway to explore how academic identity is expressed across a larger sample of major social media sites, including generic platforms such as Facebook and LinkedIn (Jordan, 2018).

References

Ahmad Kharman Shah, N. (2015). *Factors influencing academics' adoption and use of Twitter in UK Higher Education* (Doctoral dissertation, University of Sheffield, UK). Retrieved from http://etheses.whiterose.ac.uk/id/eprint/11505

Almousa, O. (2011, December 6-8). *Users' classification and usage-pattern identification in academic social networks*. Paper presented at the 2011 IEEE Jordan conference on Applied Electrical Engineering and Computing Technologies (AEECT), Amman, Jordan. DOI: 10.1109/AEECT.2011.6132525

Bastian, M., Heymann, S., & Jacomy, M. (2009). Gephi: An open source software for exploring and manipulating networks. *Proceedings of the International AAAI Conference on Weblogs and Social Media* (pp. 361-362). Palo Alto, USA: AAAI.

Bennett, L., & Folley, S. (2014). A tale of two doctoral students: Social media tools and hybridised identities, *Research in Learning Technology*, *22*, 1-10. DOI: 10.3402/rlt.v22.23791

Carpenter, J. Wetheridge, L., & Smith, N. (2010). *Researchers of tomorrow: Annual report 2009–2010*, London: British Library/JISC. Retrieved from https://www.jisc.ac.uk/reports/researchers-of-tomorrow

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, *20*(1), 37–46. DOI: 10.1177/001316446002000104

Dominguez, S. & Hollstein, B. (Eds.). (2014). *Mixed methods social networks research: Design and application*. Cambridge: Cambridge University Press.

Edwards, G. (2010). Mixed-method approaches to social network analysis (Discussion Paper ID 842). Southampton: National Centre for Research Methods. Retrieved from http://eprints.ncrm.ac.uk/842/

Ellison, N. (2013). *Future identities: Changing identities in the UK – the next 10 years*. London: Government Office for Science. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/275752/13-505-social-media-and-identity.pdf

Espinoza Vasquez, F.K., & Caicedo Bastidas, C.E. (2015). *Academic social networking sites: A comparative analysis of their services and tools*. Paper presented at iConference 2015, Newport Beach, USA. Retrieved from https://www.ideals.illinois.edu/bitstream/handle/2142/73715/380_ready.pdf?sequence=2

Esposito, A. (2014). *The transition 'from student to researcher' in the digital age: Exploring the affordances of emerging ecologies of the PhD e-researchers*. (Doctoral dissertation, Universitat Oberta de Catalunya, Barcelona, Spain). Retrieved from http://hdl.handle.net/10609/41741

Esposito, A. (2015, September). *PhD researchers using social media: Trajectories of academic identities*. Presentation at academic identity in the digital university: current trends and future challenges. The Society for Research in Higher Education, London, UK.

Fleiss, J.L. (1981). *Statistical methods for rates and proportions* (2nd ed). New York: John Wiley.

Fransman, J. (2013). *Becoming academic in the digital age: representations of academic identity in the online profiles of early career researchers*. London: Society for Research in Higher Education. Retrieved from https://www.srhe.ac.uk/downloads/FRANSMAN_Final_Report.pdf

Gruzd, A., Staves, K., & Wilk, A. (2011) *Tenure and promotion in the age of online social media*. Paper presented at the Association for Information Science and Technology (ASIS&T 2011) Annual Meeting, New Orleans, USA. DOI: 10.1002/meet.2011.14504801154

Hale, S.A. (2012, November 15). Build your own interactive network (Blog post). *Interactive Visualizations*. Retrieved from http://blogs.oii.ox.ac.uk/vis/?p=191

Hoffmann, C.P., Lutz, C., & Meckel, M. (2015) A relational altmetric? Network centrality on ResearchGate as an indicator of scientific impact. *Journal of the Association for Information Science and Technology*, *67*(4), 765-775. DOI: 10.1002/asi.23423

Hogan, B., & Wellman, B. (2014). The relational self-portrait: Selfies meet social networks. In M. Graham & W.H. Dutton (Eds.) *Society & the Internet: How networks of information and communication are changing our lives* (pp. 53-66). Oxford: Oxford University Press.

Hyland, K. (2011). The presentation of self in scholarly life: Identity and marginalization in academic homepages. *English for Specific Purposes*, *30*(4), 286-297. DOI: 10.1016/j.esp.2011.04.004

Hyland, K. (2013). Individuality or conformity? Identity in personal and university homepages. *Computers & Composition*, *29*(4), 309-322. DOI: 10.1016/j.compcom.2012.10.002

Jordan, K. (2014). Academics and their online networks: Exploring the role of academic social networking sites. *First Monday*, *19*(11). Retrieved from https://firstmonday.org/article/view/4937/4159

Jordan, K. (2017). *Understanding the structure and role of academics' ego-networks on social networking sites* (Doctoral dissertation, The Open University, UK). Retrieved from http://oro.open.ac.uk/48259/

Jordan, K. (2018, December 5-7). *Networked selves and networked publics in academia: Exploring academic online identity through sharing on social media platforms.* Paper presented at the Annual Society for Research in Higher Education Conference, Newport, Wales. Retrieved from http://oro.open.ac.uk/58548/

Jordan, K. (2019). Separating and merging professional and personal selves online: the structure and processes which shape academics' ego-networks on academic social networking sites and

Twitter. *Journal of the American Society for Information Science and Technology*, early view. DOI: 10.1002/asi.24170

Jordan, K., & Weller, M. (2018) Communication, collaboration and identity: Factor analysis of academics' perceptions of online networking. *Research in Learning Technology, 26*, 2013. DOI: 10.25304/rlt.v26.2013

Kimmons, R. (2014). Social networking sites, literacy, and the authentic identity problem. *TechTrends, 58*(2), 93-98. DOI: 10.1007/s11528-014-0740-y

Kimmons, R., & Veletsianos, G. (2014). The fragmented educator 2.0: Social networking sites, acceptable identity fragments, and the identity constellation. *Computers & Education, 72*, 292-301. DOI: 10.1016/j.compedu.2013.12.001

Manca, S., & Ranieri, M. (2016) "Yes for sharing, no for teaching!": Social Media in academic practices. *The Internet and Higher Education, 29*, 63-74. DOI: 10.1016/j.iheduc.2015.12.004

McAlpine, L., & Akerlind, G.S. (2010). *Becoming an academic: International perspectives*. Basingstoke: Palgrave Macmillan.

Menendez, M., de Angeli, A., & Menestrina, Z. (2012). Exploring the virtual space of academia. In *Proceedings of the 10th International Conference on the Design of Cooperative Systems* (pp. 49-62). London: Springer-Verlag.

Morse, J. (2007). Theoretical saturation. In M.S. Lewis-Beck, A. Bryman, & T.F. Liao (Eds.) *The SAGE encyclopaedia of social science research methods* (pp. 1122-1123). London: SAGE.

Stewart, B. (2015). *Scholarship in abundance: Influence, engagement, and attention in scholarly networks*. (Doctoral dissertation, University of Prince Edward Island, Charlottetown, Canada). Retrieved from http://bonstewart.com/Scholarship_in_Abundance.pdf

Strauss A.L., & Corbin J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. London: SAGE.

Thelwall, M., & Kousha, K. (2013). Academia.edu: Social network or academic network? *Journal of the Association for Information Science and Technology, 65*(4), 721-731. DOI: 10.1002/asi.23038

Thelwall, M., & Kousha, K. (2015) ResearchGate: Disseminating, communicating and measuring scholarship? *Journal of the Association for Information Science and Technology, 66*(5), 876–889. DOI: 10.1002/asi.23236

Van Noorden, R. (2014). Online collaboration: Scientists and the social network, *Nature, 512*(7513). Retrieved from http://www.nature.com/news/onlinecollaboration-scientists-and-the-social-network-1.15711

Veletsianos, G. (2016). *Social media in education: Networked scholars*. New York: Routledge.

Wengraf, T. (2001). *Qualitative research interviewing*. London: SAGE.

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Systematic Mapping Study of Academic Engagement in MOOC

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Abstract

MOOCs are presented as an affordable and easily accessible modality that offers the opportunity to democratize education in our time; however, this convenience training favors a low completion rate of the participants. Faced with this situation, scholars have suggested that it is necessary to deepen the construct of academic engagement, a concept that has been addressed in the study of face-to-face training, to better understand how students participate in this educational modality. This article systematically explores the existing literature, in the period of 2015-2018, about the construct of academic engagement in online, massive and open learning courses, through a Systematic Mapping of Literature, a method which aims to identify the characteristics of production in a given subject. The results show that there is a considerable increase in published articles that associate academic engagement and MOOCs, mainly from the United States, Australia, and the United Kingdom. Most of the mapped publications employ qualitative methods, with an exploratory approach, although there are several correlational studies. The study of participation patterns and instructional design appear as the main topics of interest in the field. In addition to providing a general overview of production on the subject, the research provides accurate information that will identify works for more in-depth reviews. Thus, it also offers a replicable and flexible literature search method for different research interests.

Keywords: MOOC, academic engagement, e-learning, technology

Introduction

Talking about massive, open and online courses (MOOCs) means referring to a low-cost educational offering, with the possibility of connection at any time and place. Although the idea of education at convenience is accessible to the user, it also encourages participants to postpone, forget, or disengage from carrying out the academic activities (Kizilcec, Piech, & Schneider, 2013; Milligan, Littlejohn, & Margaryan, 2013). Academic research records show that although a large number of students enroll to start MOOCs, only a small fraction manages to complete them (Halawa, Greene, & Mitchell, 2014; Jordan, 2014). Therefore, there is consistent criticism among MOOCs researchers, one of which is that this method does not offer students the necessary structures to learn significantly and autonomously, which causes lack of persistence, lack of motivation and, finally, course desertion (Conole, 2015; Jordan, 2014; Milligan et al., 2013).

The possibility offered by MOOCs to democratize education and the limitation of its low completion rate have led to an area of interest for educational research. Although some authors consider that research in MOOCs is an incipient and challenging area (de Barba, Kennedy, & Ainley, 2016; Gašević, Dawson, & Siemens, 2015; Greene, Oswald, & Pomerantz, 2015), since their emergence in 2006 research has focused on (1) studying aspects to motivate participants to complete the courses (e.g., Kizilcec, Pérez-Sanagustín, & Maldonado, 2016; Kizilcec & Schneider, 2015); (2) identifying aspects related to self-regulation of learning to reduce dropout or predict performance and/or retention (e.g., Kizilcec et al., 2016); and, (3) analyzing course design elements for the same purpose (e.g., Conole, 2015). These three topics are linked to what other researchers have called *academic engagement* in the classroom modality.

Researchers have studied the academic engagement construct as a way to improve discontent, avoid boredom, improve motivation and student participation in academic activities, increase success levels, and understand the positive development of students (Appleton, Christenson, & Furlong, 2008; Carter, Reschly, Lovelace, Appleton, & Thompson, 2012; de Barba et al., 2016; Valdivia, Ramírez-Montoya, & Valenzuela, 2018). Academic engagement is also studied as being a valuable construction to capture the gradual process by which students abandon academic activities (Appleton et al., 2008; Kizilcec et al., 2013). In MOOCs, researchers and educators consider academic engagement as the main theoretical foundation to intervene and understand possible dropouts, to improve positive performance, and encourage the completion of an educational goal (Joksimovic et al., 2018).

As every cognitive construct, there is no single definition or form of measurement for engagement. Newmann, Wehlage, and Lamborn (1992) define it as the psychological inversion in which the student invests energy and effort to understand something. Meanwhile, York, Gibson, and Rankin (2015) indicate that engagement is a term generally used to refer to the student's psychological investment, his or her willingness to invest time in educational behaviors, or to a general reference of student involvement in educational activities. In MOOCs, engagement can be conceptualized in a similar way as in face-to-face education; however, its operationalization, in terms of the forms and processes of data collection, is totally different. According to Joksimović et al. (2018), in MOOCs, engagement consists of time spent on course activities, participation in tests and exams, time spent in videos, and participation in exercises and assignments.

Given the emerging condition of academic engagement as a construct associated with MOOCs as a response to the problem of low success found in these educational environments, this research aims to map the scientific production on academic engagement in MOOCs published in the years 2015, 2016, 2017 and in the beginning of 2018, to identify the specific lines of study within this topic. The research answers the question: What has been the production in the three-year period between 2015 and 2018 on academic engagement in MOOCs?

Studies on the academic engagement of participants in MOOCs are recent; however, the subject is in consolidation as a line of study, and several literature reviews associated with the construct have been done. Different authors have identified academic engagement as a research trend in MOOCs. Ebben and Murphy (2014), for example, analyzed 25 articles published between 2011 and 2013 with the objective of identifying research topics on MOOCs. The following trends stand out in their results: academic engagement, creativity, learning analytics, evaluation, and critical discourses. Subsequently, Sa'Don, Alias, and Ohshima (2014), examined 164 articles published between 2008 and 2014 with the same objective as Ebben and Murphy, specifically in institutions of Higher Education. Their results highlight research trends such as evaluation and engagement/motivation, social interaction, retention, politics, instructional design, and cultural diversity. Authors like Anderson, Huttenlocher, Kleinberg, and Leskovec (2014) and Kizilcec, Pérez-Sanagustín, and Maldonado (2016) argue that there is still little understanding of how students participate and become involved in MOOCs, and that this construct is still under construction.

Bozkurt, Akgün-Özbek, and Zawacki-Richter (2017) conducted a systematic literature review that identified trends and research patterns in massive environments. The authors reviewed 362 empirical articles from 2008 to 2015 and conducted content and discourse analyses. Among their results they found that: (1) research on MOOCs would increase in subsequent years; (2) conceptual/descriptive studies are the most used methodology in MOOCs, constituting the majority of articles (53.3%) in almost all years studied; (3) the three main areas of research in MOOCs are: theories and models, characteristics of the students, and instructional design; and (4) the second most used methodology is quantitative research (19.6%) with few surveys, correlational, or experimental studies.

Raffaghelli, Cucchiara, and Persico (2015) discussed the methodological approaches in MOOCs research between 2008 and 2014. Their analysis covered 60 articles, and the results of their study show that the majority of the research consisted of theoretical studies and case studies, and, like Bozkurt et al. (2017), the authors found that experimental studies are very scarce. In their discussion, Raffaghelli, Cucchiara, and Persico (2015) emphasize that the theoretical frameworks to address research questions in the area are not clear and that there is little interest in knowing about the tools and methodological aspects of MOOCs research.

Veletsianos and Shepherdson (2016) analyzed the published empirical literatures on MOOCs between 2013 and 2015 and from 2013 to 2015. In their results they show that: (1) more than 80% of the literature in the area was published in North America and Europe; (2) almost half of the works lacked citations; (3) a quantitative focus was favored for carrying out research in MOOCs through surveys and automated methods; (4) qualitative methods, which are a minority in their study, use interviews, observations, and focus groups; and (5) little research is done about the instructor or expert (Veletsianos & Shepherdson, 2016).

Joksimovic et al. (2018) conducted a literature review on learning approaches in MOOCs. In their study, they analyzed the constructs related to the learning used in the prediction and measurement of the engagement and the learning outcome (Joksimovic et al., 2018). One of the results reported by the authors was the lack of solid frameworks to explain learning in an open online environment, thus they proposed an appropriate framework for open online contexts based on the model as developed by Reschly and Christenson (2012), which defines engagement as a process and as a result (Joksimovic et al., 2018).

The analysis of the reviews allows us to deduce that, although the conclusions of the research have suggested that academic engagement is a relevant construct to understand the participation of students in MOOCs, researchers on this environment have not incorporated the concept in their literature reviews. Thus, as pointed out by Anderson et al. (2014) and Kizilcec et al. (2016), the understanding of how students participate is still scarce.

Method

The research was developed through a Systematic Mapping Study (SMS). SMS is a type of literature review used to identify, select, and synthesize production in a specific field or associated with a concept, with the purpose of identifying what evidence is available on the subject (Cooper, 2016; Kitchenham & Charters, 2007). As outlined by Kitchenham and Charters (2007), a SMS focuses on classification, thematic analysis, and identification of publication without evaluating quality. This type of study differs from systematic reviews, which focus on quality, in order to identify the best practices based on empirical evidence (Kitchenham & Charters, 2007).

According to the authors reviewed (Cooper, 2016; Dybå, Dingsøyr, & Hanssen, 2007; Kitchenham & Charters, 2007; Petersen, Vakkalanka, & Kuzniarz, 2015), the method of the present work was structured in three central moments: (1) the search approach, (2) the search protocol, and (3) the analysis. Each one is described below.

First Moment: Search Approach

The approach consisted in the formulation of the following questions to guide the inquiry:

1. How many studies are in the range of 2015 to March 2018?
2. In which country were the works published in the period indicated?
3. Who are the authors of the most cited documents?
4. What documents are referenced most frequently?
5. What journals/conferences have been interested in the production of the academic engagement construct?

6. What methodological perspectives, designs, and approaches to educational research are most used in the study of the construct?

7. What type of instruments are most used in the study of academic engagement in MOOCs participants?

8. What thematic lines emerge in the study of academic engagement in MOOCs participants?

Second Moment: Development of the Search Protocol

The search protocol was designed based on the steps performed by Petersen, Vakkalanka, and Kuzniarz (2015) both for the selection of scientific production and for its analysis. Figure 1 graphically represents this process.

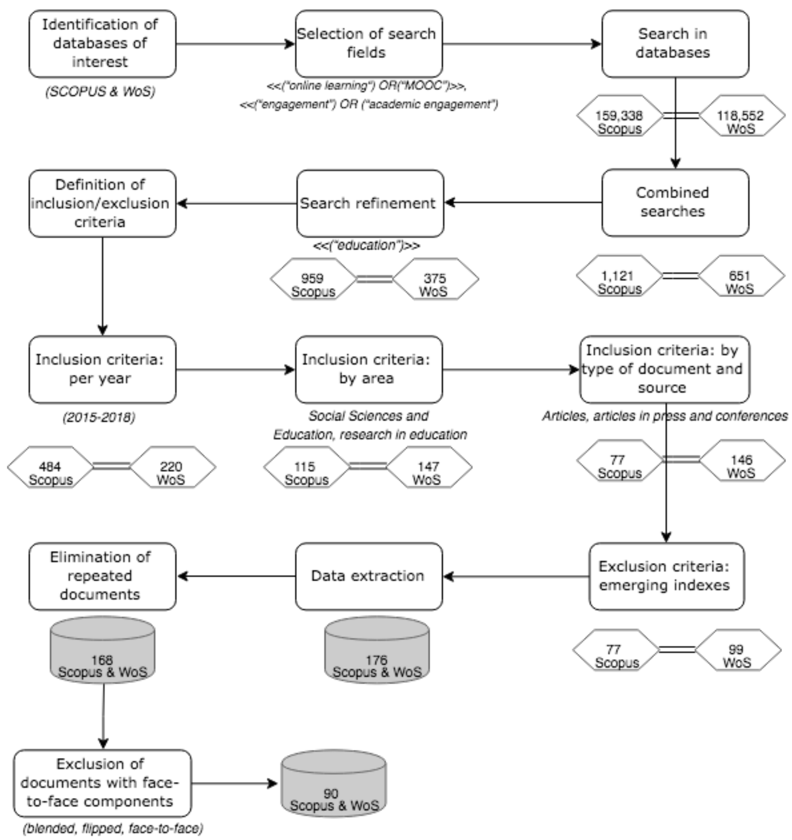

Figure 1. Flow diagram of the search protocol.

As recommended by Dybå, Dingsøyr, and Hanssen (2007), indexes were chosen that met different quality criteria: (1) containing intelligent tools to track, analyze and visualize the research; (2) integrating global critical and scientific research; and (3) having peer evaluation. The two databases chosen that met the quality criteria mentioned were: (1) *Scopus* and (2) *Web of Science* (WoS). This allowed a global search of production in fields such as science, technology, medicine, social sciences, and arts and humanities.

Searches in Scopus and WoS were carried out on March 1st, 2018. To have control over the search result for analysis after this work, several individual search expressions were created. Once the individual searches were carried out, a combination of searches was done. Table 1 shows the individual and combined searches, and the results obtained in each step.

Table 1

Boolean Expressions and their Combination in Scopus and WoS

Boolean expression	SCOPUS	WoS
(<<online learning>>) OR (<<MOOCs>>)	18,075	11,226
(<<engagement>>) OR (<<academic engagement>>)	141,263	107,326
Combined search (<<online learning>>) OR (<<MOOCs>>) AND (<<engagement>>) OR (<<academic engagement>>)	1,121	651
(<<education>>)	959	375

Note. The search was conducted on March 1st, 2018.

Four inclusion criteria were defined: (1) per year (2015-2018), (2) per area (the one with the highest frequency), (3) per type of document and source (articles, articles in press and conferences), and (4) per language (English). One exclusion criterion was set: without emerging indexes. Regarding the fourth inclusion criterion (per language), it is important to mention that no documents were found in a language other than English, so it was not considered as part of the flow diagram of the search protocol. The results for each index are shown in Table 2.

Table 2

Inclusion and Exclusion Criteria Results in Scopus and WoS

	SCOPUS		WoS	
Inclusion / exclusion criteria	Selection	Results	Selection	Results
Per year	2015-2018	484	2015-2018	220
Per area	Social sciences	115	Education and educational research	147
Per type of document and source	Articles, articles in press and conferences	77	Articles, articles in press and conferences	146
Per language	English	77	English	146
Without emerging indexes	Only established indexes	77	Only established indexes	99

In summary, 77 documents from the Scopus database and 99 documents from the WoS database were considered, a total of 176 documents to continue with the extraction, analysis, and classification of results.

Third Moment: Analysis and Classification

As a part of this step, data extraction was performed. Of the 176 documents chosen (see Figure 1), the following information was extracted from each database: (1) authors, (2) names, (3) abstracts, (4) year of publications, (5) type of sources, (6) number of citations, and (7) type of documents.

In some cases, journals are indexed in both databases, Scopus and WoS. For this reason, the next step was to identify duplicated documents that were found in both databases; eight duplicated documents were deleted and 168 documents were eligible for consideration. Finally, an analysis was made to detect and exclude documents with face-to-face components (blended, flipped classroom). Thus, 78 documents were discarded, and a total of 90 documents were considered in the investigation (see Figure 1 to consult the analysis and classification procedure).

The 90 documents selected were then grouped into the three main research perspectives: quantitative, qualitative, or mixed methods. To address other questions of the present investigation, the classification scheme of educational research designs provided by Creswell (2007, 2012), and Creswell and Poth (2018) was used, in addition to Hurtado's (2010) research approach classification. Figure 2 shows the different alternatives for perspectives, designs, and approaches sought in the review.

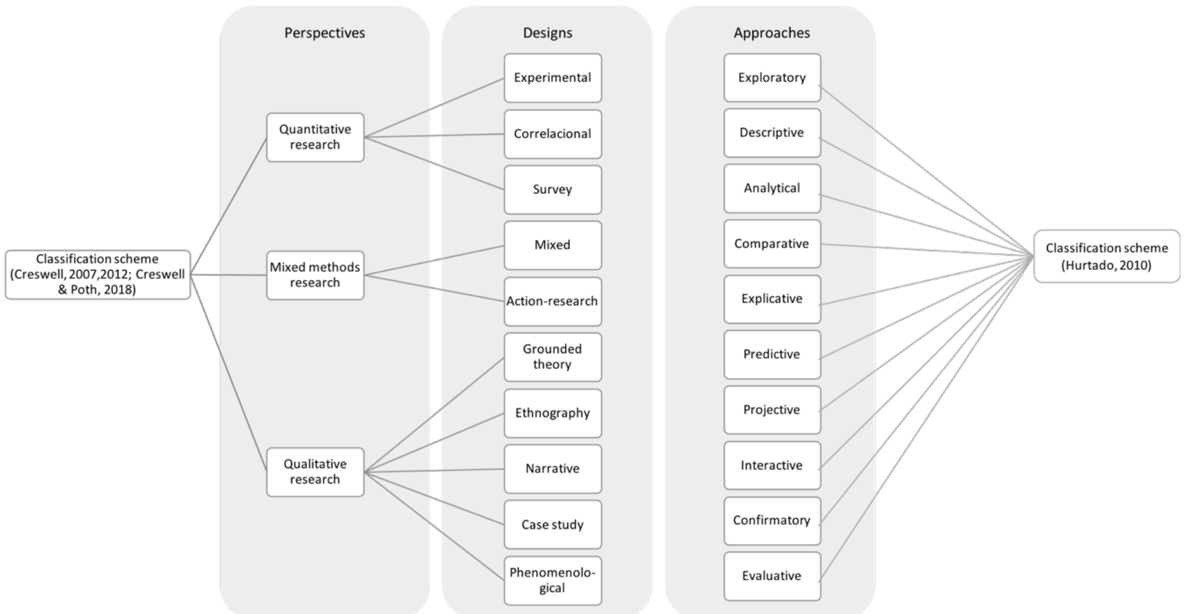

Figure 2. Perspectives, designs, and approaches sought in educational research.

On the other hand, the specific thematic lines were identified in an emergent way from reading, coding, and classifying the thematic contents of the abstracts of the selected works. In the following section, the results obtained are presented.

Results

How Many Studies are in the Range of 2015 to March 2018?

The final count of documents admitted with the selected criteria was 90 (see mapped production at https://goo.gl/yvViRV), 44 from Scopus and 46 from WoS. The summary of the documents selected by database and by year can be found in Figure 3, which shows an increase of the research carried out in both databases from 2015 to 2017.

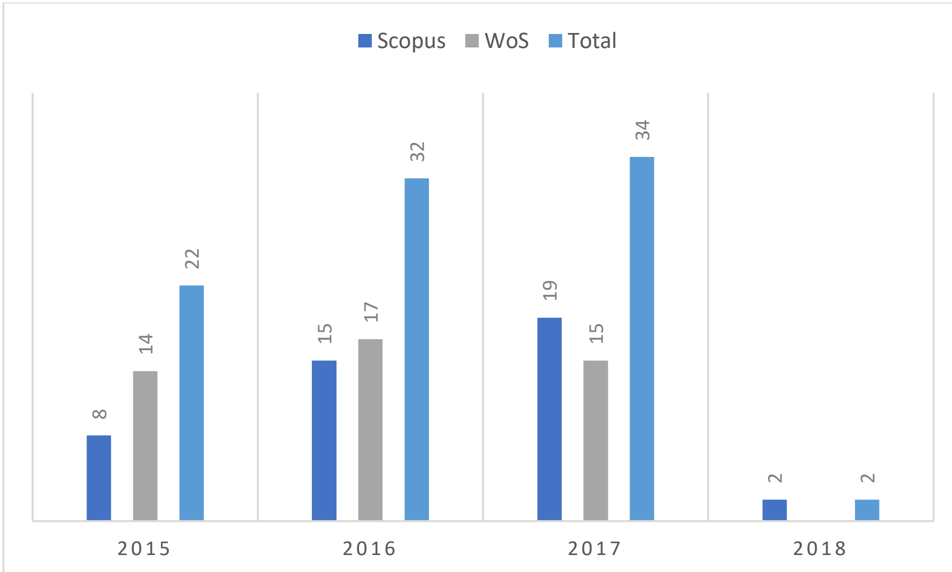

Figure 3. Documents selected by database and by year.

From 2015 to March 2018, a greater number of articles were published (78%) than conferences (22%). The difference is greater in 2017, where 94% of the documents are articles and only 6% are conferences. Table 3 shows the sets of articles according to their type and year of publication.

Table 3

Documents Selected by Type

Year	Articles	Conferences	Article identifier	Conference identifier
2015	64%	36%	[A35, A36, A37, A38, A39, A40, A41, A42, A43, A45, A46, A47, A51, A52]	[A83, A84, A85, A86, A87, A88, A89, A90]
2016	69%	31%	[A19, A20, A21, A22, A23, A24, A25, A26, A27, A28, A29, A31, A32, A33, A34, A44, A48, A49, A50, A56, A71, A72]	[A57, A74, A75, A76, A77, A78, A79, A80, A81, A82]
2017	94%	6%	[A02, A03, A04, A05, A06, A07, A08, A09, A10, A11, A12, A13, A14, A15, A16, A17, A18, A30, A53, A54, A55, A58, A59, A61, A62, A63, A64, A65, A66, A69, A70, A73]	[A67, A68]
2018	100%	0%	[A01, A60]	
Total	78%	22%	70 articles	20 conferences

In Which Country Were the Works Published in the Period Indicated?

To know in which countries the research on the academic engagement in MOOCs was published, the places of affiliation of the first authors in the selected documents were identified; the geographical distribution is presented in Figure 4. The results show that the research of the construct is present in the five continents, with the largest number of articles published in the United States of America (21), the United Kingdom (16), and Australia (11).

Figure 4. Geographical distribution of documents by frequency.

Who Are the Authors of the Most Cited Documents?

A total of 9 documents have 11 or more citations reported in the databases, 5 of them from the Scopus database and 4 from WoS. As shown in Table 4, the author with the highest number of reported citations is Jordan, K. with the article: *Massive Open Online Course Completion Rates Revised: Assessment, Length and Attrition* (26 citations). In second place is Toven-Lindsey, B., Rhoads, R. A., and Lozano, J. B. with the article: *Virtually Unlimited Classrooms: Pedagogical Practices in Massive Open Online Courses* (24 citations). The third position is from Hew, K. F. with the article: *Promoting Engagement in Online Courses: What Strategies can we Learn from Three Highly Rated MOOCs* (20 citations). It is important to note that the most cited documents (more than 10 citations) all are articles that were published between 2015 and 2016. The relevance of these articles is relative, since perhaps the documents of the last years (2017 and 2018) did not have enough time to be cited; however, this is a limitation of the methodology (Kitchenham & Charters, 2007). The results of this exercise are important for the purposes of this research, since the most cited documents of the years 2015 and 2016 are identified.

Table 4

Most Cited Authors and Documents

ID	Authors	Name of the document	Year	Type of document	Citations	Database
A38	Jordan, K.	Massive open online course completion rates revisited: Assessment, length and attrition	2015	A	26	S
A43	Toven-Lindsey, B., Rhoads, R. A. & Lozano, J.	Virtually unlimited classrooms: Pedagogical practices in massive open online courses	2015	A	24	W
A36	De Freitas S. I., Morgan J., & Gibson D.	Will MOOC transform learning and teaching in Higher Education? Engagement and course retention in online learning provision	2015	A	23	S
A24	Hew, K. F.	Promoting engagement in online courses: What strategies can we learn from three highly rated MOOCs	2016	A	20	S
A44	Barak, M., Watted, A., & Haick, H.	Motivation to learn in massive open online courses: Examining aspects of language and social engagement	2016	A	19	W
A45	Goldberg, L. R., Bell, E., King, C., O'Mara, C., McInerney, F., Robinson, A., & Vickers, J.	Relationship between participants' level of education and engagement in their completion of the Understanding Dementia Massive Open Online Course	2015	A	16	W
A25	Evans, B. J., Baker, R. B., & Dee, T. S.	Persistence patterns in massive open online courses (MOOC)	2016	A	15	S
A40	Anders, A.	Theories and applications of massive online open course [MOOC]: The case for hybrid design	2015	A	13	S

A46	Brinton, C. G., Rill, R., Ha, S., Chiang, M., Smith, R., & Ju, W.	Individualization for Education at Scale: MIIC Design and Preliminary Evaluation	2015	A	11	W

Note. A= Article, S=Scopus, W=Web of Science.

In general, 52 documents (58%) from both databases do not have citations, leaving 42% of the documents with at least one citation. Of these, 58% correspond to documents from the WoS database and 42% to documents from the Scopus database.

What Documents Are Referenced Most Frequently?

To answer this research question, the references of the 90 selected documents were obtained. Once the database was created, the references that were not in APA format were eliminated, and a total of 2,131 references formed the database to be analyzed. Table 5 shows the references with the highest frequency used for the documents.

Table 5

Most Frequently Referenced Documents

Reference	Articles that cite it	Type of document
Kizilcec, R. F., Piech, C., & Schneider, E. (2013). *Deconstructing disengagement: Analyzing learner subpopulations in massive open online courses*. Third International Conference on Learning Analytics and Knowledge, LAK '13 Leuven, Belgium. Retrieved from https://web.stanford.edu/~cpiech/bio/papers/deconstructingDisengagement.pdf	A11, A24, A25, A28, A38, A45, A47, A57	Conference
Breslow, L. B., Pritchard, D. E., DeBoer, J., Stump, G. S., Ho, A. D., & Seaton, D. T. (2013). Studying learning in the worldwide classroom: Research into edX's first MOOC. *Research & Practice in Assessment*, *8*, 13-25. Retrieved from https://www.rpajournal.com/dev/wp-content/uploads/2013/05/SF2.pdf	A24, A38, A44, A45, A57	Article
Perna, L. W., Ruby, A., Boruch, R. F., Wang, N., Scull, J., Ahmad, S., & Evans, C. (2014). Moving through MOOC: Understanding the progression of users in Massive Open Online Courses. *Educational Researcher*, *43*, 421-432. https://doi.org/10.3102/0013189X14562423	A20, A25, A38, A45, A53, A57	Article
Ho, A. D., Chuang, I., Reich, J., Coleman, C., Whitehill, J., & Northcutt, C. (2015). *HarvardX and MITx: Two years of open online courses* (HarvardX Working Paper No. 10). doi:10.2139/ssrn.2586847	A23, A38, A44, A45, A57	Report

Reference	Articles that cite it	Type of document
Allen, I.E., & Seaman, J. (2013). *Changing course: ten years of tracking online education in the United States*. Babson Survey Research Group and Quahog Research Group, Babson Park, MA. Retrieved from http://www.onlinelearningsurvey.com/reports/changingcourse.pdf	A07, A18, A21, A41, A46	Report
Jordan, K. (2014) Initial trends in enrolment and completion of massive open online courses. *The International Review of Research in Open and Distance Learning, 15*(1), 133-160. DOI: https://doi.org/10.19173/irrodl.v15i1.1651	A28, A38, A44, A45, A46	Article
Conole, G. (2013). MOOC as disruptive technologies: strategies for enhancing the learner experience and quality of MOOC. *Revista de Educación a Distancia. Número, 39*. Retrieved from http://www.um.es/ead/red/39/conole.pdf	A12, A24, A28, A42	Article
DeBoer, J., Ho, A. D., Stump, G. S., & Breslow, L. (2014). Changing "course": Reconceptualizing educational variables for massive open online courses. *Educational Researcher, 43*, 74-84. https://doi.org/10.3102/0013189X14523038	A25, A38, A45, A57	Article
Ferguson, R., & Clow, D. (2015) Examining engagement: Analyzing learner subpopulations in massive open online courses (MOOC). In *5th International Learning Analytics and Knowledge Conference* (LAK15; p. 1-8). Poughkeepsie, NY, USA: ACM. https://doi.org/10.1145/2723576.2723606	A11, A38, A44, A45	Conference

The most referenced documents focus on three major research areas: (1) to describe the development and characteristics of learning environments (e.g., Conole, 2013), (2) to understand how learning is achieved in these environments (e.g., Breslow et al., 2013; Perna et al., 2014), and (3) to understand how to support and motivate participants to continue or complete the courses (e.g., Kizilcec, Piech, & Schneider, 2013; Jordan, 2014). This result makes sense as recent studies report that the theoretical and empirical frameworks in MOOCs environments are in development (Joksimovic et al., 2018).

What Journals/Conferences Have Been Interested in the Production of the Academic Engagement Construct?

Research regarding the construct of academic engagement was most frequently published in Elsevier's *Computers & Education* (Q1 and h-index of 125), Blackwell Publishing's *British Journal of Educational Technology* (Q1 and h-index of 71), Carfax Publishing's *Distance Education* (Q1 and h-index of 33), and Athabasca University's *International Review of Research in Open and Distance Learning* (open access, Q1 and h-index of 46). The first three journals listed above are from the United Kingdom and the last from Canada. In terms of conferences, research regarding the construct of academic engagement was published most frequently in the *International Technology, Education, and Development* (INTED) and the *International Conference on Education and New Learning Technologies* (EDULEARN), both organized in Spain. Research on this construct also appeared (less frequently) in the journal *IEEE Transactions on*

Learning Technologies (Q1 and h-index of 33) and in the *Journal of Computing in Higher Education,* both from the United States of America, as well as in the journal *Higher Education Research & Development* (Q1 and h-index of 29) from the United Kingdom.

As shown in Table 6, the journals in which research on the construct of academic engagement is published most frequently are in the Quartile 1 with the highest level of impact, also, their h-indexes are greater than 24. This indicates the quality and quantity with which the scientific works of the researchers in the area are being published.

Table 6

Frequencies by Type of Document and Source

Type	Source	Country	Impact	h-index	Freq.	ID
Journal	*Computers & Education*	United Kingdom	Q1	125	7	A44, A48, A50, A53, A60, A61, A63
Conference	*INTED 2015, 2016, 2017: 9th 10th 11th International Technology, Education and Development Conference*	Spain	n/a	n/a	6	A68, A74, A78, A79, A80, A86
Journal	*British Journal of Educational Technology*	United Kingdom	Q1	71	5	A2, A3, A13, A24, A36
Journal	*Distance Education*	United Kingdom	Q1	33	5	A23, A39, A52, A64, A66
Journal	*International Review of Research in Open and Distance Learning*	Canada	Q1	46	5	A29, A33, A37, A38, A40
Conference	*EDULEARN15 & 16: 7th and 8th International Conference on Education and New Learning Technologies*	Spain	n/a	n/a	4	A76, A85, A88, A89
Journal	*IEEE Transactions on Learning Technologies*	USA	Q1	33	4	A46, A54, A59, A71
Journal	*Journal of Computing in Higher Education*	USA	Q1	24	2	A11, A12
Journal	*Higher Education Research & Development*	United Kingdom	Q1	29	2	A6, A35

What Methodological Perspectives, Designs, and Approaches to Educational Research Are Most Used in the Study of the Construct?

Of the studies in the area, 51% correspond to qualitative research, 38% to quantitative research, and 10% to mixed method studies. Figure 5 summarizes the educational research perspectives identified in the documents.

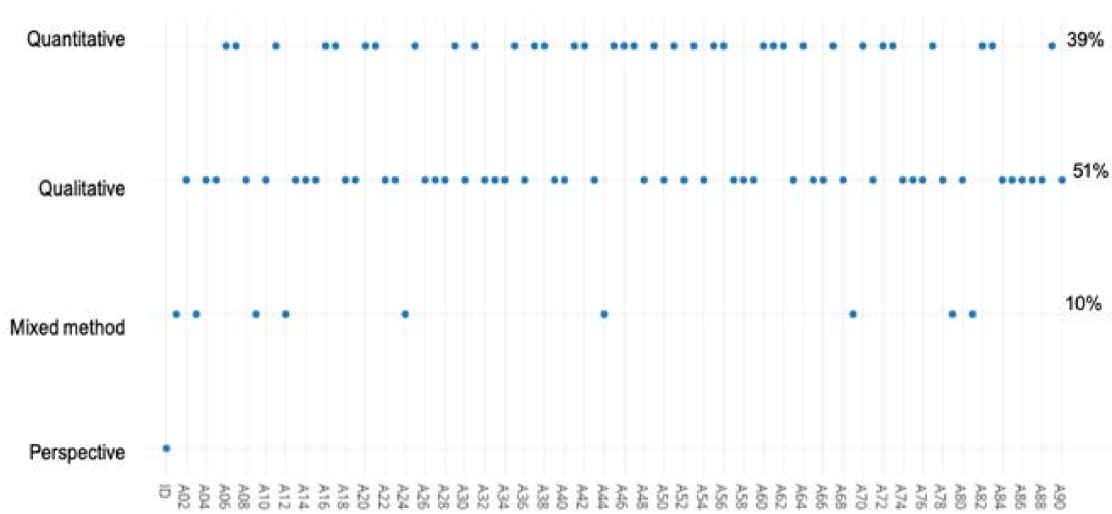

Figure 5. Perspectives of educational research used in documents.

Following the classification scheme of educational research designs provided by Creswell (2007, 2012) and Creswell and Poth (2018), it was found that most of the documents correspond to correlation research (31%), followed by phenomenological research (23%), case studies (18%), mixed method studies (9%), surveys (6%), and grounded theory (4%). The least recurrent were the narrative studies (3%) and the experimental investigations (2%). In addition to the previous classification, and as the objective of this research, the Systematic Review category is reported with 3% of production. Figure 6 shows the designs in the mapped production.

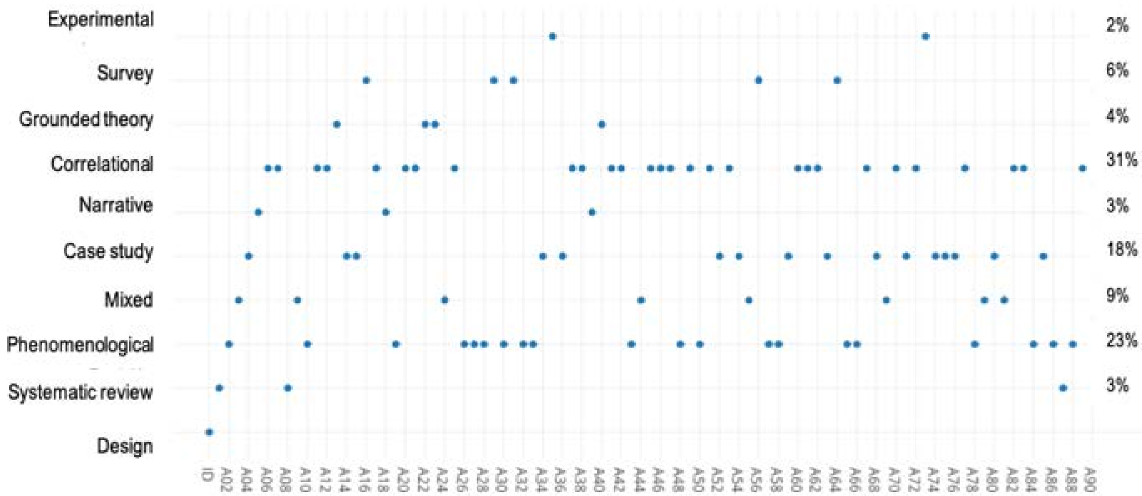

Figure 6. Designs of educational research used in the documents.

Table 7 identifies the sets of documents belonging to each research design. For this analysis it is important to highlight that the titles and abstracts of all documents were read. The method sections of only 36 documents (those that were available in their full-text version), were also read.

Table 7

Classification by Design and Research Method

Design	Qualitative research	Quantitative research	Mixed methods	Total	ID
Correlational		30%	1%	31%	A06, A07, A11, A12, A17, A20, A21, A25, A37, A38, A41, A42, A45, A46, A47, A49, A51, A53, A60, A61, A62, A67, A70, A72, A77, A82, A83, A89
Phenomenological	23%			23%	A02, A10, A19, A26, A27, A28, A30, A32, A33, A43, A48, A50, A57, A58, A65, A66, A78, A84, A86, A88, A90
Case study	18%			18%	A04, A14, A15, A34, A36, A52, A54, A59, A63, A68, A71, A74, A75, A76, A80, A85

Mixed		1%	8%	9%	A03, A09, A24, A44, A55, A69, A79, A81
Survey		6%		6%	A16, A29, A31, A56, A64
Grounded theory	4%			4%	A13, A22, A23, A40
Narrative	3%			3%	A05, A18, A39
Systematic Review	2%		1%	3%	A01, A08, A87
Experimental		2%		2%	A35, A73

An exploratory approach, which seeks to know more about some unknown phenomenon, was found in 32% of the documents; 23% of the documents look for explanations of relationships between factors to determine what will be the future behavior or the trend of that event, that is, they follow a predictive approach; 20% of the documents follow a descriptive approach; in 11% of the documents, two or more groups are studied and their behavior compared, situating them in the comparative approach; 4% of the documents follow an evaluative approach; 3% seek to understand the situations in terms of the relationships of their components following an analytical approach; and 3% corresponds to confirmatory approaches in which hypotheses are tested. With 2% and 1% are the interactive and projective approaches. Figure 7 shows the approaches identified in the works.

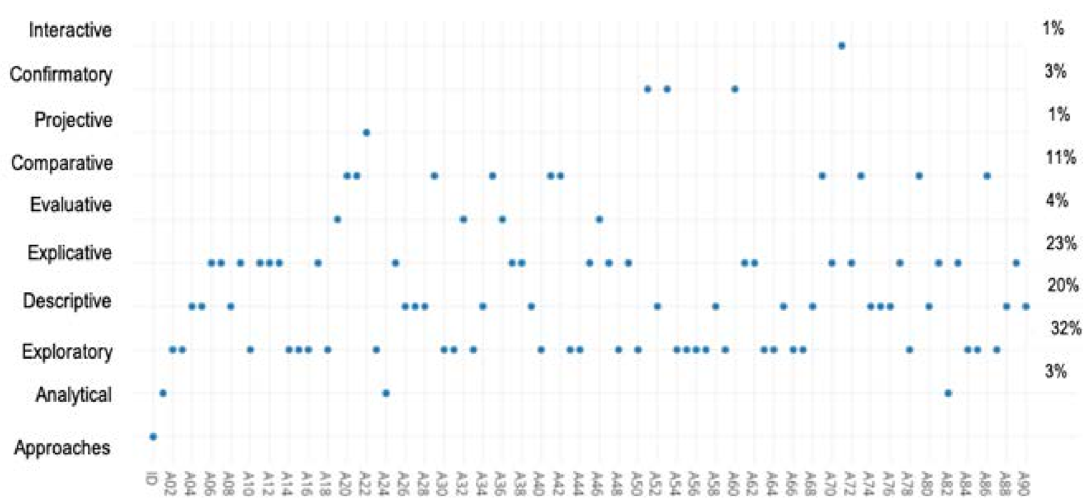

Figure 7. Approaches to educational research used in the documents.

Table 8 presents the sets of documents that belong to each approach and in each research path.

Table 8

Classification by Approach and Research Method

Approach	Mixed methods	Quantitative research	Qualitative research	Total	ID
Exploratory	2%	6%	24%	32%	A02, A03, A10, A13, A14, A15, A16, A18, A23, A30, A31, A33, A40, A43, A44, A48, A50, A54, A55, A56, A57, A59, A63, A64, A66, A78, A84, A85, A87
Explanatory	3%	20%		23%	A06, A07, A09, A11, A12, A17, A25, A37, A38, A45, A47, A49, A61, A62, A67, A70, A72, A77, A81, A83, A89
Descriptive			20%	20%	A04, A05, A08, A26, A27, A28, A34, A39, A52, A58, A65, A68, A74, A75, A76, A80, A88, A90
Comparative	2%	8%	1%	11%	A20, A21, A29, A35, A41, A42, A69, A73, A79, A86
Evaluative		1%	3%	4%	A19, A32, A36, A46
Analytic	2%	1%		3%	A01, A24, A82
Confirmatory		3%		3%	A51, A53, A60
Interactive			1%	1%	A71
Projective			1%	1%	A22

What Type of Instruments Are Most Used in the Study of Academic Engagement in MOOCs Participants?

To answer this research question, the method section of the documents found in full text (36) was read, and 4 documents that explicitly mentioned the data collection instruments in the abstract were added. In total, the instrumentation used in 40 documents is reported in this section.

Learning analytics, questionnaires, interviews, and surveys were the most commonly used instruments (see Table 9). It is also worth noting that social networks (Facebook and Twitter) and new technologies in education such as eye-tracking were also used to measure the construct of academic engagement.

Table 9

Instruments Used

Instruments	ID
Learning analytics	A03, A07, A09, A11, A17, A25, A38, A44, A54, A60, A61, A67, A70, A79
Questionnaires	A02, A53, A54, A55, A62, A66, A77, A44, A60, A63, A76, A79
Interviews	A26, A27, A32, A39, A63, A65, A02, A03, A53, A55
Surveys	A16, A20, A24, A25, A29, A31, A33, A41
Discussion boards	A45, A55, A57
Twitter	A12, A13, A37
Participant Observation	A24, A37
Exams	A06, A45
Facebook	A13, A37
Eye-tracking	A89

Note. More than 40 instruments were found since each document used between one and three instruments.

What Thematic Lines Emerge in the Study of Academic Engagement in MOOCs Participants?

From this analysis trends or thematic lines emerged, among which the following stand out: (1) research in the area of course design, instructional design, or improvement of the learning environment (e.g., A04 and A05); (2) research to identify, predict, or know patterns of participation (e.g., A11 and A12); (3) presentation, description of success stories, or evaluation of new pedagogies (e.g., A32 and A35); (4) inquiry into the participant-teacher, participant-participant, or participant-content interaction (e.g., A08 and A26); (5) motivation to learn (e.g., A2 and A31); and (6) persistence (e.g., A25, A37).

Some of the less frequent thematic lines in the MOOCs construct research were: eye-tracking, perseverance, multitasking, gender, evaluation, curriculum design, credits, coaching, and access to Higher Education. The categorization of documents by thematic line type can be found in Table 10.

Table 10

Research Trends in the Study of Academic Engagement in MOOCs

Trend	Frequency	ID
Instructional design	13	A04, A05, A10, A21, A23, A24, A34, A69, A75, A76, A78, A84, A85
Participation patterns	12	A11, A12, A13, A14, A15, A22, A27, A61, A70, A72, A82, A86
New pedagogies	8	A32, A35, A36, A41, A42, A46, A68, A71
Interaction	7	A08, A26, A33, A47, A57, A59, A66
Learning motivation	6	A02, A31, A44, A48, A58, A63
Persistence	6	A25, A37, A38, A45, A49 A60
Learning communities	5	A20, A43, A50, A52, A77
Academic performance	5	A07, A09, A54, A67, A79
Theoretical models	4	A01, A40, A74, A90
Experiences	3	A39, A56, A65
Gamification	3	A16, A83, A88
Learning analytics	2	A30, A73
Self-regulated learning	2	A62, A64
Production of digital media	2	A18, A87
Feedback	2	A03, A06
Access to Higher Education	1	A55
Coaching	1	A80
Credits	1	A29
Dropout	1	A28
curriculum design	1	A18
Evaluation	1	A51
Gender	1	A17
Multitasking	1	A53
Perseverance	1	A81
Eye-tracking	1	A89

Conclusions

Although in a SMS the decisions about the search nucleus and the limits are chosen by the authors, an arbitrary choice, the mappings are at the upper end of the spectrum of reliability in an investigation to gain a vision of the state of the art of a research topic (Cooper, 2016; Perryman, 2016). The results of this research provide useful information about the state of the art of research on the construct of academic engagement in massive and open online environments.

The results confirm that the production of the construct is increasing and, as in the research of Raffaghelli et al. (2015) and Veletsianos and Shepherdson (2016), in the study of academic engagement this same trend is forecast for 2018. Until now, research on the construct is reported more frequently in journals than in conference proceedings/or reading books. The main journals in which it is published are in the quartile 1 (Q1) with the highest position and highest impact factor according to the Journal Citation Report, with h-indexes greater than 24. This speaks not only of the current impact of the issue but also of the quality in which the results are being disseminated.

This research also sheds light on which documents have the greatest incidence in the area, in addition to providing information about the authors and documents with the highest number of citations. The three categories in which the most referenced documents are grouped are: (1) instructional design, (2) how to achieve learning, and (3) motivation and persistence. This tells us that research in this area is only recently emerging, a finding consistent with the research of Joksimovic et al. (2018). This can also be reflected in the documents identified in this research study with the highest number of citations (see Table 6). In these documents, and according to Joksimovic et al. (2018), researchers and professors interested in online education are searching for a framework for the academic engagement construct, one that may provide infrastructure as well as allow for comparison and contrast of the different dimensions of the engagement and pedagogical practices in MOOCs, and thus lead to a greater scientific understanding of how learning happens at scale.

Most of the documents selected in this study correspond to qualitative research that seeks to describe a phenomenon to understand it in depth. This result could be due to the fact that the theoretical and conceptual frameworks for online learning environments are still in development (de Barba, et al., 2016; Gašević et al., 2015; Greene et al., 2015). However, following the methodological design classification scheme of Creswell (2007, 2012) and Creswell and Poth (2018), 31% of the documents have correlational designs. The objective of predicting the success of students in MOOCs, not only to construct predictive models but also to explain the variance in diverse dependent variables of interest, is a very relevant objective to incorporate interventions for the improvement of these learning environments. The previous results contrast with the research carried out by Veletsianos and Shepherdson (2016) in which they report that research in MOOCs follows a quantitative approach with automated methods; however, the results support the research of Raffaghelli et al. (2015) and Bozkurt et al. (2017) which argue that the majority of MOOCs research consists of conceptual/descriptive studies. One limitation of this result is that, of the 90 documents selected for this SMS, only 36 were available in their full-text version. Therefore, it was only possible to read the method section of 36 out of 90 documents. The reading of only the abstract and title of the rest of the documents, on some occasions, may not have accurately reflected the methodological designs used.

Learning analytics emerged as the main source of data collection in the area, followed by questionnaires, interviews, surveys, and forums. However, other more easily accessible methods of data collection emerged, such as the use of the social networks Twitter and Facebook. Methods that might be considered more technological also emerged, such as eye-tracking. The systematic study of the dimensions and variables used to measure the construct is an interesting topic to study in future research.

Although the SMS was carried out in a short time (2015-2018), the results showed that the research of the academic engagement construct seems to be distributed and have a presence in the five continents, with the largest number of articles published in the United States of America (23%); this result was expected since the most popular platforms were developed in that country (e.g., Edx, Coursera, Udacity). These statements differ from the research of Veletsianos and Shepherdson (2016) in which they report that 80% of MOOCs studies were published in North America and Europe. In this case, in the research of academic engagement, only 56% were published in these two areas, Asia and Oceania participated with 16% and 20% respectively. An interesting question for future research would be to investigate which topics are addressed in the different geographical regions.

Some of the research trends that were identified within the study at hand were also identified within previous research. For example, Ebben and Murphy (2014), identified *learning* analytics as a research trend, and Sa'Don et al. (2014) identified *interaction and instructional design*. Specifically in the research on the academic engagement construct, the two strongest thematic lines were (1) instructional design and (2) participation patterns, which tells us about the interest of researchers to find empirical evidence about the major challenges of MOOCs with respect to retention (Greene et al., 2015), desertion (Halawa et al., 2014), motivation (Kizilcec & Schneider, 2015), and a design that enhances all of the above (Conole, 2015). Although less frequent, themes that arose within the research reviewed that could be of interest for future research include the study of perseverance, the production of digital media, policies of access to Higher Education, eye-tracking, the competence of multitasking, and mentoring or coaching. The latter was also identified by Raffaghelli et al. (2015) as a deep area in need of research on ways to improve learning outcomes in these environments.

In summary, the results of this study contribute to the investigation of online, massive and open learning environments in two ways. First, the research that has been carried out on academic engagement in said environments was identified; and, second, it provides the academic community with a better understanding of the opportunities for future research, identifying relevant issues and challenges in the area.

Given that research in these environments is a topic with growing academic activity, this work recognizes the importance of new frames of reference that strengthen the knowledge we have about mass learning. Undoubtedly, the gaps and research challenges in MOOCs cannot be achieved without ambition for a better understanding of the academic engagement construct.

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References

Anderson, A., Huttenlocher, D., Kleinberg, J., & Leskovec, J. (2014). *Engaging with massive online courses*. In Proceedings of the 23rd International Conference on World Wide Web - WWW '14 (pp. 687-698). Seoul, Korea. doi:10.1145/2566486.2568042

Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008). Student engagement with school: Critical conceptual and methodological issues of the construct. *Psychology in the Schools, 45*(5), 369-386. doi:10.1002/pits.20303

Bozkurt, A., Akgün-Özbek, E., & Zawacki-Richter, O. (2017). Trends and patterns in massive open online courses: Review and content analysis of research on MOOC (2008-2015). *The International Review of Research in Open and Distributed Learning, 18*(5), 1-19. doi:10.19173/irrodl.v18i5.3080

Breslow, L. B., Pritchard, D. E., DeBoer, J., Stump, G. S., Ho, A. D., & Seaton, D. T. (2013). Studying learning in the worldwide classroom: Research into edX's first MOOC. *Research & Practice in Assessment*, *8* 13-25. Retrieved from https://www.rpajournal.com/dev/wp-content/uploads/2013/05/SF2.pdf

Carter, C. P., Reschly, A. L., Lovelace, M. D., Appleton, J. J., & Thompson, D. (2012). Measuring student engagement among elementary students: Pilot of the Student Engagement Instrument—Elementary Version. *School Psychology Quarterly, 27*(2), 61-73. doi:10.1037/a0029229

Conole, G. (2015). Designing effective MOOC. *Educational Media International, 52*(4), 239-252. doi:10.1080/09523987.2015.1125989

Cooper, D. (2016). What is a mapping study? *Journal of the Medical Library Association, 104*(1), 76-78. doi:10.3163/1536-5050.104.1.013

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston, MA: Pearson. doi:10.1017/CBO9781107415324.004

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (Vol. 2). Thousand Oaks, CA: Sage. doi:10.1016/j.aenj.2008.02.005

Creswell, J. W., & Poth, C. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. Los Ángeles, CA: Sage.

de Barba, P. G., Kennedy, G. E., & Ainley, M. D. (2016). The role of students' motivation and participation in predicting performance in a MOOC. *Journal of Computer Assisted Learning, 32*(3), 218-231. doi:10.1111/jcal.12130

Dybå, T., Dingsøyr, T., & Hanssen, G. K. (2007). *Applying systematic reviews to diverse study types: An experience report*. In Proceedings - 1st International Symposium on Empirical Software

Engineering and Measurement, ESEM 2007 (pp. 225-234). Madrid, Spain. doi:10.1109/ESEM.2007.21

Ebben, M., & Murphy, J. S. (2014). Unpacking MOOC scholarly discourse: A review of nascent MOOC scholarship. *Learning, Media, and Technology, 39*(3), 328-345. doi:10.1080/17439884.2013.878352

Gašević, D., Dawson, S., & Siemens, G. (2015). Let's not forget: Learning analytics are about learning. *TechTrends, 59*(1), 64-71. doi:10.1007/s11528-014-0822-x

Greene, J. A., Oswald, C. A., & Pomerantz, J. (2015). Predictors of retention and achievement in a massive open online course. *American Educational Research Journal, 52*(5), 925-955. doi:10.3102/0002831215584621

Halawa, S., Greene, D., & Mitchell, J. (2014). Dropout prediction in MOOCs using learner activity features. *eLearning Papers, 37,* 1-10. Retrieved from https://pdfs.semanticscholar.org/a6d3/082a9a077d8f935bfefba1a4449bf5443f20.pdf?_ga=2.265077195.578108738.1551219502-1104262769.1531256554

Hurtado, J. (2010). *Guía para la comprensión holística de la ciencia* [Guide for the holistic understanding of science]. Dirección de investigación y posgrado (Vol. 2). Caracas, Venezuela.

Joksimovic, S., Poquet, A., Kovanovic, V., Dowell, N., Millis, C., Gasevic, D., & Brooks, C. (2018). How do we model learning at scale? A systematic review of research on MOOC. *Review of Educational Research, 88*(1), 43-86. doi: 10.3102/0034654317740335

Jordan, K. (2014). Initial trends in enrolment and completion of massive open online courses. *International Review of Research in Open and Distance Learning, 15*(1), 133-160. doi:10.19173/irrodl.v15i1.1651

Kitchenham, B., & Charters, S. (2007). *Guidelines for performing systematic literature reviews in software engineering Version 2.3* (Report No. EBSE-2007-01). Keele University and University of Durham.

Kizilcec, R. F., Pérez-Sanagustín, M., & Maldonado, J. J. (2016). Self-regulated learning strategies predict learner behavior and goal attainment in massive open online courses. *Computers and Education, 104*, 18-33. doi:10.1016/j.compedu.2016.10.001

Kizilcec, R. F., Piech, C., & Schneider, E. (2013). *Deconstructing disengagement: Analyzing learner subpopulations in massive open online courses.* In Lak '13. Leuven, Belgium. doi:10.1145/2460296.2460330

Kizilcec, R. F., & Schneider, E. (2015). Motivation as a lens to understand online learners. *ACM Transactions on Computer-Human Interaction, 22*(2), 1-24. doi:10.1145/2699735

Milligan, C., Littlejohn, A., & Margaryan, A. (2013). Patterns of engagement in connectivist MOOC. *MERLOT Journal of Online Learning and Teaching*, *9*(2), 149-159. Retrieved from http://jolt.merlot.org/vol9no2/milligan_0613.pdf

Newmann, F., Wehlage, G., & Lamborn, S. (1992). The significance and sources of student engagement. In F. Newmann (Ed.), *Student engagement and achievement in American secondary schools* (pp. 11-39). New York, NY: Teachers College, Columbia University. doi: 10.4236/ojapps.2014.45022

Perna, L.W., Ruby, A., Boruch, R.F., Wang, N., Scull, J., Ahmad, S. & Evans, C. (2014). Moving through MOOCs: Understanding the progression of users in massive open online courses. *Educational Researcher*, *43*(9), 421-432. Retrieved from https://www.learntechlib.org/p/157468/

Perryman, C. L. (2016). Mapping studies. *Journal of the Medical Library Association*, *104*(1), 79-82. doi:10.3163/1536-5050.104.1.014

Petersen, K., Vakkalanka, S., & Kuzniarz, L. (2015). Guidelines for conducting systematic mapping studies in software engineering: An update. *Information and Software Technology*, *64*, 1-18. doi:10.1016/j.infsof.2015.03.007

Raffaghelli, J., Cucchiara, S., & Persico, D. (2015). Methodological approaches in MOOC research: Retracing the myth of Proteus. *British Journal of Educational Technologies*, *46*(3), 488-509. doi: 10.1111/bjet.12279

Reschly, A. L., & Christenson, S. L. (2012). Jingle, jangle, and conceptual haziness: Evolution and future directions of the engagement construct. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 3-20). New York, NY: Springer.

Sa'Don, N. F., Alias, R. A., & Ohshima, N. (2014). *Nascent research trends in MOOC in higher educational institutions: A systematic literature review*. In International Conference on Web and Open Access to Learning, ICWOAL 2014. Dubai, United Arab Emirates. doi: 10.1109/ICWOAL.2014.7009215

Valdivia, J. A., Ramírez-Montoya, M. S., & Valenzuela, J. R. (2018). Motivation and knowledge: Pre-assessment and post-assessment of MOOC participants from an energy and sustainability project. *International Review of Research in Open and Distributed Learning*, *19* (4). doi: 10.19173/irrodl.v19i4.3489

Veletsianos, G., & Shepherdson, P. (2016). A systematic analysis and synthesis of the empirical MOOC literature published in 2013-2015. *The International Review of Research in Open and Distributed Learning*, *17*(2). doi: 10.19173/irrodl.v17i2.2448

York, T. T., Gibson, C., & Rankin, S. (2015). Defining and measuring academic success. Practical Assessment. *Research & Evaluation*, *20*(5), 1-20. Retrieved from http://pareonline.net/getvn.asp?v=20&n=5

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Exploring Demographics and Students' Motivation as Predictors of Completion of a Massive Open Online Course

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Abstract

This paper investigates the degree to which different variables affect the completion of a Massive Open Online Course (MOOC). Data on those variables, such as age, gender, English proficiency, education level, and motivation for course enrollment were first collected through a pre-course survey. Next, course completion records were collected via the Coursera database. Finally, multiple binomial logistic regression models were used to identify factors related to MOOC completion. Although students were grouped according to their preferences, working in groups did not affect students' likelihood for MOOC completion. Also, other variables such as age, the institution hosting the MOOC, academic program alignment with students' needs, and students' intention to complete the course all affected their probability of MOOC completion. This study contributes to the literature by indicating the factors that influence the probability of MOOC completion. Results show that older participants (age > 50 years old) have higher probability of completing the MOOC. Students' MOOC completion also increases when the MOOC provides experiences that add to students' current academic backgrounds and when they are hosted by institutions with a strong academic reputation. Based on these factors, this study contributes to research methods in MOOCs by proposing a model that is aligned with the most important factors predicting completion as recommended by the current MOOC literature. For the next phase of assigning learners to work in groups, findings from this study also suggest that MOOC instructors should provide assistance for group work and monitor students' collaborative processes.

Keywords: MOOC completion, demographics, motivation, intention of completion, groups in MOOCs

Introduction

The Massive Open Online Course (MOOC) is a popular online learning platform in which millions of students enroll. MOOCs offer educational opportunities for people who otherwise could not afford a formal education (Dillahunt, Wang, & Teasley, 2014). Unfortunately, MOOCs are also known for their high attrition rates (Ho et al., 2014; Lim, Coetzee, Hartmann, Fox, & Hearst, 2014; Malan, 2013). According to Liyanagunawardena, Adams, and Williams (2013), most MOOCs have a completion rate of less than 10%. Many factors cause dropouts in MOOCs, including overall lack of intention to complete the course (Cross, 2013; Onah, Sinclair, & Boyatt, 2014), lack of time and support (Hew & Cheung, 2014; Kellogg, Booth, & Oliver, 2014), change of job or location (Gütl, Rizzardini, Chang, & Morales, 2014; Onah et al., 2014), and language barriers (Schulze, 2014).

Many studies have been conducted to identify factors that contribute to MOOC completion; however, the findings vary across those studies. Cisel (2014) indicated that learner performance in MOOCs was highly correlated with the learner's geographic location, employment status, and time constraints, and that unemployed learners from high Human Development Index (HDI) countries were more likely to complete the course. Other variables that have been examined for their effects on MOOC completion include years of education (Guo & Reinecke, 2014; Schulze, 2014), friends' performance in a MOOC (Brown et al., 2015), prior online learning experience (Morris, Hotchkiss, & Swinnerton, 2015), English proficiency (Engle, Mankoff, & Carbrey, 2015; Konstan, Walker, Brooks, Brown, & Ekstrand, 2015; Schulze, 2014), number of posts and number of videos watched (Bonafini, 2017; Bonafini, Chae, Park, & Jablokow, 2017), gender (Bayeck, Hristova, Jablokow, & Bonafini, 2018; Breslow et al., 2013; Konstan et al., 2015; Schulze, 2014), and age (Breslow et al., 2013; Guo & Reinecke, 2014; Konstan et al., 2015; Morris et al., 2015; Schulze, 2014; Zhang et al., 2016). Most of the studies agree that there is a positive relationship between age and MOOC completion rates. Zhang et al. (2016) concluded that learners with age over 40 years who intended to complete the course achieved higher MOOC completion rates. In addition, Morris, Hotchkiss, and Swinnerton (2015) found that unemployed and older learners who had higher levels of education and previous online learning experiences tended to achieve higher course completion rates.

In spite of the numerous studies conducted to study learner motivations for enrolling in MOOCs (Belanger & Thornton, 2013; Gil-Jaurena, Callejo-Gallego, & Agudo, 2017; Konstan et al., 2015; Macleod, Haywood, Woodgate, & Alkhatnai, 2014; Radford, Coningham, & Horn, 2015; Zhong, Zhang, Li, & Liu, 2016), only a few of them have investigated the influence of motivation on MOOC completion. Konstan, Walker, Brooks, Brown, and Ekstrand (2015) concluded that most of the reasons that learners enrolled in a MOOC, such as university/instructor-related reasons or access to educational institutions-related reasons, did not affect course completion, but that learners' self-reported intention of completing the MOOC was a significant predictor of course completion.

In consideration of the inconsistent findings for predictors of MOOC completion from the existing literature, this paper presents a MOOC completion model that includes relevant variables to identify the most useful predictors pertaining to MOOC completion. This model identifies relevant characteristics of MOOC completers and non-completers, which can further inform the design and development of future MOOCs.

Literature Review

Students' motivation for taking a MOOC has been identified as a crucial factor for course engagement, which keeps learners persisting in the course (Xiong et al., 2015). Motivation factors, which contribute to sustained student engagement, include interest in the topics (Dillahunt et al., 2014; Hew & Cheung, 2014; Kizilcec & Schneider, 2015), curiosity about MOOCs (Hew & Cheung, 2014; Zheng, Rosson, Shih, & Carroll, 2015), current job needs (Christensen et al., 2013), the opportunity to connect with others (Belanger & Thornton, 2013), preparation for future jobs (Kizilcec & Schneider, 2015; Zheng, Rosson, Shih, & Carroll, 2015), relevance to current academic programs, interest in earning a certificate, and interest in the professor or the institution that offers the MOOC (Kizilcec & Schneider, 2015). Xiong et al. (2015) categorize these motivations as intrinsic motivations (interest related), extrinsic motivations (external rewards related, e.g. earning course completion certificate), and social motivations (taking this course with friends and connecting with others). Upon finding out that intrinsic and extrinsic motivations are significant predictors of learner engagement, and learner engagement correlates positively with retention, Xiong et al. (2015) propose forming a student learning community and providing incentives (e.g., certificates) as motivation factors to enhance learner engagement and retention.

Plenty of studies suggest that the use of group work could improve learning interaction and engagement, and that it has potential to enhance learning in MOOCs (Arendale & Hane, 2014; Berger & Wild, 2016; Hiltz, 1998; Jones, 1997; Williams, Duray, & Reddy, 2006, Wen, 2016). By working with others in a MOOC, students could learn from and assist one another in the learning process (Yuan & Powell, 2013). In their study, Guàrdia, Maina, and Sangrà (2013) found that collaborative work and peer assistance and assessment were effective MOOC design principles. Kulkarni, Cambre, Kotturi, Bernstein, and Klemmer (2015) found that "the more geographically diverse the discussion group, the better the students performed" (p. 1126).

A number of grouping approaches in MOOCs have been implemented in recent years. These approaches can be summarized into two categories: random grouping and criteria-based grouping. Random grouping is done by assigning learners into groups randomly (Zheng, Vogelsang, & Pinkwart, 2015). Whereas criteria-based grouping is performed based on different grouping mechanisms. For instance, Wen (2016) formed teams based on the transactive discussion within a large community and further deployed an automated agent to support team discussion. Zheng, Vogelsang, and Pinkwart (2015) created MOOC groups based on learner's preferred collaboration media and demographic information, including gender, time zone, and language. Sinha (2014) proposed to assign MOOC students to teams based on their connections with other learners in a social network.

In addition to motivation and grouping factors, learner's intention for completing a MOOC was identified as a significant estimator of their actual completion of a MOOC (Bonafini et al., 2017; Koller, Ng, Do, & Chen, 2013; Konstan et al., 2015). For instance, Koller, Ng, Do, and Chen (2013) concluded that learners with the intention of completing a MOOC achieved higher completion rates when compared to those who did not. Bonafini, Chae, Park, and Jablokow (2017) found that student's desire for certification had an amplifying effect on students' MOOC completion, as well as on the number of videos watched by the students. These studies inform us that a learner's commitment in completing the course plays an importance role in terms of improving learner engagement and retention in MOOCs. In this sense, it seems that the higher level of goal commitment a learner sets for oneself when the tasks are achievable, the better performance the learner will achieve (Locke, 1982).

The existing literature lays the foundation for incorporating pertinent variables to build a MOOC completion model for a particular MOOC such as learner demographics, motivation for enrollment, intention of completion, and working in groups.

Methodology

The purpose of this paper is to develop a multiple binomial logistic regression model that distinguishes significant variables affecting MOOC completion. The completion level is treated as a binary dependent variable with the result of either completing the course or not. Independent variables include age, gender, education level, motivation for taking the MOOC, working in groups, and intentions of completing the course. Participants were recruited to work in small online groups by matching their grouping preferences, such as their preferred language, media to communicate, and intention of completing the course. Students who had group preferences that could not to be matched by their preferences were placed in the control group. This study investigates the following research questions:

1. What are the characteristics of MOOC learners who participated in this study?
2. What are the learners' preferences related to working in groups?
3. What are the learners' motivations for taking this MOOC?
4. Which demographics and motivational factors predict the probability of MOOC completion?

Participants

Participants in this study were recruited from a MOOC offered through the Coursera platform from July to August, 2014 (Jablokow, Matson, & Velegol, 2014). Prior to the beginning of the course, an invitation for participating in online groups was sent out to MOOC learners. Learners who responded with interest in working in online groups received a pre-course survey, which inquired about their demographic information, reasons for taking this course, and grouping preference, among other questions. Participants were assigned into groups following the order of their preferred language to communicate within a team, intention of completion, and mode of communication (synchronous text, asynchronous text, or synchronous video and audio) (Zhang et al., 2016). Some of the synchronous groups were formed based on converted time zones. Participants whose grouping preference could not be satisfied or matched with others such as preferred language to speak in an online team or preferred time to work with others, were assigned into a control group. Students who were assigned to the control group received no instructional guidance or monitoring for group work.

After the online groups were formed, a general group work instruction email was sent out to the participants. In consideration of the large number of Chinese participants who volunteered for this grouping study, the email instruction was also translated into Chinese. Various online tools were suggested for different types of group communication such as MOOC discussion forums and email for learners' asynchronous communication, and Skype and QQ (a Chinese instant messaging tool) for learners' synchronous communication. Additionally, ZOOM (a video conferencing tool for large group discussions) was offered by the research team to learners for free use.

Data Sources

Pre-course survey. At the beginning of this course, a pre-course survey was sent to participants to collect their demographic information, such as gender, age, level of education, level of English proficiency, previous online learning experience, and employment status.

Post-course survey. At the end of this course, a post-course survey was sent to participants to gather feedback of their experiences of working in online groups in this MOOC.

Completion data. Learners in this MOOC were required to submit at least six assignments in order to obtain a certificate of completion. For learners who opted to earn a certificate of completion with distinction, twelve additional peer reviews were required. Learners who failed to meet these requirements were not awarded a completion certificate. Original course completion data was retrieved from Coursera with three levels of completion: none, normal, and distinction. These three levels of completion were recoded as a binary variable showing two levels of course completion: Complete (the combination of normal completion and completion with distinction) and Non-Complete.

Data Analysis

The pre-course survey data was exported from Qualtrics, students' completion records were collected through Coursera, and various data sets were retrieved and combined together in an SQL database. The data analysis and its graphical representation were computed using ArcMAP, SPSS, and R-Studio. R-Studio was used to run multiple binomial logistic regression models in order to identify the predictors that affect learners' MOOC completion. Within the model, MOOC completion is defined as a binary dependent variable, and all the independent variables are defined as categorical variables.

Independent variables were drawn from existing literature as shown in Table 1. We included learner demographics in our model as suggested by the research of Bayeck, Hristova, Jablokow, and Bonafini (2018), Breslow et al. (2013), Cisel (2014), and Engle, Mankoff, and Carbrey (2015), which include age, gender, education level, English proficiency, and employment status. We also included as parameter estimates: learners' motivations for taking MOOCs, as suggested in the research of Belanger and Thornton (2013), Brown et al. (2015), Dillahunt, Wang, and Teasley (2014), and Kizilcec and Schneider (2015). Motivations for taking MOOCs included interest in the subject, interest in the institution and professor that provides the course, building social connection with others, employment opportunities, earning a certificate, and friends' taking the course. Other variables identified from the literature contained the intention of completing the course (Engle et al., 2015; Koller et al., 2013; Konstan et al., 2015) and participation in online groups (Kulkarni, Cambre, Kotturi, Bernstein, & Klemmer, 2015; Sinha, 2014; Wen, 2016; Zheng, Vogelsang, & Pinkwart, 2015).

Table 1

Variable Literature and Data Sources

	Variable	**Literature Source**	**Data Source**
1	English level	Engle et al. (2015); Konstan et al. (2015); Schulze (2014); Zhang et al. (2016).	Pre-course survey
2	Education level	Engle et al. (2015); Guo and Reinecke (2014); Schulze (2014); Zhang et al. (2016).	Pre-course survey
3	Age	Bonafini, Chae, Park, and Jablokow (2017); Breslow et al. (2013); Guo and Reinecke (2014); Konstan et al. (2015); Morris et al. (2015); Schulze (2014); Zhang et al. (2016).	Pre-course survey
4	Gender	Bayeck et al. (2018); Bonafini (2017); Breslow et al. (2013); Konstan et al. (2015); Schulze (2014).	Pre-course survey
5	Intention to complete	Bonafini (2017); Koller et al. (2013); Konstan et al. (2015).	Pre-course survey
6	Groups	Kulkarni et al. (2015); Sinha (2014); Wen (2016); Zheng, Rosson, Shih, and Carroll (2015).	Grouping database
7	Previous online Learning experience	Morris et al. (2015); Zhang et al. (2016).	Pre-course survey
8	Employment status	Cisel (2014); Morris et al. (2015).	Pre-course survey
9	Personal interest	Belanger and Thornton (2013); Dillahunt et al. (2014); Hew and Cheung (2014); Kizilcec and Schneider (2015).	Pre-course survey
10	Connect with others	Belanger and Thornton (2013); Zheng, Rosson, Shih, and Carroll (2015).	Pre-course survey
11	Institution	Kizilcec and Schneider (2015).	Pre-course survey
12	Professor	Kizilcec and Schneider (2015).	Pre-course survey
13	Earn certificate	Bonafini (2017); Kizilcec and Schneider (2015);	Pre-course survey

14	Related to academic program	Kizilcec and Schneider (2015).	Pre-course survey
15	Current job	Christensen et al. (2013); Kizilcec and Schneider (2015); Zheng, Rosson, Shih, and Carroll (2015).	Pre-course survey
16	Future job	Kizilcec and Schneider (2015); Zheng, Rosson, Shih, and Carroll (2015).	Pre-course survey
17	Friend take	Brown et al. (2015).	Pre-course survey
18	MOOC completion	Dependent variable.	Coursera database

Findings

This section presents findings from the statistical analyses conducted to examine the characteristics of MOOC learners who participated in this study, their preferences of working in groups, their motivations of taking this MOOC, and which demographics and motivations factors predict MOOC completion. Statistical analyses were performed using SPSS and R-Studio.

Learner Characteristics

To address our first research question "What are the characteristics of MOOC learners who participated in this study?" we analyzed participants' demographics. Demographics show that students who participated in this study (n = 655) came from all over the world (see Figure 1 for participants' locations on a world map). Table 2 presents the top ten countries where the learners were located. Chinese learners accounted for the largest number of volunteers participating in this grouping study (25.2%), followed by learners from the United States (17.9%).

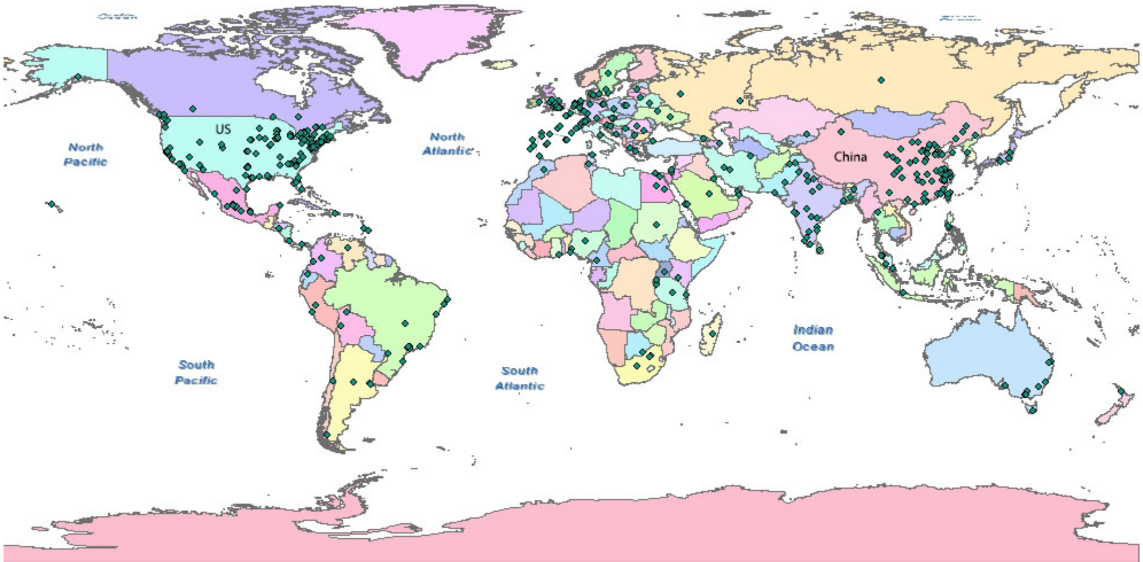

Figure 1. Location of the participants.

Table 2

Distribution of Participants by Country

Country	Frequency	%	Cumulative %
China	165	25.2	56.6
United States	117	17.9	74.5
India	59	9.0	83.5
Mexico	24	3.7	87.2
Canada	18	2.7	89.9
Brazil	16	2.4	92.4
Taiwan	15	2.3	94.7
Egypt	12	1.8	96.5
Spain	12	1.8	98.3
Nigeria	11	1.7	100.0
Others	206	31.5	31.5
Total	655	100.0	

When analyzing participants' demographics, we noticed that our participants are comprised of a larger percentage of female (61.3%) than male (38.7%) learners. Whereas, there is almost an equal number of female (48%) and male (52%) learners from the total population of 39069 who enrolled in this MOOC. Data on 31 out of 655 participants were excluded from our original dataset due to missing records for several variables. Valid records of 624 participants were used in this study.

Participants classified themselves as belonging to one of four English levels: Poor (6.1%), Basic (23.7%), Fluent (41.7%), or Native (28.5%). Participants were categorized into six age levels, which were ages 10-19 (10.8%), 20-29 (35.8%), 30-39 (20.5%), 40-49 (14.7%), 50-59 (11.7%), and 60 and above (6.5%). Sixty-five percent of the participants indicated an intention to complete the entire course when given the options of choosing either to complete all, most, some, or none of the course modules in the pre-course survey. For comparison purpose, thirty percent of the total population planned to complete this MOOC.

Learner Grouping Preferences

To address our second research question "What are the learners' preferences related to working in groups?" we used the grouping preference question in the pre-course survey that asked participants to rank their preferences regarding working in groups by marking the most important factor as 1 and the least important as 9. Results synthesized in Table 3 show that participants' first preference for participating in online groups was to work with people whose native language was the same as theirs. Participants' second grouping preference was to be grouped with others who had similar intentions of completing the course (e.g., complete the whole course, most of the course modules and assignments, or none of those). Their third preference was to be grouped with others who had a similar availability to join group meetings. Although the researchers grouped learners according to their identified preferences, students indicated in their post-course survey that many participants had difficulties in arranging online meetings due to the time zone differences and schedule conflicts.

Table 3

Ranking of Participants' Grouping Preferences

	Ranking	**Mean**	***SD***
Language spoken	1	2.79	2.073
Intention to complete	2	3.15	1.900
Similar schedule to work Together	3	4.15	2.505
Education level	4	4.29	1.901
Country living is different	5	4.65	2.389
Age	6	5.15	2.202
Similar occupation	7	6.25	2.085
Country living is the same	8	6.93	1.680
Gender	9	7.65	1.579

**Note*. *SD* = Standard deviation.

Learners' Motivations for Taking this MOOC

To address our third research question "What are the learners' motivations for taking this MOOC?" we used the motivation question from the pre-course survey. The motivation question was stated as follows: "Please rate the importance of the following reasons for you to enroll in this course on a scale of 1-5 (1 as not at all important, 5 as absolutely critical) in the statements below." Statements listed included: "I am interested in taking a course from this particular institution;" "I am interested in taking a course from this particular professor(s);" I am interested in earning a certificate;" "I am interested in connecting with other students;" "I have friends taking this course;" "The course relates to my current academic program;" "The course relates to my current job;" and "The course will be helpful for me to get a new job."

Results show that participants rated taking this course because of their friends as most the important reason, with a mean score of 4.2 as shown in Table 4. Other important factors that emerged from participants' responses were: because of the MOOC professors ($\bar{x} = 3.03$), institution offering the MOOC ($\bar{x} = 2.37$), and participants' personal interest ($\bar{x} = 2.27$). Table 4 seems to suggest that learners tend to be more socially and extrinsically motivated since they enrolled in the course because their friends were also taking it.

Table 4

The Importance of Motivation Factors for Enrolling in MOOC

	Mean	**Std. Error**	***SD***
Friends	4.20	.031	.782
Professors	3.03	.042	1.068
Institution	2.37	.050	1.264
Personal Interest	2.27	.045	1.147
New Job	2.05	.046	1.181
Current Job	2.05	.046	1.181
Academic Program	2.05	.046	1.181
Connect with Others	2.04	.043	1.088
Earn Certificate	1.35	.032	.807

**Note*. *SD* = Standard deviation.

Demographics and Motivation Factors Predicting the Probability of MOOC Completion

Stepwise binomial logistic regression was used to build answers to the fourth research question: "Which demographics and motivational factors predict the probability of MOOC completion?" In this procedure, an interactive process was used for variable selection. The investigators started by performing a saturated model to map out which factors may affect the probability of MOOC completion. Then, parameter estimates were removed when identified as nonsignificant (p-value greater than 0.05). After excluding these nonsignificant parameters, the model was refitted and the p-values of the remaining parameter estimates were rechecked to assure that all variables with significant p-value were included in the model. The lowest

Akaike Information Criterion (AIC) (Akaike, 1973) was used to decide for the model that contained the best predictor subset.

The saturated model contains demographics parameter estimates such as education level (Education), age (Age), gender (Gender), employment status (Employment: full time/part time/not working), and English proficiency (English_Level). The model also includes the parameter estimates: students assigned to work in groups according to their preferences (Groups), students' motivation for taking the MOOC such as personal interest (Personal_Int), interest in connecting with others (Connect_w_Others), course offered by a certain institution (Institution) or professor they like (Professor), relationship of MOOC content to their academic program (Academic_Pgm), relationship of MOOC content to their current job responsibilities (Current_Job), MOOC fostering a potential skill participants might need in their future job (Future_Job), intention of completion (Intent_Completion), participants' desire to earn a certificate (Earn_Certificate), and friends' participation in the same MOOC (Friends).

Results from the saturated model (Model 1) displayed in Table 5 present Gender, English_Level, Education, Employment, Personal_Int, Connect_w_Others, Earn_Certificate, Current_Job, Future_Job, Friends, and Groups as not significant factors in predicting the probability of learners' MOOC completion. On the other hand, the variables Age, Institution, Professor, Academic_Pgm, and Intent_Completion are significant (p-value < 0.05) when considering course completion (AIC = 752.46 and $G^2 = 750.12$).

Table 5

AIC Comparison Among Models

	Model	AIC
Model 1	Completion ~ Gender + English_Level + Education + Employment + Age + Personal_Int + Connect_w_Others + Institution + Professor + Earn_Certificate + Academic_Pgm + Current_Job + Future_Job + Friends + Intent_Completion + Groups	752.46
Model 2	Completion ~ Age + Institution + Professor + Academic_Pgm + Intent_Completion	718.12
Model 3	Completion ~ Age + Institution + Academic_Pgm + Intent_Completion	717.45

The researchers reran the model with only the significant predictors labeled as Model 2 in Table 5. Results show all variables as significant (AIC = 718.12 and $G^2 = 750.12$) with exception of the variable Professor ($p > 0.05$), indicating that learners' desire of taking this MOOC with a specific professor is not a significant factor affecting course completion when compared to other factors such as student age, the institution hosting the MOOC, MOOC content related to the student's current academic program, and the student's intention to complete the course.

The investigators removed the variable Professor from the model and reran the analysis (Model 3). Results from multiple binomial logistic regression on Model 3 (Table 6) presented Age5 ($p = 0.00404$), Age6 ($p = 0.00306$), Institution3 ($p = 0.01757$), Institution5 ($p = 0.01513$), Academic_Pgm3 ($p = 0.04061$), Intent_Completion5 ($p = 0.03448$) as statistically significant when considering MOOC completion (AIC = 717.45 and $G^2 = 750.12$). Model 3 also presents an improvement of fit with a lower AIC when compared to previous models as shown in Table 5.

Table 6

Model 3: Multiple Binomial Logistic Regression Presenting Age, Institution, Academic Program, and Intention to Complete the MOOC as Significant Variables

Coefficients	**Estimate**	**z value**	**p-value**
(Intercept)	-3.01157	-4.166	3.10E-05 ***
Age2	0.14526	0.426	0.67022
Age3	0.39474	1.061	0.28885
Age4	0.65473	1.701	0.08901
Age5	1.17022	2.875	0.00404 **
Age6	1.40091	2.961	0.00306 **
Institution2	0.52938	1.831	0.06708
Institution3	0.68319	2.375	0.01757 *
Institution4	0.30471	0.873	0.3824
Institution5	1.00574	2.429	0.01513 *
Academic_Pgm2	-0.08525	-0.316	0.752
Academic_Pgm3	0.53921	2.047	0.04061 *
Academic_Pgm4	-0.0878	-0.247	0.80479
Academic_Pgm5	0.352	0.728	0.46671
Intent_Completion2	-1.42697	-1.185	0.23612
Intent_Completion3	0.48371	0.692	0.48911
Intent_Completion4	1.13618	1.704	0.08844
Intent_Completion5	1.40575	2.114	0.03448 *
Null deviance	750.12 on 629 degrees of freedom		
Residual deviance	681.45 on 612 degrees of freedom		
AIC	717.45		

Note: *** $p< 0.001$; ** $p<0.01$; * $p<0.05$

As shown in Table 7, the odds of completing a MOOC for participants who are at Age5 (50 to 59 years old) over the odds of completing a MOOC for participants who are at Age1 (up to 19 years old) is exp (1.17022)

= 3.22, meaning that the probability of MOOC completion increases by a multiplicative factor of 3.22 for participants between the ages of 50 to 59 in comparison to participants less than 19 years old.. Likewise, the odds of completing a MOOC for participants who are at Age6 (above 60 years old) over the odds of completing a MOOC for participants who are at Age1 (up to 19 years old) is exp (1.40091) = 4.06, meaning that for older participants the probability of MOOC completion is even bigger, increasing by a multiplicative factor of 4.06.

Table 7

Odds Ratio of Multiple Binomial Logistic Regression Coefficients in Model 3

Coefficients	**Odds ratio**	**Confidence interval (2.5%, 97.5%)**	
(Intercept)	0.04921413	0.0099133	0.1808451
Age2	1.15633887	0.60284086	2.312948
Age3	1.48400145	0.72460047	3.1392124
Age4	1.92461899	0.91496897	4.1674627
Age5	3.22269393	1.47095305	7.2976927
Age6	4.05889711	1.61618906	10.4110257
Institution2	1.69787955	0.96343306	2.9999831
Institution3	1.9801884	1.12999262	3.4980814
Institution4	1.35623809	0.68222608	2.6866481
Institution5	2.73392595	1.2105576	6.1669373
Academic_Pgm2	0.91828417	0.53801261	1.5525023
Academic_Pgm3	1.71464723	1.02195189	2.8742068
Academic_Pgm4	0.91594201	0.44841206	1.8157699
Academic_Pgm5	1.42191421	0.53264162	3.6086101
Intent_Completion2	0.24003458	0.01122428	2.0920954
Intent_Completion3	1.62208169	0.45749282	7.7080725
Intent_Completion4	3.1148375	0.95372359	14.15117
Intent_Completion5	4.07858993	1.25417009	18.4701751

The odds of completing a MOOC for students who perceive the institution hosting the MOOC as moderately important (*Institution3*) is 1.98 times greater over the odds of students who perceive the institution hosting the MOOC as not important at all (*Institution1*). Similarly, the odds of completing a MOOC for students who perceive the institution hosting the MOOC as very important (*Institution5*) over the odds of students who perceive the institution hosting the MOOC as not important at all (*Institution1*) is 2.73. These results indicate that each one-point increase in the scale of importance for the institution hosting the MOOC is associated with MOOC completion increasing by a multiplicative factor of 1.98 and 2.73, respectively, for the ones who perceive the institution as moderately important and very important.

The odds of completing a MOOC for students who perceive that it is moderately important for the MOOC to be aligned with their academic program (*Academic_Pgm3*) over the odds of students who perceive that is not important at all for the MOOC be aligned with their academic program (*Academic_Pgm1*) is exp (0.53921) = 1.71. This means that each one-point increase in the scale of importance for an academic program is associated with the MOOC completion increasing by a multiplicative factor of 1.71.

The odds of completing a MOOC for students who strongly agree with the statement of intention to complete (*Intent_Completion5*) over the odds of students who indicated no intention to complete (*Intent_Completion1)* is exp (1.40575) = 4.08. This means that the probability of MOOC completion increases by factor of 4.08 for participants who are initially strongly committed with the intention to complete the course. The researchers also explored the interaction effect between the independent variables, however, none of these interactions were significant.

Discussion and Conclusion

This study shows that age, the institution hosting the MOOC, alignment with students' academic needs, and students' intention to complete the course can affect the probability of students' completion of a MOOC. The results are in line with the literature (e.g., Morris et al., 2015; Schulze, 2014; Zhang et al., 2016) in showing that older participants tend to achieve a higher course completion rate. This study extends the literature by indicating that the age of participant relates to MOOC completion, and older students (age > 50 years old) present a higher probability of completing a MOOC when compared with young ones.

It also sheds light on the importance of MOOCs providing experiences that add to students' current academic experiences as well as the importance of MOOCs being hosted by institutions with high academic reputation. As the majority of MOOC students are college degree holders (Christensen et al., 2013; Despujol, Turró, Busquéis, & Cañero, 2014), it makes perfect sense that when students expect that a MOOCs content will add knowledge to their current academic experiences, it increases their probability of completing the MOOC. This result adds to the literature that points out that students tend to register in MOOCs to learn new things, gain understanding of the subject matter, and to develop professional skills (Belanger & Thornton, 2013; Christensen et al., 2013).

In order to fulfill students' desire to register in a MOOC that is aligned with their academic needs, this study suggests a focus on making MOOC goals and content as clear as possible for its audience. By doing so, a MOOC can attract students who are looking for an experience that is aligned with their academic expectations, avoiding simply curious enrollments, which may diminish subsequent students' dropout. With this, MOOC providers should explicitly inform their potential students about the characteristics of MOOC content and how students may use the knowledge that will be acquired in that MOOC.

Based on the idea that "MOOCs enable learning with the best" (Davis et al., 2014, p. 6), it is intuitively known that an institution's reputation may motivate students' enrollment in MOOCs. However, this study advances the field by showing how much the reputation of an institution has the potential to affect the probability of students completing a MOOC. From an alternate perspective, it is also possible that the creation of a MOOC may enhance an institution's reputation as reported by Jansen and Schuwer (2015).

In addition to discussing the variables that relate to MOOC completion, it is also important to discuss the examined variables that did not influence the likelihood of completion. Results from the multiple binomial regression model show that variables such as gender, student personal interest, connection with others, friends and groups did not play a role on the probability of students' completion in this MOOC. Although "taking course because of friends who also took it" was rated by learners as the most important motivation factor for enrolling in this course, it did not appear as a significant predictor of MOOC completion. This factor may boost MOOC registration as suggested by Schulze (2014), but not MOOC completion as reported in this study.

Another surprising result from this study is the lack of effect on completion when students work in online groups. This result contradicts the literature (e.g., Kulkarni, et al., 2015; Williams et al., 2006), and to understand this result it is important to look at the design of the group work implemented in this MOOC. The lack of support and monitoring of students' group work process may explain why group work failed to increase MOOC completion rates. Moreover, students' group work activities were not facilitated or assessed by MOOC instructors or researchers.

Assigning learners to work in groups in MOOCs presents many challenges because of the heterogeneity in learner population, such as differences in education levels, cultural backgrounds, and study schedules. There seems not to be a perfect grouping mechanism that satisfies the needs of all learners. In the next stage of our research, we hope to record learners' interactions and learning behaviors as they engage in group activities in various social media applications (e.g. Skype and discussion forums) and use these data to understand how learners could benefit from MOOCs. These additional data could also help us to improve the grouping interventions, and eventually provide a better MOOC experience to the learners.

It is also worth noting that some learners didn't meet online with others regardless of being assigned into groups (as reported by participants in their post-course survey), a factor which may have contributed to the lack of effect that groupwork had on course completion. Feedback provided by students in the post-course survey informed the lack of monitoring students' group activity. We hypothesize that this could be one of the reasons why assigning learners to work in groups did not work in this study. Thus, further implications of this study suggest to MOOC instructors assigning teaching assistants (TAs) and/or group leaders to student groups as ways of providing assistance and monitoring their work process. These TAs could be recruited from learners who have completed the MOOC previously and are willing to assist others in taking the course. Another way to foster participants' group work would be assigning roles to each group member such as group leader and meeting coordinator. Meanwhile, data on the communication and interaction among team members in both synchronous and asynchronous media will be collected and analyzed to inform the design and facilitation of group work in the next phase of this grouping research. In the end, the authors expect that MOOC instructors and MOOC providers should be aware of students' motivations for enrollment and the demographics that impact the likelihood of students' MOOC completion so that this information may be used to shape the course content and format to better support learners.

Limitations

Although this study identifies variables that impact MOOC completion, it is not possible to infer the reasons why those variables are significant. We can speculate that age plays an important role in affecting MOOC completion since older people may have more time to take the course and may have better time management and self-regulation skills. However, more investigation is needed to gain a deeper understanding of the reasons why older people have a higher probability of completing MOOCs.

Another limitation of this study is its small sample size compared to the large number of students who enrolled in this MOOC. Because of effect size and subject taught in this MOOC, the findings may not be generalizable to other MOOCs. This effect size could be overcome with studies comprising multiple MOOC cohorts. In the next phase of this study, the investigators aim to implement follow up interviews with students to collect feedback about their group work process and suggestions on how to improve their group work experiences. Future plans also include researching indicative variables of course completion as described in Pursel, Zhang, Jablokow, Choi, and Velegol (2016) such as course activities, number of videos watched, and number of posts made in the discussion forum as predictors of MOOC completion.

References

Akaike, H. (1973). Information theory and an extension of the maximum likelihood principle. In B. N. Petrov & F. Caski (Eds.), *Proceedings of the Second International Symposium on Information Theory* (pp. 267-281). Budapest: Akademiai Kiado.

Arendale, D. R., & Hane, A. R. (2014). Holistic growth of college peer study group participants: Prompting academic and personal development. *Research & Teaching in Developmental Education*, *31*(1), 7-29. Retrieved from http://search.proquest.com/docview/1658878111?accountid=13158

Bayeck, R. Y., Hristova, A., Jablokow, K., & Bonafini, F. C. (2018). Exploring the relevance of single-gender group formation: What we learn from a massive open online course (MOOC). *British Journal of Educational Technology*, *49*(1), 88-100. doi: 10.1111/bjet.12528

Belanger, Y., & Thornton, J. (2013). *Bioelectricity: A quantitative approach: Duke university's first MOOC.* Duke University. Retrieved from http://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/6216/Duke_Bioelectricity_MOOC_Fall2012.pdf

Berger, D., & Wild, C. (2016). Turned on, tuned in, but not dropped out: Enhancing the student experience with popular social media platforms. *European Journal of Law and Technology*, *7*(1). Retrieved from http://ejlt.org/article/view/503/639

Bonafini, F. (2017). The effects of participants' engagement with videos and forums in a MOOC for teachers' professional development. *Open Praxis*, *9*(4), 433-447. http://dx.doi.org/10.5944/openpraxis.9.4.637

Bonafini, F. C., Chae, C., Park, E., & Jablokow, K. W. (2017). How much does student engagement with videos and forums in a MOOC affect their achievement? *Online Learning*, *21*(4), 223-240. doi: 10.24059/olj.v21i4.1270

Breslow, L., Pritchard, D. E., DeBoer, J., Stump, G. S., Ho, A. D., & Seaton, D. T. (2013). Studying learning in the worldwide classroom: Research into edX's first MOOC. *Research & Practice in Assessment*, *8*(1), 13-25. Retrieved from https://files.eric.ed.gov/fulltext/EJ1062850.pdf

Brown, R., Lynch, C., Wang, Y., Eagle, M., Albert, J., Barnes, T., ... & McNamara, D. S. (2015, June). Communities of performance & communities of preference. In *Proceedings of EDM Workshops* (pp. 12-19). Madrid, Spain. Retrieved from http://ceur-ws.org/Vol-1446/edm2015ws_proc.pdf

Christensen, G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E. J. (2013). The MOOC phenomenon: Who takes massive open online courses and why? *Social Science Research Network Journal*. http://dx.doi.org/10.2139/ssrn.2350964

Cisel, M. (2014). Analyzing completion rates in the first French xMOOC. In *Proceedings of the European MOOC Stakeholder Summit 2014, 26.* Retrieved from https://www.openeducationeuropa.eu/sites/default/files/legacy_files/asset/From-field_37_6.pdf

Cross, S. (2013). *Evaluation of the OLDS MOOC curriculum design course: Participant perspectives and experiences.* OLDS MOOC Project, Milton Keynes. Retrieved from http://oro.open.ac.uk/37836/1/EvaluationReport_OLDSMOOC_v1.0.pdf

Davis, H. C., Dickens, K., Leon Urrutia, M., Vera, S., del Mar, M., & White, S. (2014). MOOCs for universities and learners: An analysis of motivating factors. In *Proceedings of the 6th International Conference on Computer Supported Education CSEDU* (pp. 105-116). Spain: Springer. Retrieved from https://eprints.soton.ac.uk/363714/1/DavisEtAl2014MOOCsCSEDUFinal.pdf

Despujol, I. M., Turró, C., Busquéis, J., & Cañero, A. (2014, October). Analysis of demographics and results of student's opinion survey of a large scale MOOC deployment for the Spanish speaking community. In *Frontiers in Education Conference (FIE), 2014 IEEE* (pp. 1-8). Madrid, Spain: IEEE.

Dillahunt, T., Wang, B., & Teasley, S. (2014). Democratizing higher education: Exploring MOOC use among those who cannot afford a formal education. *The International Review of Research in Open and Distributed Learning, 15*(5). http://dx.doi.org/10.19173/irrodl.v15i5.1841

Engle, D., Mankoff, C., & Carbrey, J. (2015). Coursera's introductory human physiology course: Factors that characterize successful completion of a MOOC. *The International Review of Research in Open and Distributed Learning, 16*(2). http://dx.doi.org/10.19173/irrodl.v16i2.2010

Gil-Jaurena, I., Callejo-Gallego, J., & Agudo, Y. (2017). Evaluation of the UNED MOOCs implementation: Demographics, learners' opinions and completion rates. *The International Review of Research in Open and Distributed Learning, 18*(7). http://dx.doi.org/10.19173/irrodl.v18i7.3155

Guàrdia, L., Maina, M., & Sangrà, A. (2013). MOOC design principles: A pedagogical approach from the learner's perspective. *eLearning Papers, 33*, 1-6. Retrieved from http://r-libre.teluq.ca/596/1/In-depth_33_4.pdf

Guo, P. J., & Reinecke, K. (2014, March 4-5). Demographic differences in how students navigate through MOOCs. In *Proceedings of the First ACM Conference on Learning@ Scale Conference* (pp. 21-30). Atlanta, Georgia. Retrieved from https://cs.rochester.edu/hci/pubs/pdfs/edX-MOOC-demographics-and-navigation_LAS-2014.pdf

Gütl, C., Rizzardini, R. H., Chang, V., & Morales, M. (2014). Attrition in MOOC: Lessons Learned from Drop-Out Students. In L. Uden, J. Sinclair, YH. Tao, D. Liberona (Eds.), *Learning technology for education in cloud. MOOC and big data* (pp. 37-48). Springer, Cham.

Hew, K. F., & Cheung, W. S. (2014). Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges. *Educational Research Review*, *12*, 45-58. https://doi.org/10.1016/j.edurev.2014.05.001

Hiltz, S. R. (1998). *Collaborative learning in asynchronous learning networks: Building learning communities.* Invited address at the WEB98 Conference, Orlando, Florida. Retrieved from https://files.eric.ed.gov/fulltext/ED427705.pdf

Ho, A. D., Reich, J., Nesterko, S., Seaton, D. T., Mullaney, T., Waldo, J., & Chuang, I. (2014). HarvardX and MITx: The first year of open online courses (HarvardX and MITx Working Paper No. 1). Retrieved from https://dash.harvard.edu/handle/1/11987422

Jablokow, K., Matson, J. V., & Velegol, D. (2014). *A multidisciplinary MOOC on creativity, innovation, and change: Encouraging experimentation and experiential learning on a grand scale.* In *Proceedings of the 2014 ASEE Annual Conference & Exposition,* Indianapolis, IN. Retrieved from http://www.asee.org/public/conferences/32/papers/9669/view

Jansen, D., & Schuwer, R. (2015). Institutional MOOC strategies in Europe. *Status report based on a mapping survey conducted in October - December 2014. The European Association of Distance Teaching Universities.* Retrieved from http://www.eadtu.eu/documents/Publications/OEenM/Institutional_MOOC_strategies_in_Europe.pdf

Jones, B. M. (1997, March). *Study groups: Collaboration and conflagration*. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL. Retrieved from http://files.eric.ed.gov/fulltext/ED408362.pdf

Kellogg, S., Booth, S., & Oliver, K. (2014). A social network perspective on peer supported learning in MOOCs for educators. *The International Review of Research in Open and Distributed Learning, 15*(5). http://dx.doi.org/10.19173/irrodl.v15i5.1852

Kizilcec, R. F., & Schneider, E. (2015). Motivation as a lens to understand online learners: Toward data-driven design with the OLEI scale. *ACM Transactions on Computer-Human Interaction (TOCHI), 22*(2), 6. http://dx.doi.org./10.1145/2699735

Koller, D., Ng, A., Do, C., & Chen, Z. (2013). Retention and intention in massive open online courses: In depth. *Educause Review, 48*(3), 62-63. Retrieved from https://er.educause.edu/articles/2013/6/retention-and-intention-in-massive-open-online-courses-in-depth

Konstan, J. A., Walker, J. D., Brooks, D. C., Brown, K., & Ekstrand, M. D. (2015). Teaching recommender systems at large scale: Evaluation and lessons learned from a hybrid MOOC. *ACM Transactions on Computer-Human Interaction (TOCHI), 22*(2), 10. https://doi.org/10.1145/2728171

Kulkarni, C., Cambre, J., Kotturi, Y., Bernstein, M. S., & Klemmer, S. R. (2015, February). Talkabout: Making distance matter with small groups in massive classes. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing, Vancouver, BC, Canada*, 1116-1128. Retrieved from http://www.cs.cmu.edu/~chinmayk/assets/pdfs/talkabout-cscw.pdf

Lim, S., Coetzee, D., Hartmann, B., Fox, A., & Hearst, M. A. (2014, March). Initial experiences with small group discussions in MOOCs. In *Proceedings of the First ACM Conference on Learning@ Scale Conference, Atlanta, Georgia, USA*, 151-152. Retrieved from https://dl.acm.org/citation.cfm?id=2567854

Liyanagunawardena, T., Adams, A., & Williams, S. (2013). MOOCs: A systematic study of the published literature 2008-2012. *The International Review of Research in Open and Distributed Learning*, *14*(3), 202-227. http://dx.doi.org/10.19173/irrodl.v14i3.1455

Locke, E. A. (1982). Relation of goal level to performance with a short work period and multiple goal levels. *Journal of Applied Psychology*, *67*(4), 512-514. http://dx.doi.org/10.1037/0021-9010.67.4.512

Macleod, H., Haywood, J., Woodgate, A., & Alkhatnai, M. (2014). Emerging patterns in MOOCs: Learners, course designs, and directions. *TechTrends, 59*(1), 56–63. http://dx.doi.org/10.1007/s11528-014-0821-y

Malan, D. J. (2013). Implementing a massive open online course (MOOC). *Journal of Computing Sciences in Colleges*, *28*(6), 136-137. Retrieved from https://dl.acm.org/citation.cfm?id=2460182

Morris, N. P., Hotchkiss, S., & Swinnerton, B. (2015). *Can demographic information predict MOOC learner outcomes?* In *Proceedings of the EMOOC Stakeholder Summit*, Belgium. Retrieved from https://www.researchgate.net/publication/278392770_Can_demographic_information_predict_MOOC_learner_outcomes

Onah, D. F., Sinclair, J., & Boyatt, R. (2014). Dropout rates of massive open online courses: Behavioural patterns. In *EDULEARN14 Proceedings* (pp. 5825-5834). Barcelona: IATED Academy. Retrieved from http://wrap.warwick.ac.uk/65543/

Pursel, B. K., Zhang, L., Jablokow, K. W., Choi, G. W., & Velegol, D. (2016). Understanding MOOC students: Motivations and behaviours indicative of MOOC completion. *Journal of Computer Assisted Learning*, *32*, 202–217. doi: 10.1111/jcal.12131

Radford, A. W., Coningham, B., & Horn, L. (2015). MOOCs: Not just for college students—How organizations can use MOOCs for professional development. *Employment Relations Today*, *41*(4), 1–15. http://dx.doi.org/10.1002/ert.21469

Schulze, A. S. (2014). *Massive open online courses (MOOCs) and completion rates: Are self-directed adult learners the most successful at MOOCs?* (Unpublished doctoral dissertation). Pepperdine University, California, United States. Available from ProQuest Dissertations & Theses Global. (1549976283)

Sinha, T. (2014, February). Together we stand, together we fall, together we win: Dynamic team formation in massive open online courses. In *The Fifth International Conference on the Applications of Digital Information and Web Technologies (ICADIWT 2014), Bangalore, India*, 107-112. doi: 10.1109/ICADIWT.2014.6814694.

Wen, M. (2016). *Investigating virtual teams in massive open online courses: Deliberation-based virtual team formation, discussion mining and support* (Doctoral dissertation, Carnegie Mellon University). Retrieved from https://www.lti.cs.cmu.edu/sites/default/files/wen,%20miaomiao%20-%20CMU-LTI-16-015%20-%202016.pdf

Williams, E. A., Duray, R., & Reddy, V. (2006). Teamwork orientation, group cohesiveness, and student learning: A study of the use of teams in online distance education. *Journal of Management Education*, *30*(4), 592-616. https://doi-org.ezproxy.lib.vt.edu/10.1177/1052562905276740

Xiong, Y., Li, H., Kornhaber, M. L., Suen, H. K., Pursel, B., & Goins, D. D. (2015). Examining the relations among student motivation, engagement, and retention in a MOOC: A structural equation modeling approach. *Global Education Review*, *2*(3). Retrieved from https://ger.mercy.edu/index.php/ger/article/view/124

Yuan, L., & Powell, S. (2013). *MOOCs and open education: Implications for higher education* [White Paper]. Retrieved from http://www.smarthighered.com/wp-content/uploads/ 2013/03/MOOCs-and-Open-Education.pdf

Zhang, Q., Peck, K. L., Hristova, A., Jablokow, K. W., Hoffman, V., Park, E., & Bayeck, R. Y. (2016). Exploring the communication preferences of MOOC learners and the value of preference-based groups: Is grouping enough? *Educational Technology Research and Development*, *64*(4), 809-837. https://doi.org/10.1007/s11423-016-9439-4

Zheng, S., Rosson, M. B., Shih, P. C., & Carroll, J. M. (2015). Understanding student motivation, behaviors, and perceptions in MOOCs. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing - CSCW '15*, (pp. 1882-1895). Vancouver: ACM. http://dx.doi.org/10.1145/2675133.2675217

Zheng, Z., Vogelsang, T., & Pinkwart, N. (2015). The impact of small learning group composition on student engagement and success in a MOOC. In *Proceedings of the 8th International Conference of Educational Data Mining* (pp. 500-503).

Zhong, S.-H., Zhang, Q.-B., Li, Z.-P., & Liu, Y. (2016). Motivations and challenges in MOOCs with eastern insights. *International Journal of Information and Education Technology, 6*(12), 954–960. http://dx.doi.org/10.7763/ijiet.2016.v6.824

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Master's Students' Perceptions and Expectations of Good Tutors and Advisors in Distance Education

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Abstract

The purpose of this study was to explore non-thesis Master's students' perceptions and expectations of good tutors and advisors in distance education programmes. It also examined whether these perceptions and expectations are related to student characteristics including age, gender, university, programme, semester, and previous online learning experience. The current study was conducted within the framework of Transactional Distance Theory. Using a mixed methods approach, a questionnaire was administered to 143 students in four programmes in two universities in Turkey and interviews were conducted with 11 of these students. Results showed that good tutors and advisors in distance education provide a stimulating student-centred learning environment, have a caring and individualised interaction and communication with students, and have subject expertise and basic technology skills. The results of this study will improve distance education tutors and advisors' practices in supporting graduate students' education and research.

Keywords: tutor, advisor, distance education, graduate students' perceptions, graduate students' expectations

Introduction

Distance Education (DE) can be defined as "teaching and planned learning in which teaching normally occurs in a different place from learning, requiring communication through technologies as well as special institutional organization" (Moore & Kearsley, 2011, p. 2). In 2014, while enrolments for regular Higher Education programmes declined in the U.S., DE enrolments increased, including graduate programmes (Allen, Seaman, Poulin, & Straut, 2016). Similarly in Turkey, the number of universities offering DE programmes and the number of DE students are continually increasing (Higher Education Council [HEC], 2016). For graduate students, common reasons for increased enrolment in DE may include fulfilling a desire for lifelong learning, global and equitable access of courses, need for promotion, and flexibility of learning considering the restrictions of adult life (Wisker, 2012). However, graduate student attrition rates are also high, especially in DE (Stoessel, Ihme, Barbarino, Fisseler, & Stürmer, 2015). Due to this increasing number of student enrolments, DE requires further attention to ensure the success of its programmes, student learning, and retention.

Within the context of this study, DE *tutors* and *advisors* differ only in terms of their responsibilities. While both are usually full-time faculty, in Turkey, a tutors' main responsibilities include designing and delivering courses, while an advisors' main responsibility is to supervise student research projects. Therefore, curriculum may require tutors to assume the role of advisors. Moreover, advisors are not only expected to support graduate students with learning and research, but also with their socialisation and enculturation to the discipline (Gardner & Mendoza, 2010). These different roles may affect the type of competencies they need to develop to provide improved support to graduate students (Bawane & Spector, 2009).

The literature documents that tutor-related issues are one of the most important success factors for DE programmes (Soong, Chan, Chua, & Loh, 2001) and that graduate students perceive tutors as their main academic support (Cain, Marrara, Pitre, & Armour, 2007). Within the theory of Transactional Distance, Moore (1993) suggested that the success of DE programmes relies on the tutor's role in adjusting dialogue and course structure based on student needs. However, students' conceptions of a good DE tutor might differ from the education providers (Abdulla, 2004; Dennen, Darabi, & Smith, 2007). Therefore, improvements in DE programmes should be guided by learners as well as experts.

Students' expectations influence their course experience, and their attitude towards the experience influences the types of support they need (Howland & Moore, 2002). For example, students with a more constructivist approach to learning expect to be independent learners, while other students may rely more on the experts' knowledge, validation, continuous feedback, and a well-structured course (Howland & Moore, 2002). However, regardless of the level of self-regulation skills, students need tutorial support when applying new knowledge (Moore, 1989).

Aside from their level of education, student perceptions and expectations may also vary with other factors including age, gender, subject area (Jelfs, Richardson, & Price, 2009), level of experience in online courses (Huang, 2002), and context (Bawane & Spector, 2009). Furthermore, the few international studies found to explore graduate students' opinions frequently used either quantitative (e.g., Young, 2016) or qualitative methods (e.g., Edwards, Perry, & Janzen, 2011). Consequently, it is crucial to explore which tutor and advisor characteristics constitute a "good tutor" and a "good advisor" according to distance education graduate students in light of the aforementioned factors and through more comprehensive data collection methods. Therefore, this current study investigates non-thesis Master's students' perceptions and expectations of good tutors and advisors in DE programmes by considering students' general characteristics (age, gender, semester, previous online experience), and context (university, programme) through a mixed-methods research design.

Relevant Research

From a theoretical perspective, Transactional Distance (TD) is defined as "a psychological and communications space to be crossed, a space of potential misunderstanding between the inputs of instructor and those of the learner" (Moore, 1993, p. 22). TD theory explains the interplays of TD, course structure, dialogue, and student autonomy in distance education to reach learning outcomes. This theory suggests that a well-designed learning environment with ample opportunity for interaction and discussion may reduce the psychological and communicational distance students feel in DE. Giossos, Koutsouba, Lionarakis, and Skavantzos (2009) reconsidered TD theory and proposed that teacher actions are the inputs of the DE system producing TD as an outcome through the mechanisms of dialogue, structure, and autonomy. Similarly, several research studies revealed that teacher actions (e.g. Benson & Samarawickrema, 2009; Huang, 2002; Joo, Andrés, & Shearer, 2014; Lemak, Shin, Reed, & Montgomery, 2005), course structure (Stein, Wanstreet, Calvin, Overtoom, & Wheaton, 2005), and students' age (Huang, Chandra, DePaolo, & Simmons, 2016) influence students' TD perceptions.

The main challenges of graduate DE students include engaging in the research culture of the university, dealing with isolation, self-regulating their learning, and effectively using online communication (Wisker, 2012). Wisker (2012) suggests that while working with students, DE supervisors should maintain a system of communication and support throughout the research process, prepare students for research, writing, and new forms of communication, and be sensitive to students' life and work demands. Supervisors should also provide constructive feedback, opportunities and online spaces and technologies for communication, and maintain dialogue toward successful and reciprocally satisfying research processes (Wisker, 2012). Although these suggestions are beneficial, few research studies reported the type of support students themselves expect from their tutors and advisors (e.g., Edwards et al., 2011; Holzweiss, Joyner, Fuller, Henderson, & Young, 2014; Young, 2006).

Available studies about students' opinions reported a variety of qualities students expect from good tutors and advisors in graduate distance education. Results showed that students learned better when courses and assignments were relevant to real life; designed to improve their reflections, critical thinking, and problem-solving skills; and supported with a variety of tools including discussion forums, videos, videoconferencing, and online library research (Holzweiss et al., 2014). Students valued learning experiences that are challenging and meaningful (Edwards et al., 2011; Young, 2006).

Effective communication is a vital factor for the success of online programmes (Young, 2006). Students expect high connectivity with their tutors and advisors (Schroeder, Baker, Terras, Mahar, & Chiasson, 2016), want to feel their tutor's presence online (Dennen et al., 2007), and expect timeliness in all communications (Cain et al., 2007). Therefore, availability for help was expected from tutors and advisors at predetermined times (Cain et al., 2007; Schroeder, 2012). Students had negative attitudes toward inadequate online discussion durations (Risner & Kumar, 2016). While they expected advisors to promote peer interaction (Lessing & Schulze, 2002), their need to communicate with tutors and advisors was higher than their desire to connect with other students (Schroeder et al., 2016).

Students expected their tutors to provide timely feedback, written feedback, constructive criticism, guidance for research especially for planning, scheduling, statistical analysis, reporting, interpretation, presentation of results, and literature searches (Cain et al., 2007; Dennen et al., 2007; Edwards et al., 2011; Holzweiss et al., 2014; Lessing & Schulze, 2002; Young, 2006). They expected caring, guidance, and individualised advising (Schroeder, 2012). For students, effective tutors considered students' needs, motivated them for better performance, and respected them as valued individuals (Edwards et al., 2011; Holzweiss et al., 2014; Young, 2006).

Regarding assessment, students preferred to clearly know the tutors' expectations and preferred to see useful examples (Dennen et al., 2007; Howland and Moore, 2002; Young, 2006). Students had negative attitudes toward small assignments graded for quantity such as regular posting on discussion boards for points (Howland & Moore, 2002).

The available studies rarely considered advisors' roles in students' projects or research. This might be because different countries and programmes have varying degree completion requirements. In Turkey, a project with research emphasis is required for non-thesis Master's degree completion. However, there is inadequate literature to guide the practice in Turkey. Furthermore, the available studies reported in this section used either quantitative or qualitative methods, whereas a more comprehensive understanding is needed. Therefore, this current study is conducted to investigate non-thesis Masters' students' perceptions of and expectations of good tutors and advisors in DE programmes, whilst also exploring variables that might relate to these perceptions and expectations, using a mixed methods research design to reach a comprehensive conclusion.

Methodology

The study's research questions follow:

1. What are the perceptions of students studying in non-thesis Master's programmes of good tutor characteristics in distance education?
2. Are there differences between these perceptions in terms of student age, gender, university, subject field, previous online learning experience, and the number of semesters spent in the programme?
3. What are students' expectations of good tutors and advisors in distance education?

A mixed methods research design, specifically the concurrent triangulation strategy was employed (Creswell, 2007). First, a questionnaire was used to collect quantitative data, followed by interviews to collect qualitative data. Data were analysed separately, and their results compared and combined after completion of their individual analyses. Both data types have equal weight in this study.

Participants and Data Collection

The population of this study is students studying in non-thesis Master's DE programmes in Turkey. In 2015, of 47 public and private universities offering DE Master's programmes in Turkey (HEC, 2016), researchers had access to two public universities (U1 and U2) that were purposefully selected for their representativeness, based on their Learning Management Systems (LMSs). Their LMSs for DE represent the two most commonly used in these programmes in Turkey (Enocta and Moodle); representing 70% of universities offering DE graduate programmes in Turkey for 2016. They both used Adobe Connect for online sessions. The distance education courses in both universities are conducted fully online except for students' final exams and the degree requirement of a research project. U1 had one programme and U2 had eight distance education programmes.

After the approval of the Human Research Ethics Committee in both universities, an online questionnaire was sent to all students in both universities. Their contact information was obtained from the Distance Education Research and Practice Centers (DERPC) which govern distance education programmes in Turkey. Due to limited response to the online questionnaire even with the reminders, the questionnaire was administered paper-based at the end of the semester when students came to campuses for final exams. In U1, all 75 students were given the questionnaire and 54 responded (response rate 72%). In U2, due to administrative restrictions, 300 students in three programmes were given the questionnaire and 89 responded (response rate 29.7%). Total number of participants was 143 and the total response rate was 38.1%.

Based on the questionnaire results, respondents' ages ranged from 23 to 52 (M=32.10, SD=5.91) with 22.4% (n=32) having had previous online learning experience. There were 99 female (69.2%) and 44 male (30.8%) students. Of the 143 participants, 37.8% studied Classroom Teaching (CT) (n=54), 23.1% studied Health Institutions Management (HIM) (n=33), 21.7% studied Nursing at Home (NH) (n=31), and 17.5% studied Educational Administration and Planning (EAP) (n=25).

After the questionnaire's administration, semi-structured interviews were conducted with students who were working on their research projects. The students volunteered by writing their email address on the questionnaire. No students volunteered from U2. In U1, 11 students from the CT Programme volunteered out of 25 students, likely due to the rapport they had with the first author who worked in the programme as a content manager and support personnel. Seven male and four female students were interviewed. Their ages ranged from 24 to 31 (M=27.27, SD=2.33), and none had previous online learning experience. The interviews lasted an average of 20.54 minutes.

Instruments

The original questionnaire had five factors with a total of 33 five-point Likert-type items in the form of an agreement scale developed by Jelfs, Richardson, and Price (2009) which was used to examine students' perceptions of a good tutor in DE, with the permission of the authors (e.g. item: "A good tutor helps students to adopt a critical approach"). These five factors were Critical Thinking (CT), Subject Expertise (SE), Pastoral Care (PC), Promoting Interaction (PI), and Vocational Guidance (VG). Several demographic items were added to the questionnaire in order to collect data about participants' age, gender, university, subject field, previous online learning experience, and the number of semesters spent in the programme. Since the language of instruction in U1 and U2 is Turkish, the questionnaire was translated into Turkish, and back-to-back translated with confirmation from native speaker language instructors.

For each factor, Cronbach's Alpha Coefficients for internal consistency were satisfactory in both the original study, in which the Cronbach's Alpha Coefficients ranged from .66 to .89 (Jelfs et al., 2009) and in the current study, in which they ranged from .69 to .88. Confirmatory Factor Analysis (CFA) was conducted to confirm the five-factor model. Considering the standardised path diagram and the obtained fit indices, it is concluded that the CFA results provided sufficient evidence for the factors (χ^2 (485)=924.32, $p<.05$, χ^2/df=1.89, RMSEA=.080, SRMR=.084, RMR=.056, PNFI=.557, CFI=.881).

A semi-structured interview schedule with probing questions was developed in Turkish based on relevant literature and the research questions. For its content validity, two subject field experts examined the schedule and a pilot implementation was conducted with two participants. The final form had two sections and nine items, with four about tutors and five about advisors. The interview questions were about the characteristics of good tutors and advisors, their support for students' learning, motivation, and independent work, their advising process, and interaction with students.

Data Analysis

For the first research question, descriptive data analysis was conducted. For the second research question, Pearson correlation, Independent samples *t*-test, and MANOVA were conducted. For the third research question, qualitative data in the form of audio recordings were transcribed and the data were analysed using Constant Comparative Method (Glaser & Strauss, 1965). As a guide, the five factors of the questionnaire were used as the main categories in the qualitative data analyses regarding students' perceptions and expectations from tutors. However, since the questionnaire has no items regarding advisors, the data about the advisors were analysed considering the advisor expectations listed by Wisker (2012). To establish trustworthiness (Lincoln & Guba, 1985), triangulation was applied by comparing and combining interview and questionnaire data analyses in the findings section. Resulting categories and subcategories were reported with their occurrence frequencies. A member check was used and two researchers conducted qualitative analysis independently. The comparison of main and subcategories of the two researchers resulted in 78% agreement. Then, the two researchers refined the main and subcategories in order to reach total agreement.

Results

Perceptions of Good Tutors Based on Questionnaire Data (Research Question 1)

CT has the highest average mean score (*M*=4.44), followed by SE, and PC. PI and VG factors had relatively lower mean scores (Table 1). The participants' ratings for individual questionnaire items ranged between 3.48 and 4.59, indicating positive perceptions for all listed tutor characteristics.

Table 1

Descriptive Analysis Results of the Factors in the Questionnaire

Factors in the questionnaire	***M***	**SD**
Critical Thinking (CT)	4.44	.41
Subject Expertise (SE)	4.40	.52
Pastoral Care (PC)	4.23	.53
Promoting Interaction (PI)	3.86	.72
Vocational Guidance (VG)	3.67	.99

Note. 1: Strongly Disagree, 5: Strongly Agree.

Variations in the Perceptions of Good Tutor Characteristics (Research Question 2)

There was negative, significant, and low correlation between participants' age and their good tutor perceptions in terms of PI (r= -21), VG (r= -.17), and PC (r= -.17; Table 2). This indicates that the younger the student, the higher their perceptions of good DE tutors for these factors.

Significant differences were found in the participants' ratings when their gender, university, subject field, and previous online learning experience were examined. There was a significant mean difference between male and female students for SE and PC factors. Male students had higher mean scores ($p<.01$) in both factors. There were also significant differences in results among the two universities and their programmes. The students at U2 had higher mean scores than those at U1 on CT, VG, and PI factors. MANOVA results showed a significant multivariate main effect for subject field with Pillai's Trace=.25, F (15,411)=2.46, $p<.05$, with effect size of .08. Follow-up ANOVA tests were conducted and tested based on $p<.01$ using the Bonferroni method due to several comparisons. Although there was no significant difference between the three programmes at U2, the students registered to HIM and NH programmes at U2 had higher mean score on PI factor than students registered to the CT programme at U1.

For the VG factor, there was a significant mean difference between participants who had previous online learning experience and those who did not. Students who had previous learning experience had higher ratings for this factor. The number of semesters spent in the programme did not have a statistically significant impact on student perceptions.

Table 2

Summary of Results for Research Question 2

Variables	**Analysis**	**CT**	**VG**	**SE**	**PI**	**PC**	**Conclusion based on *p*<.01**
Age	Pearson correlation	-	$p<.05$	-	$p<.05$	$p<.05$	Significant Relationship VG, PI, PC
r		-.16	-.17	-.06	-.21	-.17	
Gender (M/F)	Independent samples *t*-test	-	-	p<.05	-	p<.01	Significant differences for SE: M>F PC: M>F
Cohen's *d*		.17	.21	.44	.11	.49	
University (U1/U2)	Independent samples *t*-test	$p<.05$	$p<.05$	-	$p<.01$	-	Significant differences for CT: U2>U1 VG: U2>U1 PI: U2>U1
Cohen's *d*		.40	.40	.02	.66	.11	
Subject Field (EAP, HIM, NH, CT)	MANOVA	-	-	[a]$p<.05$	$p<.01$	-	Significant differences for PI: HIM>CT ($p<.01$) NH>CT (p<.01) No significant difference for [a]SE: HIM>NH ($p>.01$)
Partial η^2		.05	.04	.06	.13	.03	
Previous Online Learning Experience	Independent samples *t*-test	-	$p<.01$	-	-	-	Significant difference for VG: Previous Experience>No Experience
Cohen's *d*		.10	.64	.07	.31	.26	
Completed Semesters (1,2)	Independent samples *t*-test	-	-	-	-	-	No significant difference
Cohen's *d*		.09	.08	.28	.04	.33	

Note. CT: Critical Thinking, VG: Vocational Guidance, SE: Subject Expertise, PI: Promoting Interaction, PC: Pastoral Care.
[a] Bonferroni correction has been applied to individual ANOVA ($p<.01$).

Perceptions of and Expectations from Good Tutors and Advisors (Research Questions 1 and 3)

A comparison of quantitative and qualitative data analysis results for triangulation showed complementary findings. In reporting the interview results, the 11 participants are represented with letters A to K.

For students' perceptions of good tutors, the major theme was Critical Thinking, which included three main categories: *instructional approach*, *presentation*, and *evaluation*. The students appreciated tutors' use of both online (n=4, ABFG) and video lectures (n=3, BCH). However, they complained about the overuse of the presentation method and expected tutors to use alternative methods, constructivist, and student-centred approaches (n=7, ACDEFHK), and to adapt their lectures specifically for DE (n=1, C). The students expected tutors not to read lecture notes or presentation slides (n=6, BCDGHK), but to give in-depth and easy to understand explanations (n=2, BI). They wanted lectures to be well planned (n=2, AC), interesting (n=8, BCDEFHIK), of satisfying depth (n=3, CFK) with useful visuals and videos (n=4, CGIJ), and with various concrete, real-life examples that facilitate understanding the application of theories (n=9, ABCDFGIJK). This result complements the quantitative analysis results that students perceived a good tutor should provide stimulating and interesting lessons that facilitate critical thinking.

Although the evaluation category was not included in the questionnaire, interview results showed that students wanted their tutors to use alternative evaluation methods rather than written tests to determine students' overall performance (n=2, CK). They desired their tutors to assign individual, interesting, and useful homework (n=2, HK), give adequate information about the exams (n=2, BH), and to have fair and sound evaluation methods (n=3, CJK).

Regarding interaction and communication, the students perceived that their tutors should make use of a variety of tools and methods for communication and interaction (n=5, ABCIJ) provided in their LMS (n=3, CFH) or with social media (n=5, ABGIJ), and should give information about these tools (n=2, DK). The questionnaire did not include a category about DE tools and technologies for communication. In the interviews the students argued that there should be a mutual effort in establishing student-tutor communication (n=3, BCD). Similar to the questionnaire results, the students expected tutors to promote and facilitate student-student communication, discussion, and sharing (n=4, ABIK). However, the students had different opinions about the use of group projects (n=2, AK). Moreover, tutors were expected to moderate the discussions and questions in online lectures effectively (n=2, AK), and encourage students to ask questions and answer vocally rather than textually in order to minimise misunderstandings of written communication (n=2, DI).

In the Pastoral Care theme, two categories emerged similar to the questionnaire results: *giving feedback* and *attitude toward helping students*. The students expected their tutors to answer their questions in a timely manner (n=10, ABCDFGHIJK) and for all students (n=3, ACJ). They expected tutors to read their assignments (n=2, BK), provide them with timely, regular, frequent, adequate, and mostly written feedback with suggestions (n=9, ABCDEFGHJ). Similar to the results of the questionnaire's data, good tutors motivate students (n=1, D), understand the challenges of adult DE learners (n=2, DG), have interest in helping students (n=5, CDGHK), devote time for their students (n=4, ADJK), know their students and their names (n=1, C), and take students' opinions into account in course decisions (n=1, F). Tutors should provide them with their available times for contact (n=1, F) and be able talk to them on the phone (n=5, BDGHI). They perceived that good tutors are devoted to their profession as educators (n=3, DGJ) and tutors (n=1, J).

In addition to the questionnaire results for Subject Expertise, three categories were found in the interview results: *subject field expertise*, *distance communication skills*, and *technology expertise*. Students reported that good tutors know content area well (n=2, DG), answer questions satisfactorily (n=1, H), and bring different approaches and trends to discussions (n=1, K). However, students perceived that subject field expertise is not adequate and a good tutor should know how to communicate that material in the best way using technology (n=2, BG). Tutors were expected to have adequate knowledge and skills in technology (n=6, EFGHIJ), including computers, Internet tools, and LMS as well as skills in online course management, troubleshooting (n=2, HI), and creating graphics and visuals for their courses (n=1, G).

Vocational Guidance theme was rarely mentioned in the interviews and it is also the lowest-rated category in questionnaire results. Interview participants appreciated when tutors emphasise topics and skills that will be useful for their future career (n=1, E). However, they do not want to use the time in online lectures for vocational guidance (n=2, JK). The following quote represents some of the common challenges the interview participants encountered:

> Tutors read text during videos and students become bored... we should be able to talk, discuss a variety of topics. Lecture, lecture, lecture, up to a point. After a while I want to talk, discuss lots of other things, about articles, recent information. Tutors cannot answer all the e-mails, so the students try to ask questions about the things they don't understand during [online] lectures. Everyone is the same, they don't watch the lecture videos, and then when they ask questions there, it becomes a mass of questions. (K)

Regarding the expectations from their advisors, 12 categories were refined based on Wisker's (2012) list, which outlines 12 expectations students have of their research advisors. In the interviews, the most frequently stated expectations concerned advisors' guidance. Students expected to receive early guidance with clear explanations (n=7, ABCEFGK), and continual guidance with scaffolding as their research progresses (n=7, BEGHIJK) and as students get more independent (n=6, ABEDGI). They want to be informed during critical points where their research might go astray (n=4, CDJK). Students needed guidance about topic selection (n=7, BEDFHIJ), gaps in the literature and problem statements (n=10, BCDEFGHIJK), and the scale of the research (n=6, BEDHIJ). They wanted advisors to guide them to topics that were not only timely and important but also interesting, doable, and useful for students (n=6, BEDFIJ). They wanted advisors to help them with searching literature and access resources (n=7, ABEGIJK), and to provide them with exemplary articles (n=4, AGIJ). They also needed guidance for the design of the study (n=3, AJK), methods (n=4, BCIJ), data collection (n=7, ABCFGJK), and writing (n=3, EIK). During this continual guidance, they wanted advisors to thoroughly read, examine, and comment on their reports (n=7, ADEFHIJ), and to give formative feedback instead of summative (n=6, CDEHIJ). They strongly desired timely feedback for their work (n=7, ABCFHIK), and the provision of constructive criticism with suggestions (n=6, BCDFIJ) and praise (n=2, AD). For example, one student reported:

> First, I want to receive feedback when I ask a question... Second, he/she has to be the subject field expert, I mean, we learn at least the theory, the steps of the project, but during application, when I ask one-on-one, or how it will be, he/she has to help me. Third, he/she has to motivate me regarding the project. This is very important to me because sometimes you may really feel drained as we are working, have our own troubles, and among other things, we try to get a graduate degree too. (I)

Expectations for advisors to be available, friendly, and supportive were reported frequently. Availability of an advisor with timely replies to questions was the most important issue for the students (n=6, ABHIJK) and they preferred telephone as the main communication media for questions (n=11, ABCDEFGHIJK). They wanted their advisors to arrange office hours so that they can call them without hesitation (n=4, ABCF) or to provide remedial online sessions (n=2, BI). They appreciated advisors who are open, friendly, understanding, supportive, ready to help, and approachable (n=9, CBDFGHIJK). They wanted advisors to share interest in their research (n=2, DK), value their research and efforts (n=2, AD), and to motivate (n=6, ABDEIK). They also wanted their advisors to initiate communication occasionally by calling students to check on their progress (n=3, BCD) and encourage students to share and communicate with other students (n=3, DIJ).

The students also valued their advisors' knowledge and expertise in research and methodology (n=2, GI), their original ideas, and their efforts to keep up with the field (n=1, G). They appreciated advisors who support, motivate, and guide students for publishing and help students prepare research for publication in their career (n=3, BEI).

Discussion

Learning Environment

Participants criticised tutors' dull presentations, minimal interaction with students, and failure in online discussion moderation. They desired motivating, interesting, stimulating, and resourceful learning environments where they are allowed to be independent learners and can discuss and engage in critical thinking. The theory of Transactional Distance also suggests that course structure needs to be organised for challenging students' cognitive abilities (Moore, 1993). The participants required support for improving their critical thinking skills (Abdulla, 2004; Jelfs et al., 2009) and they desired meaningful and real-life applications of learning to improve their writing and research (Holzweiss et al., 2014). Moreover, they wanted to be acknowledged for their potential and for their work (Edwards et al., 2011).

The learning environment must be flexible so that tutors can implement various teaching strategies to meet students' learning needs (Howland & Moore, 2002). With diverse backgrounds of DE graduate students (Wisker, 2012), discussions can be used more effectively to improve students' critical thinking and their perspectives about controversial issues in their fields. Therefore, training for new DE tutors should ensure that they are equipped with appropriate strategies for distance learning environments.

Supporting interactions between students is especially important for their socialisation. However, in the current study, although students expected to be in contact with their classmates, their preference for collaborative work varied. Some preferred not to be involved in collaborative work because of communication and task completion problems with their teammates over distance (Capdeferro & Romero, 2012). To allow for such individual preferences, collaborative work could be optional. However, tutors should still employ a variety of tools and methods of communication and collaboration for those who wish to collaborate and not feel isolated. As social groups lead students to perseverance and success, advisors should support students to participate in academic communities for sharing, learning, and emotional support including reading and writing groups, online forums, seminars, workshops, and social networks (Wisker, 2012).

Regarding assessment, written tests may not be appropriate to measure problem solving, as argued by the participants. Similar to Holzweiss et al. (2014), the participants desired to engage in authentic work to apply theory into practice. Considering the increasing capabilities of Internet technologies and resources, a variety of online assessment methods including authentic tasks, problem-solving activities, and performance assessment can be used with formative evaluation (Oosterhof, Conrad, & Ely, 2008).

Interaction

Participants desired quality interaction with their tutors and advisors (Schroeder et al., 2016) and perceived them as primary sources of academic support (Cain et al., 2007). They perceived that providing feedback is the most important characteristic of a good DE tutor (Cain at al., 2007; Edwards et al., 2011; Howland & Moore, 2002; Lessing & Schulze, 2002) and expected quality and individualised feedback. They wanted advisors to give guidance and scaffolding and to give forewarnings in the research process before making vital decisions for their research. They also wanted advisors to reduce guidance as students become more independent, to monitor their progress throughout the stages of research, to provide adequate examples and resources, and to provide guidance for publication. Some participants requested remedial sessions (Lessing & Schulze, 2002). However, interview results showed that some students hesitate to make contact with their tutors and advisors, preferring not to disturb them. Therefore, they want them to have strict virtual office hours and want to be able to contact them on the phone to discuss complex problems (Howland & Moore, 2002). Moreover, they want communication to be initiated mutually and they want their advisors to be interested and excited about their students' research. Clear and polite communication is appreciated (Wisker, 2012). As stated by the participants of this study, a good tutor and advisor needs to be committed to the profession as it requires individual attention, support, and mentoring (Holzweiss et al., 2014; Young, 2006). Research advisors may need to be trained through workshops and consultation with experienced mentors for effective supervision of DE students' research (Lessing & Schulze, 2003).

Expertise

Participants agreed that good tutors and advisors know their field (Abdulla, 2004; Edwards et al., 2011; Jelfs et al., 2009), keep up with new research, and apply these to their courses and supervision. Tutors are expected to have skills and expertise in technology, troubleshooting, online course management, and creating visual course materials. However, Abdulla (2004) found that students just expect basic technical competencies from their tutors. Howland and Moore (2002) suggest that integrating new technologies just because they are popular may increase the technical problems tutors and students will experience in DE.

Any lack of tutor competency in using technology may decrease their teaching efficiency. Therefore, it is essential for inexperienced DE tutors to have hands-on training to effectively integrate technology into their courses.

Individual Differences

Although most of the participants perceived that a good DE tutor promotes interaction and provides Pastoral Care, younger students had higher expectations of tutors. This finding might suggest that these two factors relate to students' self-regulation skills which may develop over time with experience. Moreover, students' preference and level of independent learning may influence their expectations from their tutors (Howland & Moore, 2002).

Similarly, as within Jelfs, Richardson, and Price's (2009) research, younger participants expected more Vocational Guidance. Participants in U2, and participants with previous online learning experience also expected more Vocational Guidance. However, this factor had the lowest mean scores from the questionnaire and was rarely mentioned in the interviews. The interview participants were all employed during data collection, which may explain their lack of attention to this factor. The study by Holzweiss et al. (2014) suggests that while online discussion forums are useful for vocational peer information exchange, students may not consider it as a priority expectation from tutors and advisors.

Promoting Interaction showed differences in terms of university and subject field. This suggests that graduate students' perceptions of good tutors in terms of Promoting Interaction may vary depending on the DE context including styles of interactive teaching strategies of tutors, subject field, LMSs, and university culture, probable since DE learning environments may affect students' perceptions and satisfaction (Trinidad, Aldridge, & Fraser, 2005). The disciplinary differences may further affect the conception of a good tutor (Jelfs et al., 2009).

Conclusion, Implications, and Recommendations for Further Research

Being a tutor and advisor in DE programmes usually necessitates an increase in workload (Pattillo, 2005). Tutors and advisors have to adapt to new teaching styles and new technology (Wisker, 2012). The main challenges of supervisors include students' unrealistic expectations regarding the effort and time needed to complete their research, students' poor writing abilities, and poor work standard (Lessing & Schulze, 2003). However, DE graduate students have various expectations from their tutors and advisors. Some of these expectations are unrealistic for tutors and advisors who are struggling with other responsibilities, while also expected to be available to students anytime, because this is a key premise of DE (Howland & Moore, 2002; Wisker, 2012). DE students struggling to balance their work, family, and education may procrastinate due to work and family problems (Edwards et al., 2011; Kahu, Stephens, Leach, & Zepke, 2013; Wisker, 2012). Therefore, negotiated and well-communicated expectations of tutors, advisors, and students may increase student satisfaction and programme quality.

Guiding DE students is a unique challenge considering diverse student profiles, communication methods, technological competencies, and the integration of technology for communicating and collaborating with students (Wisker, 2012). Furthermore, novice advisors may need training on mentoring graduate students regarding the rules, conventions, and trends of their disciplinary community. Recent attention on online doctoral education programmes reminds us that the education of doctoral students requires even more advanced support for students (Gardner & Mendoza, 2010). As a lack of socialisation in the academic community may lead to student attrition (Lovitts, 2005), DE tutors and advisors should be strongly committed to DE. Training for time management skills may assist novice tutors and advisors.

Assessment activities should be reconsidered to challenge students' critical thinking with authentic projects. Requiring expertise, detailed planning, creativity, and time commitment from tutors and advisors, student-centred approaches that facilitate students' critical thinking skills should be emphasised. Self and peer evaluations can also be used (Howland & Moore, 2002).

This study has implications to TD theory, supporting its main principles while reporting graduate students' perceptions as novice researchers who may need the support of dialogue, structure, and autonomy in their DE programmes. This current study provided desired tutor and advisor actions from the perspective of graduate students to optimise TD, highlighted the importance of individual student characteristics in course design (Benson & Samarawickrema, 2009; Huang, 2002; Huang et al., 2016; Stein et al., 2005), and established the importance of interaction and flexibility to meet students' learning needs.

Although conducted in the Turkish context, findings can be used in the design and improvements of DE courses in similar programmes. In this current study, although generalisability of the findings was increased by collecting data from two representative universities in Turkey, results might still be limited because the interviews were conducted in only one programme. The study can be repeated with a more representative groups of students from all types of disciplines in a variety of graduate programmes and also with doctoral DE students.

Moreover, further studies can be conducted on the relationship between students' expectations and their satisfaction in a longitudinal study. Further qualitative research can be conducted to explore the expectations of students from different age groups since the age of the participants of the qualitative phase of this study was low. Finally, tutor and student personalities, content, and students' levels may determine the level of dialogue and interaction students prefer within a DE course (Moore, 1993). Therefore, for quality online graduate classes, there is potential for research on ideal frequency, duration, depth of discussions, as well as consideration of students' individual differences and capabilities of the tutors and advisors.

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References

Abdulla, A. G. (2004). *Distance learning students' perceptions of the online instructor roles and competencies*. Doctoral Dissertation. Tallahassee, Florida: Florida State University.

Allen, I. E., Seaman, J., Poulin, R., & Straut, T. T. (2016). *Online report card: Tracking online education in the United States*. Babson Park, MA: Babson Survey Research Group and Quahog Research Group.

Bawane, J., & Spector, J. M. (2009). Prioritization of online instructor roles: Implications for competency-based teacher education programs. *Distance Education, 30*(3), 383-397. http://dx.doi.org/10.1080/01587910903236536

Benson, R., & Samarawickrema, G. (2009). Addressing the context of e-learning: Using transactional distance theory to inform design. *Distance Education*, *30*(1), 5-21. https://doi.org/10.1080/01587910902845972

Cain, D. L., Marrara, C., Pitre, P. E., & Armour, S. (2007). Support services that matter: An exploration of the experiences and needs of graduate students in a distance learning environment. *International Journal of E-Learning & Distance Education, 18*(1), 42-56. Retrieved from http://www.ijede.ca/index.php/jde/article/view/129

Capdeferro, N., & Romero, M. (2012). Are online learners frustrated with collaborative learning experiences? *The International Review of Research in Open and Distributed Learning, 13*(2), 26-44. http://dx.doi.org/10.19173/irrodl.v13i2.1127

Creswell, J. W. (2007). *Research design: Qualitative, quantitative, and mixed methods approaches.* Thousand Oaks, CA: Sage.

Dennen, V. P., Darabi, A. A., & Smith, L. J. (2007). Instructor-learner interaction in online courses: The relative perceived importance of particular instructor actions on performance and satisfaction. *Distance Education*, *28*(1), 65-79. http://dx.doi.org/10.1080/01587910701305319

Edwards, M., Perry, B., & Janzen, K. (2011). The making of an exemplary online educator. *Distance Education, 32*(1), 101-118. http://dx.doi.org/10.1080/01587919.2011.565499

Gardner, S. K., & Mendoza, P. (Eds.). (2010). *On becoming a scholar: Socialization and development in doctoral education*. Sterling, VA: Stylus.

Giossos, Y., Koutsouba, M., Lionarakis, A., & Skavantzos, K. (2009). Reconsidering Moore's transactional distance theory. *European Journal of Open Distance and E-Learning*, *2009*(2). Retrieved from http://www.eurodl.org/?p=archives&year=2009&halfyear=2&article=374

Glaser, B. G., & Strauss, A. L. (1965). The constant comparative method of qualitative analysis. *Social Problems, 12*(4), 436-445. http://dx.doi.org/10.1525/sp.1965.12.4.03a00070

Higher Education Council of Turkey. (2016). Öğrenci İstatistikleri [Student Statistics]. Retrieved January 15, 2016 from https://istatistik.yok.gov.tr

Holzweiss, P. C., Joyner, S. A., Fuller, M. B., Henderson, S., & Young, R. (2014). Online graduate students' perceptions of best learning experiences. *Distance Education*, *35*(3), 311-323. http://dx.doi.org/10.1080/01587919.2015.955262

Howland, J. L., & Moore, J. L. (2002). Student perceptions as distance learners in Internet-based courses. *Distance Education*, *23*(2), 183-195. http://dx.doi.org/10.1080/0158791022000009196

Huang, H. M. (2002). Student perceptions in an online mediated environment. *International Journal of Instructional Media*, *29*(4), 405-422. Retrieved from https://www.learntechlib.org/p/64267/

Huang, X., Chandra, A., DePaolo, C. A., & Simmons, L. L. (2016). Understanding transactional distance in web-based learning environments: An empirical study. *British Journal of Educational Technology*, *47*(4), 734-747. http://dx.doi.org/10.1111/bjet.12263

Jelfs, A., Richardson, J. T., & Price, L. (2009). Student and tutor perceptions of effective tutoring in distance education. *Distance Education, 30*(3), 419-441. http://dx.doi.org/10.1080/01587910903236551

Joo, K. P., Andrés, C., & Shearer, R. (2014). Promoting distance learners' cognitive engagement and learning outcomes: Design-based research in the Costa Rican National University of Distance Education. *The International Review of Research in Open and Distributed Learning*, *15*(6). 188-210. http://dx.doi.org/10.19173/irrodl.v15i6.1908

Kahu, E. R., Stephens, C., Leach, L., & Zepke, N. (2013). The engagement of mature distance students. *Higher Education Research & Development, 32*(5), 791-804. http://dx.doi.org/10.1080/07294360.2013.777036

Lemak, D. J., Shin, S. J., Reed, R., & Montgomery, J. C. (2005). Technology, transactional distance, and instructor effectiveness: An empirical investigation. *Academy of Management Learning & Education*, *4*(2), 150-159. dx.doi.org/10.5465/AMLE.2005.17268562

Lessing, A. C., & Schulze, S. (2002). Postgraduate supervision and academic support: Students' perceptions. *South African Journal of Higher Education, 16*(2), 139-149. http://dx.doi.org/10.4314/sajhe.v16i2.25253

Lessing, A. C., & Schulze, S. (2003). Lecturers' experience of postgraduate supervision in a distance education context: Research in higher education. *South African Journal of Higher Education, 17*(2), 159-168. http://dx.doi.org/10.4314/sajhe.v17i2.25309

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage.

Lovitts, B. E. (2005). Being a good course taker is not enough: A theoretical perspective on the transition to independent research. *Studies in Higher Education, 30*(2), 137-154. http://dx.doi.org/10.1080/03075070500043093

Moore, M. G. (1989). Editorial: Three types of interaction. *American Journal of Distance Education, 3*(2), 1-7. http://dx.doi.org/10.1080/08923648909526659

Moore, M. G. (1993). Theory of transactional distance. Theoretical principles of distance education. *American Journal of Distance Education, 1*(1), 22-38. http://dx.doi.org/10.4324/9780203803738.ch5

Moore, M. G., & Kearsley, G. (2011). *Distance education: A systems view of online learning*. Belmont, CA: Wadsworth Cengage Learning.

Oosterhof, A., Conrad, R. M., & Ely, D. P. (2008). *Assessing learners online*. Saddleback River, NJ: Pearson.

Pattillo, G. (2005). Fast facts. *College and Research Libraries News, 66*(6), 500.

Risner, M., & Kumar, S. (2016). Graduate student perceptions of a globally networked course. *Journal of Applied Research in Higher Education, 8*(3), 287-301. http://dx.doi.org/10.1108/JARHE-01-2015-0009

Schroeder, S. M. (2012). *Perceived advising needs of adult learners: A qualitative analysis of advising experiences among online, classroom, & cohort adult learners*. Doctoral Dissertation. Grand Forks, North Dakota: University of North Dakota.

Schroeder, S. M., Baker, M., Terras, K., Mahar, P., & Chiasson, K. (2016). Desired and experienced levels of connectivity to an asynchronous, online, distance degree program. *Online Learning, 20*(3), 244-263. http://dx.doi.org/10.24059/olj.v20i3.691

Soong, B. M. H., Chan, H. C, Chua, B. C., & Loh, K. F. (2001). Critical success factors for on-line course resources. *Computers & Education, 36*(2), 101-120. https://doi.org/10.1016/S0360-1315(00)00044-0

Stein, D. S., Wanstreet, C. E., Calvin, J., Overtoom, C., & Wheaton, J. E. (2005). Bridging the transactional distance gap in online learning environments. *The American Journal of Distance Education, 19*(2), 105-118. https://doi.org/10.1207/s15389286ajde1902_4

Stoessel, K., Ihme, T. A., Barbarino, M. L., Fisseler, B., & Stürmer, S. (2015). Sociodemographic diversity and distance education: Who drops out from academic programs and why? *Research in Higher Education, 56*(3), 228-246. http://dx.doi.org/10.1007/s11162-014-9343-x

Trinidad, S., Aldridge, J., & Fraser, B. (2005). Development, validation and use of the online learning environment survey. *Australasian Journal of Educational Technology*, *21*(1), 60-81. https://doi.org/10.14742/ajet.1343

Wisker, G. (2012). *The good supervisor: Supervising postgraduate and undergraduate research for doctoral theses and dissertations.* New York, NY: Palgrave Macmillan. http://dx.doi.org/10.1007/978-1-137-02423-7

Young, S. (2006). Student views of effective online teaching in higher education. *American Journal of Distance Education*, *20*(2), 65-77. http://dx.doi.org/10.1207/s15389286ajde2002_2

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Quality Frameworks and Learning Design for Open Education

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Abstract

This article discusses the need to innovate education due to global changes to keep its status as a human right and public good and introduces Open Education as a theory to fulfil these requirements. A systematic literature review confirms the hypothesis that a holistic quality framework for Open Education does not exist. For its development, a brief history and definition of Open Education are provided first. It is argued that Open Education improves learning quality through the facilitation of innovative learning designs and processes. Therefore, sources of learning quality and dimensions of quality development are discussed. To support the improvement of the learning quality and design of Open Education, the Reference Process Model of ISO/IEC 40180 (former ISO/IEC 19796-1) is introduced and modified for Open Education. Adapting the three quality dimensions and applying the macro, meso, and micro levels, the OpenEd Quality Framework is developed. This framework combines and integrates the different quality perspectives in a holistic approach that is mapping them to the learning design, processes, and results. Finally, this article illustrates potential adaptations and benefits of the OpenEd Quality Framework. The OpenEd Quality Framework can be used in combination with other tools to address the complexity of and to increase the quality and impact of Open Education. To summarize, the OpenEd Quality Framework serves to facilitate and foster future improvement of the learning design and quality of Open Education.

Keywords: open education, open learning, OpenEd quality framework, learning quality, learning innovations, learning design, history, policies, ISO/IEC 40180

Introduction: The Need to Change Learning and Education

In these challenging and fast-moving times, it is most important to underline: Education is a human right and public good. Education must be continuously provided, innovated, and improved to keep this status in the face of major global challenges (United Nations, 2015). This article describes the needs and potential approaches in theory and practice to meet societal requirements by providing an overview of Open Education as well as introducing the OpenEd Quality Framework for innovating and improving future learning quality and design.

The two main change drivers of our so-called "digital age" are the globalisation and Internet, which modify all parts of our lives, working conditions, and societies as already analysed in detail (Stracke, 2018). That is happening even though the majority of people worldwide (currently 4.2 billion of the global population of 7.4 billion in the year 2016) are still offline and Internet access is very unequal in the Northern and Southern hemispheres (World Bank, 2016). On the other hand, the Internet is more evenly spread than income over the world and the number of Internet users is increasing rapidly (it tripled during the last 10 years from 1.0 to 3.2 billion) and in addition 5.2 billion people have mobile phones and almost everybody (7.0 out of 7.4 billion) is within the mobile coverage (World Bank, 2016).

Globalisation and the Internet have previously challenged and continue to challenge all societies especially in regards to learning and education (education and training in schools, universities, at work, and online; Gaskell & Mills, 2014). On the other hand, globalization and the Internet also offer new opportunities for innovative (formal, non-formal, and informal) learning (Organisation for Economic Co-operation and Development [OECD], 2016). Due to these mutating conditions in societies, there is a current and increasing need to change education, reflecting this ongoing societal revolution in relation to required competences in the future (Weinert, 2001; Westera, 2001; Stracke, 2015). Nevertheless, investments in education and training are more or less stable and not increasing in many countries despite the general recognition of their importance (OECD, 2016).

Methodology

To our knowledge, there is currently no quality framework for Open Education that is holistic, or which implements a philosophy of quality development with a continuous improvement cycle. Our research question is therefore:

- RQ1: How can we derive and develop a holistic quality framework for Open Education from current state-of-the-art literature and research results?

Our key motivation and assumptions are that (1) such a quality framework for Open Education may support the introduction of Open Education and increase the use of Open Education and (2) a quality framework will facilitate the needed change and improvement of learning and education.

Based on our long-term research focus on the quality of Open Education, our hypothesis is:

- H1: There is currently no holistic quality framework for Open Education that (1) follows the total quality management philosophy with continuous improvement cycles and (2) addresses all educational levels (micro, meso and macro).

First, we have conducted a systematic literature review to prove (or refute) our initial statement and hypothesis that no holistic quality framework for Open Education exists. A systematic literature review summarizes the state-of-the-art about a selected topic. It uses pre-defined methods and results are documented in a systematic review protocol. This type of review is based on the rigorous analysis of the evidences that arise from a careful evaluation of the available literature according to pre-defined and shared criteria. Thus, it requires a well-structured process that defines the key decisions of the review, i.e., how studies will be identified, analysed, selected, and evaluated (Booth, Sutton, & Papaioannou, 2016). In our systematic literature review, we are following the PRISMA Statement (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009). It consists of a 27-item checklist that regards methods, results, discussion, and funding and a four-phase flow diagram that concerns records identifications, records screening, articles eligibility, and studies included. We followed the PRISMA statement and its four phases as described below and presented in Figure 1. Our systematic literature review has taken into account literature published up until July of 2018.

To achieve broadest results after screening and for the full text analysis, we have defined only two simple selection criteria: (1) literature incorporated must be in English (as new international *lingua franca*) and (2) literature incorporated must also be available in full text (to keep as many results as possible eligible for analysis independent of their scientific level and document type).

We searched the keywords "Open Education" AND "Quality Framework" on four global databases. As results, we received 173 records from Google Scholar (www.scholar.google.com), 0 records from Web of Science (Clarivate Analytics through University of Maastricht and Open University of the Netherlands [OUNL] account), 0 records from Science Direct (Elsevier through University of Maastricht and OUNL account), and 8 records from Summons (University of Maastricht through OUNL account), leading to a total amount of 181 records. Three records were identified as duplicates and removed, leading to 178 records for the screening. In the screening, 18 records were removed as they were not fulfilling the selection criteria: 11 records were not in English and 7 records were not full text studies. The full texts of the remaining 160 studies were assessed and none of these studies actually presented or referenced a holistic quality framework for Open Education. Among these studies were two publications with the terms *quality models* and *frameworks* in the title: Ossiannilsson, Williams, Camilleri, and Brown (2015) and Jansen, Rosewell, and Kear (2017). Ossiannilsson et al. (2015) compare different quality models which focus on online education and summarize that all analysed quality models suffer certain deficiencies and that a holistic quality framework for Open Education is not existing. Jansen, Rosewell, and Kear (2017) explore quality frameworks for Massive Open Online Courses (MOOCs) only, classifying these frameworks as a specific type and mode of Open Education and promoting their own OpenupEd Quality Label, which focuses on self-assessment and benchmarks for MOOCs. Therefore, both studies cannot be considered to provide a holistic quality framework for Open Education.

Thus, no studies could be included in the planned qualitative and quantitative syntheses. Figure 1 provides an overview of the selection process of the studies.

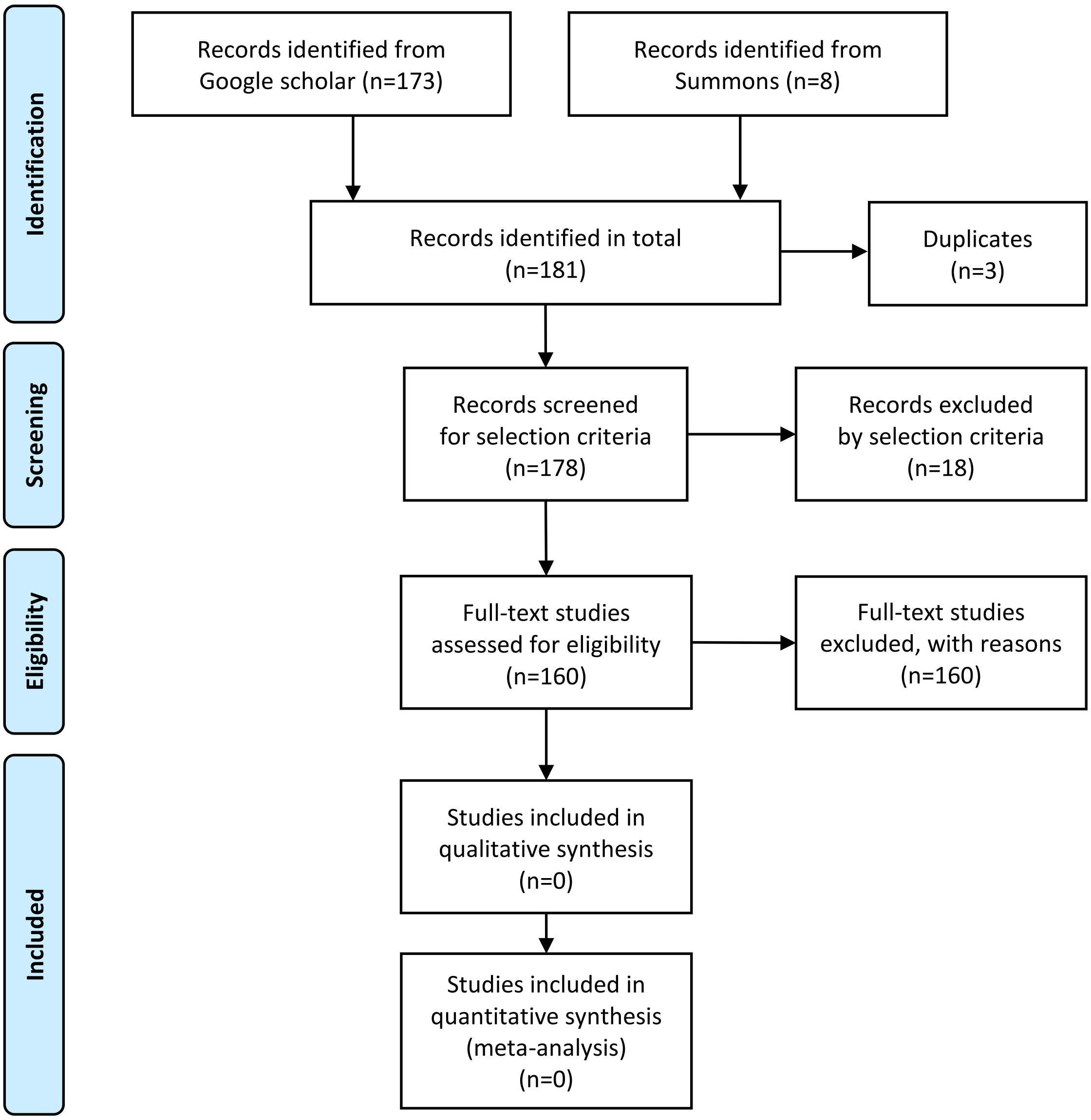

Figure 1. Selection process of identified studies following the PRISMA statement.

As a direct consequence of our systematic literature review, we claim that there is no holistic quality framework for Open Education to our best knowledge. In addition, we have also considered and analysed further publications that we know from our long-term interest in learning quality in Open Education (that were not identified by the keywords of our systematic literature review). Of these publications, there are empirical studies analysing factors for quality education but all of them are analysing specific effects, such as factors in online Higher Education (e.g., Barbera & Linder-VanBerschot, 2011), cross-cultural dimensions of online learning (e.g., Gómez-Rey, Barbera, & Fernández-Navarro, 2016) and different quality perspectives and expectations (e.g., Stracke et al., 2018), all of which do not provide a holistic quality framework for Open Education. Finally, our result is in line with the latest literature review by Esfijani (2018), which articulates a lack of a holistic quality framework in online education, as well as the absence of an integrated view on the quality of online education.

In the following section, we will define Open Education and discuss the dimensions relevant to the research at hand. Based on our discussion results and the identification of key needs (such as covering all educational levels) and documents (such as the first international quality standard ISO/IEC 40180), we will develop and present a proposal for a new and holistic OpenEd Quality Framework to improve the learning quality and design of Open Education.

Definition of Open Learning and Open Education

There is broad consensus that learning and education have to change to reflect and answer the challenges of rapidly growing globalisation and changes in societies (both leading to uncertainty regarding needs for changing personal development as well as learning and education, even in short terms) as discussed above. Learning and education should be changed by opening up to the use of Open Learning and Open Education (Stracke, 2013a, 2017a). But what do Open Learning and Open Education mean?

How to Define Open Learning and Open Education?

Open Learning and Open Education have a long history that should not be forgotten and ignored (Nyberg, 1975; Peters, 2008; Peter & Deimann, 2013; Stracke, 2018). Both terms are used to refer to pedagogical theories and approaches which follow a philosophy and thinking that can be characterized by three main beliefs (see for more details Stracke, 2014a, 2015):

1. Learners cannot be forced to learn but can only learn by themselves.
2. Learners have to explore and create their own knowledge, skills, and competences.
3. Educators should not be teachers but facilitators of these self-directed learning processes.

In the following, we will use only the term "Open Education.” In general, the difference between "Open Education" and "Open Learning" is that Open Education (which can be classified as both formal and non-formal learning) involves an educator, whereas in Open Learning (often classified as non-formal or informal learning), the learners learn independently, without support of educators.

We have to define Open Education first: While the concept of Open Education is broad and diverse (Gaskell & Mills, 2014), we believe that our following definition targets the core meaning of the term Open Education:

> ***Open Education*** *is designing, realizing, and evaluating learning opportunities with visionary, operational, and legal openness to improve* ***learning quality*** *for the learners.*

Open Education is as manifold as the term openness (Wiley, 2009), as it can be related to quite diverse approaches and understandings. Generally, Open Education refers to both, learning innovations and learning quality. It aims to change educational environments and offer a selection of diverse methodologies, tasks, and resources for learners. As expressed in our definition as well as discussed above, improving learning quality has to be the final objective supported by learning innovations.

Therefore, Open Education must be adapted for given situations, and in particular, for the specific learners and their needs (Kirschner & van Merriënboer, 2013). The *open* aspect of Open Education refers not only to the dimensions of “legal” openness (accessibility and availability), but also refers to the dimensions of operational openness (such as open design frameworks) and of visionary openness (such as open policies) (for more details see Stracke, 2017b, 2018).

In the following, we will analyse dimensions of quality development and openness in general before applying these general quality aspects to Open Education, leading to a general framework for Open Education called "OpenEd Quality Framework."

Quality Development

Sources of Learning Quality

In international discussions about the need to change education and about future learning (from theory, research, and politics but also from press, individuals, and social communities), the main focus is currently on technological innovations and the new opportunities they provide. We suggest that the discussions regarding the topic at hand can be categorized under two separate strands: the learning innovation strand and the learning history strand.

Some theories and experts are claiming brand new and extraordinary chances, sometimes promising new learning eras and paradigms (Stracke, 2014a) even though they are only a fusion of former theories: e.g., the concepts of connectivism by Siemens (2005) or of Social Learning by Hart (2011). Even the arrival of fundamental new ways of learning is promised under the label of "learning 2.0 / 3.0" in analogy to the terms "Web 2.0 / 3.0" (Downes 2005; Karrer, 2007; Redecker, 2009). Finally, new concepts and descriptions of our world as a 'flat world' are leading to predictions that the key competence "to learn how to learn" will become the most important asset for all workers due to worldwide changes and faster innovation cycles in business sectors and at work (Friedman, 2006). Those concepts such as 'the flat world' by Friedman (2006) are claiming to constitute a new movement and progress in education as well as in the whole world. However, it is our belief that such claims for a new movement and new competences are just marketing speech and cannot be accepted, as it has been evident in pedagogy for several hundreds of years that "to learn how to learn" is important for learning processes and progress as well as for the development of personality and competences (Dewey, 1966; Piaget, 1953; Rousseau, 1968; Vygotsky, 1988).

The discussion articulated above may best be categorized as part of the learning innovation strand. From this special perspective, it seems that the unique focus on learning innovations is the only pathway and road map for a better education and training in the future as the change and innovation of learning are needed. The underlying, and often hidden argument is that through innovations we would earn many new chances to learn, and without them we are not matching the changing times of globalisation and worldwide Internet as well as the "new digital generation," and the so labelled "digital natives" (Prensky, 2001) even though that they are not existing in reality as it could be proven by several studies (see e. g., Schulmeister, 2008).

On the other hand, there has been a long-term discussion with a longstanding tradition, since the beginning of our culture, about learning quality and what constitutes learning covering a broad range of topics including: the quality of (a) learning objectives and design, (b) learning materials and input, (c) learning processes, and (d) learning outcomes and the achieved knowledge, skills and built competences (Inglis, 2005).

We call this debate the (learning) history strand, as in the past, many theories were developed dealing directly or implicitly with the question how to ensure or to improve learning quality (see for an overview Stracke, 2006). In the educational history, some topics like quality management for education and training are less than 100 years old but general concepts aiming at learning quality have existed for ages.

Surprisingly, both discussion strands articulated above were not interconnected and did not reflect each other (Stracke, 2014a). It seems that those who support learning innovations do not want to refer to theories of the past, and that the authors of learning history do not want to recognise global changes. This led us to an important question that requires urgent attention and an answer in our changing times: What is the relation between learning innovations and history?

Our answer is based on three strong opinions regarding the current societal situation and learning needs that were explained and discussed in detail by Stracke (2013a):

1. Learning history should not be ignored: Modern innovation theories cannot ignore the treasure of expertise from history without losing a well-proven foundation for basing their argumentation.

2. Learning innovations are currently mainly technology driven: But technologies cannot be successful by themselves, they require an appropriate learning design and setting with an attractive and motivating learning environment.

3. Learning is not completely changing: The new modes and types of access to and interactions in learning processes through new technologies do not change completely the way people learn.

Learning quality is more than learning innovations, and the focus on learning quality is most important for the success of learning processes. Consequently, quality development is the crucial task for learning, education, and training. Learning opportunities have to meet the needs of the learners and to provide the appropriate quality to fulfil their requirements. That can sometimes mean a simple learning course with teacher-centred education, and sometimes a complex sophisticated learning environment with learner-oriented group work facilitated by an educator as moderator, tutor, or enabler and enriched with new learning technologies and innovations including social media and online communities. This means that learning quality cannot be pre-defined but must be adapted to the given situation and learners. In this sense, learning history and learning innovations are two different approaches and points of view that are interdependent, and cannot be reflected solely. They must be analysed in conjunction for achieving the best and appropriate learning opportunity and success. Next to them, standards are building the third source for planning and designing the best learning opportunity and quality (Stracke, 2013) as shown in Figure 2. Standards can provide frameworks and instruments for adapting and reusing plans, designs, patterns, resources, and tools to benefit from return of investment by several repetitive applications and to achieve continuous quality improvement. Moreover, the development of standards and their application and adaptation help all involved stakeholders to discuss and reach consensus about learning quality and the way to achieve it.

Figure 2. The three sources for learning quality.

This overall objective for the continuous improvement of learning quality is called quality development. Quality development has to combine the relevant and appropriate approaches, concepts, and elements from all three sources that learning quality is based on: History (by learning theories and traditions), Innovation (by new learning options), and Standards (by consensus building on learning). In the following, we will discuss first the dimensions for quality development in general that will be transferred to Open Education afterwards.

Dimensions of Quality Development

The debate on learning quality is very old, but discussions and theories on quality development in learning and education began only few years ago. Quality development has to be distinguished from failure reduction, quality assurance, quality management, and total quality management. Failure reduction and quality assurance are focusing products: failure reduction intends to increase the number of usable products whereas quality assurance addresses the improvement of the quality of products. Quality management goes beyond quality assurance and focuses also the production processes to achieve higher quality. Finally, Total Quality Management (TQM) is defined twofold: (1) on the one hand it is considered as quality management plus a continuous improvement cycle and (2) on the other hand it is a broad and holistic concept and philosophy that includes and integrates all aspects and dimensions for improving the quality of products, and thus, going beyond their production processes. Quality development is used here as synonym for the latter holistic definition of TQM.

The concept and philosophy of holistic quality development with continuous improvement cycles were introduced in Japan first and could gain recognition, acceptance, and implementations worldwide. A long-term debate has focussed on quality development in general regarding the different quality issues, aspects, and approaches (Deming, 1982; Juran, 1951, 1992; Stracke, 2006). As articulated by Stracke (2013a) "quality development covers every kind of strategy, analysis, design, realisation, evaluation, and continuous improvement of the quality within given systems" (p. 21). Thus, quality development can be described formally by the selected focus. Quality is not a fixed characteristic belonging to subjects or systems but depends on the point of view and focus. The differentiation of the focus into the three quality dimensions *Potential*, *Process* and *Result* was introduced by Donabedian (1980) in the healthcare sector and has become widely accepted. These three quality dimensions focus on the following questions (see Donabedian, 1980; for the long-term debate on the quality issues, aspects, and approaches see Deming, 1982, 1986; Juran, 1951, 1992; Stracke, 2006):

1. Potential dimension: What are the potentials for the quality development in the future?
2. Process dimension: How can the processes be described and optimized for the purpose of quality development?
3. Result dimension: How can the quality development be supported to improve achieved results and existing systems producing the results?

Quality development requires a long process to be established and integrated throughout a whole organization and even the whole society in the case of public goods like education (Freire, 1970; Volungeviciene, Tereseviciene, & Tait, 2014). Once started, it has to become a continuous improvement cycle to be successful (Crosby, 1980; Deming, 1986). Quality cannot be described and fixed by a simple definition because in itself the concept of quality is too abstract. Potential definitions of quality like "fulfilment of customers' requirements" or "excellent status lacking defects" have to take the perspective from the individuals (such as the learners in education). Therefore, quality has to be defined and specified according to the given context and situation considering the perspectives of stakeholders involved (Donabedian, 1980). It is important to identify the relevant aspects and to specify the suitable criteria. It is necessary to find a consensus amongst the different views and perspectives to gain a common understanding of quality for the given context and situation due to different and sometimes contradictory needs and definitions of quality by all stakeholders (for detailed explanations on context determinations see Crosby, 1980; Deming, 1986; Donabedian, 1980).

The next question is now: How can quality development be addressed and improved in learning, education, and training in the digital age? The concept of Open Education tries to provide a framework in theory and practice for the improvement of the learning quality through the integration of learning innovations leading to opening up education. Therefore, quality development in and by Open Education is becoming not only more and more in vogue but also crucial. It is not a fashion but an increasing requirement due to the huge changes in societies. Thus, the quality dimensions and processes of education will be introduced in the following and applied to Open Education.

Quality Dimensions and Processes in (Open) Education

Openness in general and Open Education are vague terms and therefore their dimensions are manifold due to their usage in different disciplines and subjects (Stracke, 2018). Educational dimensions and processes are described in the following section so that researchers may apply and use them for designing the structure of Open Education afterwards.

In the following, we introduce the first and unique international quality standard for education ISO/IEC 40180 that can support the design, realization, and evaluation of Open Education. It was developed and approved in consensus by the Working Group 5 "Quality Assurance and Descriptive Frameworks" of the standardisation committee ISO/IEC JTC1 SC36 and issued by the International Standardization Organization (ISO) in 2005 as ISO/IEC 19796-1 (2005). It is currently applied in more than 60 countries worldwide as national standard. ISO/IEC 19796-1 was under official revision that has to regularly take place every five years. The final revision is approved and published as ISO/IEC 40180 (2017) now.

We have selected ISO/IEC 40180 here as a framework to improve the learning quality and design of Open Education. It requires adaptation for each given situation and avoids simplifying evaluation of quality (as often realized by using only one single specified instrument, e.g., for the quality of MOOCs by Margaryan, Bianco, & Littlejohn, 2015). Other special concepts such as design-based research or agile approaches are covered by ISO/IEC 40180: They can be combined with the international quality standard and used for its application and instantiation in specific cases. The Reference Process Model from this international standard ISO/IEC 40180 provides a general framework for designing the structure for learning, education, and training that can be used for Open Education, too. It consists of seven process categories and 38 related processes as shown in Table 1 below.

Table 1

The Reference Process Model of ISO/IEC 40180 (former ISO/IEC 19796-1)

Category & ID	Description	Processes	
Needs Analysis NA	Identification and description of requirements, demands, and constraints of an educational project	NA.1	Initiation
		NA.2	Stakeholder identification
		NA.3	Definition of objectives
		NA.4	Demand analysis
Framework Analysis FA	Identification of the framework and the context of an educational process	FA.1	Analysis of the external context
		FA.2	Analysis of staff resources
		FA.3	Analysis of target groups
		FA.4	Analysis of the institutional and organisational context
		FA.5	Time and budget planning
		FA.6	Environment analysis
Conception / Design CD	Conception and Design of an educational process	CD.1	Learning objectives
		CD.2	Concept for contents
		CD.3	Didactical concept / methods
		CD.4	Roles and activities
		CD.5	Organisational concept
		CD.6	Technical concept
		CD.7	Concept for media and interaction design
		CD.8	Media concept
		CD.9	Communication concept
		CD.10	Concept for tests and evaluation
		CD.11	Concept for maintenance
Development / Production DP	Realization of concepts	DP.1	Content realization
		DP.2	Design realization
		DP.3	Media realization
		DP.4	Technical realization
		DP.5	Maintenance
Implementation IM	Description of the implementation of technological components	IM.1	Testing of learning resources
		IM.2	Adaptation of learning resources
		IM.3	Activation of learning resources
		IM.4	Organisation of use
		IM.5	Technical infrastructure
Learning Process LP	Realization and use of the learning process	LP.1	Administration
		LP.2	Activities
		LP.3	Review of competency levels
Evaluation / Optimization EO	Description of the evaluation methods, principles, and procedures	EO.1	Planning
		EO.2	Realization
		EO.3	Analysis
		EO.4	Optimization / Improvement

Quality does not exist in a simple manner as we have shown before. First, all stakeholders have to define their own understanding of what the term “quality” stands for in relation to the given context. Then these different perspectives and opinions about quality have to be combined, to be brought into consensus and transferred into practice. The specifications of relevant aspects and criteria to define quality as well as the applications of these criteria into the given context of the organisation are quite abstract by themselves (Stracke, 2010a). For this purpose, the development of ISO/IEC 19796-1 (now ISO/IEC 40180) was started to achieve a common reference framework and the first international quality standard for learning, education, and training based on global consensus.

In a given situation and context, the relevant processes of the quality standard have to be selected and adapted. Figure 3 below presents an example for the selection of relevant processes that are marked in dark grey (for an adaptation model to introduce quality development and in particular ISO/IEC 19796-1 see Stracke, 2010b). The selection of the processes was realized in workshops and discussions among all involved stakeholders.

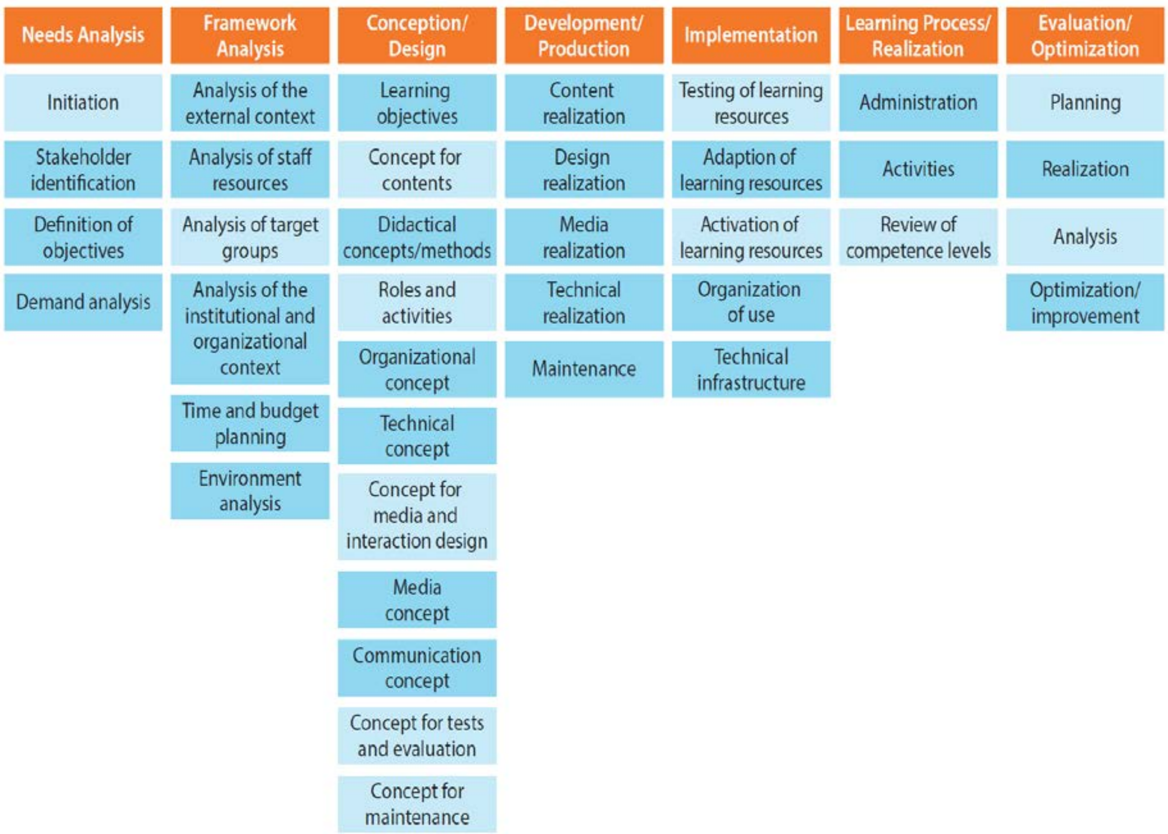

Figure 3. Example for adaptation of ISO/IEC 40180 (former ISO/IEC 19796-1).

We propose the following modification of the process categories presented in Table 2 below to allow a more simplified version with only four process categories plus evaluation and optimization as overarching activities and tasks that are targeting all other four process categories. The argumentation for the changes is that the two categories "Needs Analysis" and "Framework Analysis" as well as the two categories "Development / Production" and "Implementation" are normally undertaken together whereas the "Evaluation / Optimization" is often realized by different stakeholders. In addition, we want to highlight the importance of the optimization and the involvement of the learners in this crucial process for the continuous quality development.

Table 2

Process Categories of ISO/IEC 40180 and Proposed Modifications

ID	ISO/IEC 40180	New ID	Proposed Modification
NA	Needs Analysis	AN	Analysis
FA	Framework Analysis		
CD	Conception / Design	DE	Design
DP	Development / Production	PR	Production
IM	Implementation		
LP	Learning Process	LE	Learning
EO	Evaluation / Optimization	EV	Evaluation
		OP	Optimization

The standard ISO/IEC 40180 presents a good example of an internationally developed and recognised instrument for Open Education. It is valuable and applied worldwide due to its ability to be adapted for each given situation. Such flexible and adaptable instruments are required for the future spreading and implementation of Open Education. In the following, we apply general quality aspects to Open Education leading to a general framework called "OpenEd Quality Framework."

Quality and Levels of Open Education

In the following, we want to develop a general framework called "OpenEd Quality Framework." Therefore, we will begin by applying general quality aspects to Open Education including the three dimensions of quality development (as discussed above) as well as the three levels of education (macro, meso, and micro).

Quality Dimensions for Open Education

We can transfer and apply the three generic quality dimensions that we have analysed above to learning, education, and training in general and in particular to Open Education:

1. Learning objectives: To address and exploit the full potential of future learning, education, and training and to ensure its best quality development, the learning vision and objectives have to be defined precisely. They have to meet the given situation and sometimes very diverse target groups as the best quality always differs and is dependent on the circumstances and conditions.

In particular, in Open Education with self-directed learners, the individual learning objectives are normally manifold that designers have to reflect. Sometimes a simple solution is meeting better the learning objectives and individual needs than a highly sophisticated learning opportunity.

2. Learning realization: The learning realization is covering all processes in learning, education, and training related to its quality development. That includes the definition of learning strategies as well as the design of learning, education, and training and its practical implementation, assessment, and evaluation in courses and any other learning opportunities.

3. Learning achievements: Learning achievements are the results of the realized learning opportunities, i. e., what the learners have learned. We have to underline that this dimension is very different in learning, education, and training compared with other sectors. In learning, education, and training, the achievements are not a result of a production or service process but are built and achieved by the learners themselves. Therefore, the learning opportunities as products of learning providers cannot be judged objectively (like for travel services) but only individually for the specific given learning objectives. In particular, a learner can judge the quality of a learning opportunity only after its completion. Therefore, the quality development in learning, education, and training is more complex and difficult than in any other sector.

Figure 4 illustrates the quality dimensions and their application to Open Education:

Figure 4. Quality dimensions in Open Education.

Levels of Open Education

In general, learning, education, and training can be divided, like other sectors, into the three levels: macro level, meso level, and micro level (Stracke, 2017b). The needs analysis, design, development, realization, and evaluation of Open Education have to focus and include these three levels:

1. Macro level: At the macro level, organizational and societal contexts including policies, vision, philosophy, strategy, and official curricula from public authorities and impact are addressed,
2. Meso level: At the meso level, the institutional processes and the design processes of learning opportunities and their programmes and curricula including all different types and levels of education are analysed,
3. Micro level: At the micro level, specific learning opportunity and learning experiences of individual learners are examined.

These three levels can be applied to Open Education as well as to the three quality dimensions as we will explain in the following.

In Open Education, the following key stakeholders and entities are involved at the three levels as shown in Table 3.

Table 3

Key Stakeholders and Entities in Open Education at the Three Levels

	Key stakeholder	Entities in Open Education
Macro level	International, national and regional public authorities, associations, movements, societies	Open policies, visions, mission statements, strategies and public curricula
Meso level	Organizations including learning designers and providers and their institutional units and departments	Open methodologies, learning designs, patterns, study programmes and courses, assessments and evaluations
Micro level	Learners and educators including teachers, lecturers, trainers, moderators, tutors and evaluators	Open courses, MOOCs, OER, lesson plans, learning units and modules

We can also transfer the quality dimensions to the Open Education and differentiate them for the three levels as shown in Table 4.

Table 4

Quality Dimensions in Open Education at the Three Levels

Quality dimension	Level	In Open Education (OE)
Learning objectives	Macro level	Open Policies of OE
	Meso level	Anticipated learning objectives for OE
	Micro level	Individual learning objectives in OE
Learning realizations	Macro level	Learning strategy of OE
	Meso level	Learning design for OE
	Micro level	Learning activities in OE
Learning achievements	Macro level	Learning impact of OE
	Meso level	Organizational development for OE
	Micro level	Competence development in OE

In the following, we transfer the quality dimensions and levels of Open Education into a general framework called "OpenEd Quality Framework" as basis for the further development of appropriate instruments and tools to improve the quality of Open Education.

The OpenEd Quality Framework

In this section, we develop a general framework called "OpenEd Quality Framework" for the design, realization, and evaluation of Open Education. The Open Education (OpenEd) Quality Framework combines and integrates the quality dimensions in Open Education (cf. Figure 4) with the three levels of Open Education (cf. Table 4) as discussed above. Figure 5 illustrates these relationships.

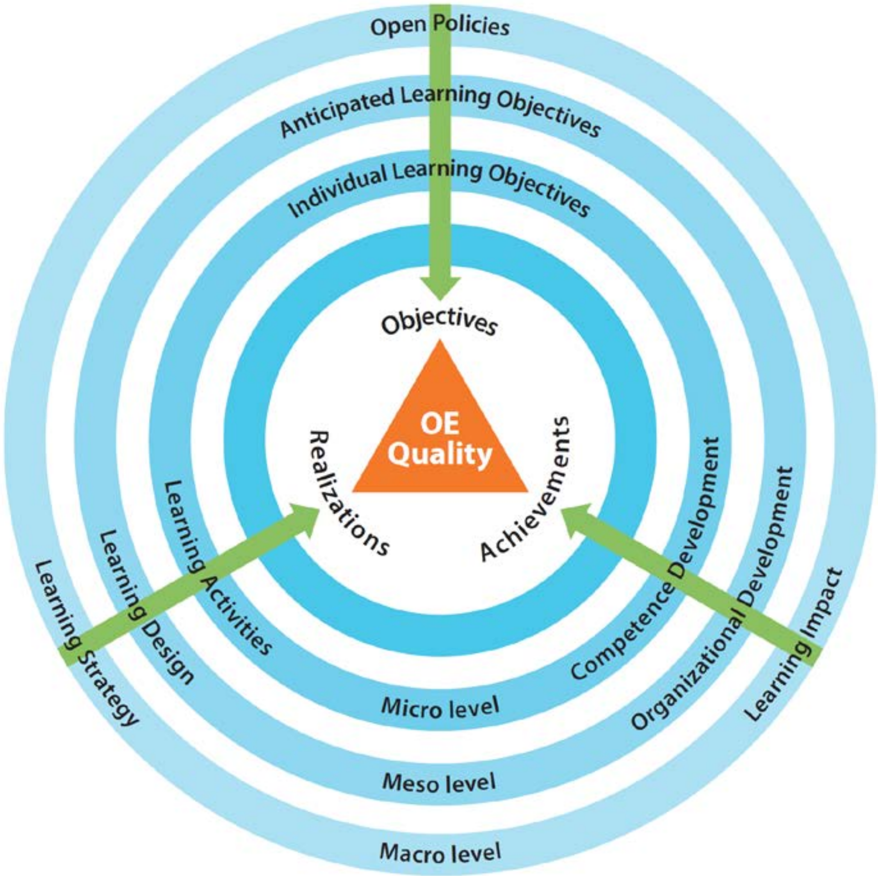

Figure 5. Quality at macro, meso, and micro level in Open Education.

Furthermore, we can apply the process categories as modified above (cf. Table 2) to the three levels in Open Education as presented in Figure 6 below.

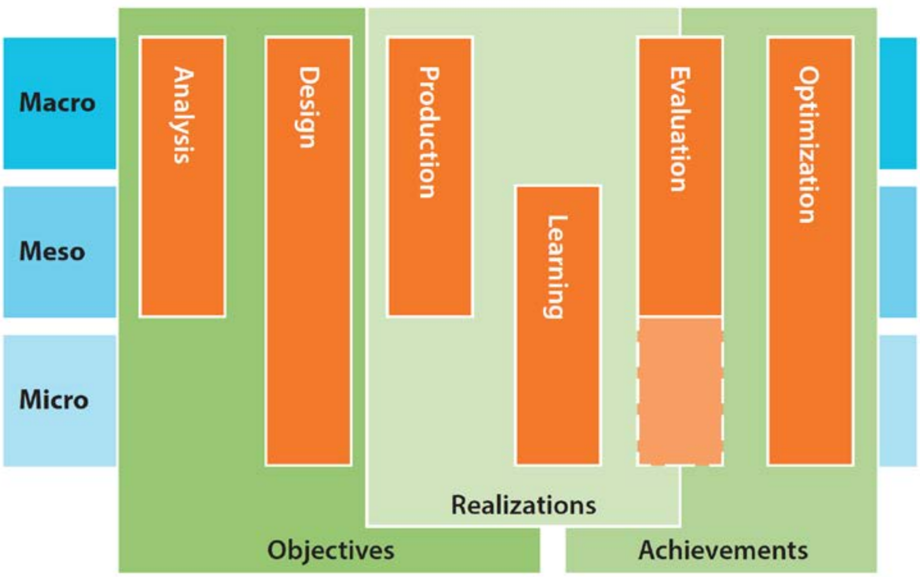

Figure 6. Processes at macro, meso, and micro level in Open Education.

Figure 6 presents the overview of which levels are addressed by the six process categories (e.g., AN is addressing the macro and meso levels, whereas DE is addressing all three levels) and shows in addition the relationship between the three quality dimensions and the process categories. For each of the six process categories and at each level that they are covering, we need appropriate services and instruments to support and improve the overall quality development in Open Education. Some instruments and tools are already developed and in practice such as the Quality Platform Learning (QPL, 2011), the Evaluation Framework for Impact Assessment (EFI, see Stracke, 2014b, 2013b). A general framework for the introduction of quality development also exists: The IDEA(L) framework (Stracke, 2010b), which consists of four phases "Initiate, Do, Evaluate, and Act" (adapted from PDCA cycle presented by Deming, 1982) and was also integrated into the international quality standard ISO/IEC 40180 (2017). Furthermore, the OpenEd Quality Framework can be combined with the Quality Reference Framework (QRF) that was developed for MOOCs as a specific type of Open Education with contributions from several thousands of MOOC learners, designers, facilitators, and providers (Stracke et al., 2018).

The methodologies and philosophies of education have to be adjusted to meet both current and future challenges. We need to modernize and open up education to better fit the given situation. Open Education can improve the quality of education and we have to improve the design of Open Education, to achieve a long-term and sustainable improvement of the learning quality across all educational systems, communities, sectors, and societies worldwide.

Conclusions

This article can only initiate the debate on the importance and impact of Open Education: Open Education can improve the quality of education and we need to improve the learning quality and design of Open Education for its broad acceptance and implementation. Our systematic literature review revealed that a holistic quality framework does not currently exist for Open Education. Therefore, we developed and presented the OpenEd Quality Framework as the first holistic quality framework. It can be used for any type of Open Education and must always be adapted to the given situation. Future research and publications are required and already started to provide more results, tools, insights, recommendations, and argumentations for further discussions and improvements.

We believe in education as a human right and public good. To keep this status due the major global challenges, learning and education have to be changed through the introduction of Open Education. This overview of Open Education in theory and practice presented the needs and potential approaches to meet these requirements. First, Open Education was defined and its history was briefly outlined. The dimensions of quality development and openness were analysed in general. Afterwards, they were transferred and adapted to Open Education. Finally, the OpenEd Quality Framework was developed integrating the modified quality dimensions and three levels of Open Education. It can be combined with other presented instruments, such as the quality standard ISO/IEC 40180 and other specific quality frameworks such as IDEA(L), EFI and the QRF.

To summarize, the OpenEd Quality Framework facilitates and fosters the development and improvement of the learning quality and design of Open Education. We believe in the importance of

Open Education for our common future. It can positively impact all our personal lives and developments as well as all learning processes, educational systems, and societies worldwide.

References

Barbera, E., & Linder-VanBerschot, J. A. (2011). Systemic multicultural model for online education: Tracing connections among learner inputs, instructional processes, and outcomes. *Quarterly Review of Distance Education, 12*(3), 167-180.

Booth, A., Sutton, A., & Papaioannou, D. (2016). *Systematic approaches to a successful literature review*. London: SAGE.

Crosby, P. B. (1980). *Quality is free. The art of making quality certain*. New York, NY: McGraw-Hill.

Deming, W. E. (1982). *Quality, productivity, and competitive position*. Cambridge, MA: The MIT Press.

Deming, W. E. (1986). *Out of the crisis*. Cambridge, MA: The MIT Press.

Dewey, J. (1966). *Democracy and education: An introduction to the philosophy of education*. New York, NY: The Free Press.

Donabedian, A. (1980). *The definition of quality and approaches to its assessment. Explorations in quality assessment and monitoring* (Vol. 1). Ann Arbor, MI: Health Administration Press.

Downes, S. (2005, October). E-learning 2.0. *eLearn Magazine*. Retrieved from http://elearnmag.acm.org/featured.cfm?aid=1104968

Esfijani, A. (2018). Measuring quality in online education: A meta-synthesis. *American Journal of Distance Education*, *32*(1), 57-73. doi:10.1080/08923647.2018.1417658

Freire, P. (1970). *Pedagogy of the oppressed*. New York, NY: Herder and Herder.

Friedman, T. (2006). *The world is flat*. London: Penguin Books.

Gaskell, A., & Mills, R. (2014). The quality and reputation of open, distance, and E-learning: What are the challenges? *Open Learning*, *29*(3), 190-205. doi:https://doi.org/10.1080/02680513.2014.993603

Gómez-Rey, P., Barbera, E., & Fernández-Navarro, F. (2016). The impact of cultural dimensions on online learning. *Journal of Educational Technology & Society, 19*(4), 225-238.

Hart, J. (2011). *Social learning handbook*. Wiltshire: Centre for Learning & Performance Technologies.

Inglis, A. (2005). Quality improvement, quality assurance, and benchmarking: Comparing two frameworks for managing quality processes in open and distance learning. *The International Review of Research in Open and Distributed Learning, 6*(1), 49-61 [1-13]. doi:http://dx.doi.org/10.19173/irrodl.v6i1.221

ISO/IEC 19796-1:2005 (2005). *Information technology - Learning, education, and training — Quality management, assurance, and metrics — Part 1: General approach*. Geneva: International Organisation for Standardization (ISO) [International Norm].

ISO/IEC 40180:2017 (2017). *Information technology — Quality for learning, education, and training — Fundamentals and reference framework*. Geneva: International Organisation for Standardization (ISO) [International Norm].

Jansen, D., Rosewell, J., & Kear, K. (2017). Quality frameworks for MOOCs. In M. J. Kinshuk & M. K. Khribi (Eds.), *Open education: From OERs to MOOCs* (pp. 261-281). Berlin, Heidelberg: Springer.

Juran, J. M. (1951). *Quality control handbook*. New York, NY: McGraw-Hill.

Juran, J. M. (1992). *Juran on quality by design. The new steps for planning quality into goods and services*. New York, NY: Free Press.

Karrer, T. (2007). Understanding e-learning 2.0. *Learning Circuits* (07/2007). Retrieved from http://www.astd.org/Publications/Newsletters/Learning-Circuits/Learning-Circuits-Archives/2007/07/Understanding-E-Learning-20

Kirschner, P., & van Merriënboer, J. J. G. (2013). Do learners really know best? Urban legends in education. *Educational Psychologist, 48*(3), 169-183. doi:https://doi.org/10.1080/00461520.2013.804395

Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of massive open online courses (MOOCs). *Computers & Education, 80*, 77-83. doi:https://doi.org/10.1016/j.compedu.2014.08.005

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine, 6*(7), 1-6. doi:https://doi.org/10.1371/journal.pmed.1000097

Nyberg, D. (1975). *The philosophy of open education*. London: Routledge and Kegan Paul.

Organisation for Economic Co-operation and Development. (2016). *Education at a glance 2016: OECD indicators*. Paris: OECD Publishing.

Ossiannilsson, E., Williams, K., Camilleri, A. F., & Brown, M. (2015). *Quality models in online and open education around the globe: State of the art and recommendations*. Oslo: International Council for Open and Distance Education.

Peter, S., & Deimann, M. (2013). On the role of openness in education: A historical reconstruction. *Open Praxis, 5*(1), 7-14. doi:http://dx.doi.org/10.5944/openpraxis.5.1.23

Peters, M. A. (2008). The history and emergent paradigm of open education. In M. A. Peters & R. G. Britez (Eds.), *Open education and education for openness* (pp. 3-15). Rotterdam: Sense Publishers.

Piaget, J. (1953). *The origin of intelligence in the child*. London: Routledge.

Prensky, M. (2001). Digital natives, digital immigrants - Part II: Do they really think differently? *On the Horizon, 9*(6), 1-6. doi:https://doi.org/10.1108/10748120110424843

Quality Platform Learning. (2011). *Quality platform learning*. Essen: Quality Certification for Vocational Education and Training.

Redecker, C. (2009). *Review of learning 2.0 practices: Study on the impact of Web 2.0 innovations on education and training in Europe*. Luxembourg: Joint Research Centre.

Rousseau, J.-J. (1968). *The social contract*. Harmondsworth: Penguin.

Siemens, G. (2005). *Connectivism: Learning as network-creation*. Retrieved from http://elearnspace.org/Articles/networks.doc

Schulmeister, R. (2008). *Gibt es eine "Net Generation"?* [= Is there a "Net Generation"?] Version 2.0. Retrieved from http://www.zhw.uni-hamburg.de/uploads/schulmeister-net-generation_v2.pdf

Stracke, C. M. (2006). Process-oriented quality management. In U.-D. Ehlers & J. M. Pawlowski (Eds.), *Handbook on quality and standardisation in e-learning* (pp. 79-96). Berlin: Springer. doi:10.1007/3-540-32788-6_6

Stracke, C. M. (2010a). Quality development and standards in learning, education, and training: Adaptation model and guidelines for implementations. *Информатизация образования и науки. Информике (Informika), 7*(3), 136-146. Retrieved from http://opening-up.education/publications/stracke-c-m-2010-quality-development-and-standards-in-learning-education-and-training-adaptation-model-and-guidelines-for-implementations

Stracke, C. M. (2010b). Quality and standards in learning, education, and training: The adaptation model IDEA for the introduction of quality development. In *Proceedings of the International Conference on the Past and Future of e-Learning Standards* (pp. 26-36). Retrieved from http://opening-up.education/publications/stracke-c-m-2010-quality-and-standards-in-learning-education-and-training-the-adaptation-model-idea-for-the-introduction-of-quality-development

Stracke, C. M. (2013a). Open learning: The concept for modernizing school education and lifelong learning through the combination of learning innovations and quality. In C. M. Stracke (Ed.), *Learning innovations and quality: The future of digital resources* (pp. 15-28). Retrieved from http://opening-up.education/publications/stracke-c-m-2013-open-learning-the-concept-for-modernizing-school-education-and-lifelong-learning-through-the-combination-of-learning-innovations-and-quality

Stracke, C. M. (2013b). The evaluation framework for impact assessment. In *Proceedings of 6th International Conference of Education, Research and Innovations (ICERI)* (pp. 4654-4663). Retrieved from http://opening-up.education/publications/stracke-c-m-2013-the-evaluation-framework-for-impact-assessment

Stracke, C. M. (2014a). The concept of open learning for opening up education. In C. M. Stracke, U.-D. Ehlers, A. Creelman, & T. Shamarina-Heidenreich (Eds.), *Changing the trajectory: Quality for opening up education* (pp. 15-24). Retrieved from http://opening-up.education/stracke-c-m-2014-the-concept-of-open-learning-for-opening-up-education

Stracke, C. M. (2014b). Evaluation framework EFI for measuring the impact of learning, education, and training. 华东师范大学学报（自然科学版）*Journal of East China Normal University*, *2*, 1-12. doi:10.3969/j.issn.1000-5641.2012.02.012

Stracke, C. M. (2015). The need to change education towards open learning. In C. M. Stracke & T. Shamarina-Heidenreich (Eds.), *The need for change in education: Openness as default?* (pp. 11-23). Retrieved from http://opening-up.education/publications/stracke-c-m-2015-the-need-to-change-education-towards-open-learning

Stracke, C. M. (2017a). Open education and learning quality: The need for changing strategies and learning experiences. In *Proceedings of 2017 IEEE Global Engineering Education Conference (EDUCON;* pp. 1044-1048). doi:10.1109/EDUCON.2017.7942977

Stracke, C. M. (2017b). The quality of MOOCs: How to improve the design of open education and online courses for learners? In P. Zaphiris & A. Ioannou (Eds.), *Learning and collaboration technologies. Novel learning ecosystems. LCT 2017, Part I, LNCS 10295* (pp. 285-293). doi:10.1007/978-3-319-58509-3_23

Stracke, C. M. (2018). Como a Educação Aberta pode melhorar a qualidade de aprendizagem e produzir impacto em alunos, organizações e na sociedade? [How can Open Education improve learning quality and achieve impact for learners, organizations and in society?]. In M. Duran, T. Amiel, & C. Costa (Eds.), *Utopias and distopias da tecnologia na educação a distância e aberta* (pp. 499-545). Campinas: & Niterói: UNICAMP & UFF. Retrieved from http://opening-up.education/publications/stracke-c-m-2018-como-a-educacao-aberta-pode-melhorar-a-qualidade-de-aprendizagem-e-produzir-impacto-em-alunos-organizacoes-e-na-sociedade

Stracke, C. M., Kameas, A., Vassiliadis, B., Sgouropoulou, C., Texeira, A. M., Pinto, M., & Vidal, G. (2017). The quality of open online education: Towards a reference framework for MOOCs. In *Proceedings of 2017 IEEE Global Engineering Education Conference (EDUCON)* (pp. 1712-1715). doi:10.1109/EDUCON.2017.7943080

Stracke, C. M., & Tan, E. (2018). The quality of open online learning and education: Towards a quality reference framework for MOOCs. In J. Kay & R. Luckin (Eds.), *Rethinking learning in the digital age. Making the learning sciences count: The international conference of the learning sciences (ICLS) 2018* (pp. 1029-1032). doi:http://hdl.handle.net/1820/9909

Stracke, C. M., Tan, E., Texeira, A. M., Pinto, M., Kameas, A., Vassiliadis, B., & Sgouropoulou, C. (2018). Gap between MOOC designers' and MOOC learners' perspectives on interaction and experiences in MOOCs: Findings from the global MOOC quality survey. In M. Chang, N.-S. Chen, R. Huang, Kinshuk, K. Moudgalya, S. Murthy, & D. G. Sampson (Eds.), *Proceedings 18th IEEE International Conference on Advanced Learning Technologies (ICALT;* pp. 1-5). doi:10.1109/ICALT.2018.0000

Stracke, C. M., Tan, E., Texeira, A., Pinto, M., Vassiliadis, B., Kameas, A., Sgouropoulou, C., & Vidal, G. (2018). *Quality reference framework (QRF) for the quality of massive open online courses (MOOCs)*. Retrieved from www.mooc-quality.eu/QRF

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development*. Washington: United Nations. Retrieved from http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

Volungeviciene, A., Teresevičiene, M., & Tait, A. (2014). Framework of quality assurance of TEL integration into an educational organization. *The International Review of Research in Open and Distributed Learning*, *15*(6), 211-236. doi:http://dx.doi.org/10.19173/irrodl.v15i6.1927

Vygotsky, L. (1988). *Thought and language*. Cambridge, MA: MIT Press.

Weinert, F. E. (2001). Concept of competence: A conceptual clarification. In D. S. Rychen (Ed.), *Defining and selecting key competencies* (pp. 45-66). Seattle: Hogrefe & Huber.

Westera, W. (2001). Competences in education: A confusion of tongues. *Journal of Curriculum Studies*, *33*(1), 75-88. doi:10.1080/00220270120625

Wiley, D. (2009). Defining "open." Retrieved from http://opencontent.org/blog/archives/1123

World Bank (2016). *World development report 2016: Digital dividends*. Washington, DC: World Bank.

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Effectiveness of OER Use in First-Year Higher Education Students' Mathematical Course Performance: A Case Study

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Abstract

This article examines the effect of two Open Educational Resources (OER) - Khan Academy Collection and a teacher-authored open textbook - on mathematical course performance and attendance amongst first-year higher education Chilean students. It also aims to find out about teachers' and students' views on the use of OER in order to understand how these resources are used and valued. To this end, quantitative and qualitative methods were employed. Findings indicate that students in face-to-face classes who used Khan Academy resources obtained better examination grades than students who used the open textbook or relied on traditional proprietary textbooks. Moreover, it was also found that students who used both types of OER had significantly lower attendance levels than students who relied on traditional proprietary textbooks. Finally, it was observed that teachers and students had very positive opinions on the use of both the Khan Academy Collection and open textbook resources.

Keywords: OER, Khan Academy, open textbook, higher education

Introduction

Education is a pivotal means of promoting development in any country. As nations seek to develop their human capital in order to participate in a society of global knowledge, there is increasing pressure on educational systems, particularly those in higher education, to meet growing demands for equal educational opportunities and to supply high quality, relevant, and efficient formal and informal educational processes.

Both equity and quality are major challenges for national educational systems in terms of the level of innovation and transformation required. UNESCO (2006) has coined the phrase *Education for Sustainable Development* (ESD) as an umbrella term for the many forms of educational practice that promote efforts to rethink educational systems in countries facing extreme educational challenges. ESD requires participatory teaching and learning approaches in order to motivate teachers and empower learners to change their behavior and take action to achieve sustainable development. It promotes competencies such as critical thinking, imagining future scenarios, making decisions, and solving problems in a collaborative way.

As a re-imagined education system is required to create a new set of skills and competencies for a burgeoning number of new learners, there appears to be the widespread consensus that new forms of educational provision must be available online and free of cost for learners. The European Commission (2012) states that digital technology "offers unprecedented opportunities to improve quality, access and equity in education and training," and that it is a "key lever for more effective learning and for reducing barriers to education, in particular social barriers" (p. 9). It recognizes, however, that technology on its own does not assure innovation; it is, instead, the level of openness regarding the use of technology (European Commission, 2013) that enables the development of the capacity to stay current, promote innovation, and exploit the potential of new learning technologies and digital content.

In this context, recent trends in the use of Open Educational Resources (OER) - also referred to as "open content" (Downes, 2007) - are enabling fundamental changes and innovation in educational provision. New ways of learning, characterized by personalization, engagement, the use of digital media, collaboration, bottom-up practices, and an approach where the learner or teacher is a creator as well as a consumer of learning content, have been facilitated by the exponential growth of OER in recent years. OER are important for stimulating innovative learning environments where users can adapt content according to their needs (Keegan & Bell, 2011).

As previously noted, the need to study and evaluate OER initiatives emerges as a relevant field of research. If these types of action are to become widespread, their effectiveness - as well as possible measures for improvement - must be studied. As formerly stated, the aim of this research is to study the effect of OER by examining a specific case study. Focusing on first-year Chilean higher education students, it aims to observe whether the performance of students in mathematical courses taught using OER improves and how students and teachers perceive this same process.

The Chilean case is particularly relevant in terms of research since the country's educational system has recently been challenged by demands from a civil society that wants access to quality education. Following a series of ongoing, student-led protests across the country, setting the foundation for a national social reform movement, the second presidential term of Michelle Bachelet's government (2014–2018) has embraced the challenge through complex structural educational reforms (Venegas, 2016). In this sense, the study of the effect of OER initiatives is a significant opportunity to contribute to Chile's public policy debate about equity in education using empirical evidence.

The Relevance of Open Educational Resources (OER)

During the last few years, the adoption of Open Educational Resources has become a major trend in public education policy-making. A series of initiatives have emerged that have led to numerous institutional, local, regional, and national policies supporting OER throughout the world. Among them, the Policies for OER Uptake (POERUP), the European Open Education Policy Project, and the Creative Commons OER Policy Registry can be highlighted. In this context, the relevance of these types of resources concerning educational development has been growing.

According to Atkins, Brown and Hammond´s (2007) definition, open educational resources can be understood as "teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others" (p. 4). These include textbooks, course materials, videos, tests, podcasts, multimedia applications, and any other material designed to access to knowledge (Atkins et al., 2007; Butcher, 2015).

In sum, open educational resources are relevant because they facilitate learning processes by delivering diverse open access materials. To this effect, various authors have highlighted the specific benefits of these resources. Orr and van Damme (2015) state that OER positively impact educational processes in three different ways by a) harnessing the possibilities afforded by digital technology (in the case of e-learning OER) to address common educational challenges; b) acting as a catalyst for social innovation and new forms of interaction between teachers and learners; and c) promoting the idea of an extended lifecycle beyond their original design and purpose, with the process of their distribution, adaptation, and iteration improving access to high quality educational materials for all. Likewise, Lane and McAndrew (2010) point out how these resources benefit a specific institution such as the United Kingdom Open University. In this case, it is emphasized that OER have several benefits, such as enhancing university reputations, supporting broader participation, providing material, and accelerating the use of new technologies.

OER and Educational Research

Along with the rise in implementing OER practices, there have also been numerous research papers published based on understanding and evaluating the usefulness of these educational policies. In this respect, the OER agenda has evolved considerably in recent years.

Initially, global OER initiatives were focused on providing infrastructure and delivering mechanisms to implement policies, which resulted in OER research being primarily focused on measuring the deployment, access, and use of these resources (UNESCO, 2011). As the OER movement advanced, a second phase began in which these initial actions were consolidated and a new wave of studies emerged. These have been aimed at assessing the efficacy and impact of OER adoption and deployment (Santos-Hermosa, Ferrán-Ferrer, & Abadal, 2013; Smith, 2013). This is the trend that currently dominates the OER research agenda.

Studies on the effectiveness and impact of OER have focused predominantly on whether adopting these resources at an institutional level brings financial and academic benefits for students and institutions, and how these processes take place. In this context, most of the research on their impact has been focused on the cost-effectiveness of "packaging" OER into courseware or textbooks (Bliss, Hilton, Wiley, & Thanos, 2013; Wiley, Hilton, Ellington, & Hall, 2012, Chiorescu, 2017). For example, Hilton and Laman (2012) conclude that students from Houston Community College who used open textbooks in psychology classes got better grades, had a lower dropout rate, and did better in the final examination. Likewise, Mi Choi and Carpenter (2017) found that both exam grades and course grades in a Human Factors and Ergonomics class did not change when traditional textbooks were replaced by free-to-use materials.

Another point to be highlighted is that great diversity has also been observed among the educational resources currently referred to as OER, depending on their level of openness (Shear, Means, & Lundh, 2015). In the same way, research has also considered the various actors who influence a teaching resource's ultimate success. Both tendencies thus imply that the research agenda on the effect of OER is still wide open and requires further studies on new educational materials and contexts to be developed.

Data and Method

This research aims to study the effect of OER on students' academic performance. Likewise, it intends to understand teacher and students' views on the use of these resources. To this effect, it employed a mixed method approach with two main phases of data collection and analysis. The first phase involved examining the effect of OER use on students' performance in mathematical courses, as well as class attendance based on registry information. The second phase went into these initial results in more depth, using quantitative and qualitative methods focused on teacher and student views on the use of OER.

Both phases involved first year students and teachers from the *Instituto Profesional Providenca* (IPP) Chilean higher education institution. Specifically, this research considered students from the Schools of Education and Engineering taking several mathematics courses during 2014, both in face-to-face classes and through e-learning. A more detailed description of both phases is provided below.

Phase 1: The OER Effect on Students' Performance

The first phase compared several groups of students to determine whether those taught with the help of OER produced better results than students whose education relied exclusively on traditional methods. Specifically, two scenarios considering different treatment and control groups were defined.

As described in Figure 1, Scenario 1 considered two treatment groups and one control group made up of face-to-face students in three different arithmetic classes from the IPP's School of Education. The first class (Control Group, n = 30) used a traditional proprietary textbook. The second class (Treatment Group 1, n = 35) was taught with the help of the Khan Academy Collection. Finally, a third class (Treatment Group 2, n = 31) was taught using a custom-designed open arithmetic textbook. This scenario took place during the second trimester of 2014 over a period of four months.

Scenario 2 compared two classes with a blended module of algebra and calculus classes in the School of Engineering, where students only came together in person for tests and the final exam. The first class (Control Group, n = 41 students) relied on traditional proprietary (institutionally-produced) resources, while the second class (Treatment Group 3, n = 21 students) used the Khan Academy Collection. This study was implemented during the second and third trimesters of 2014.

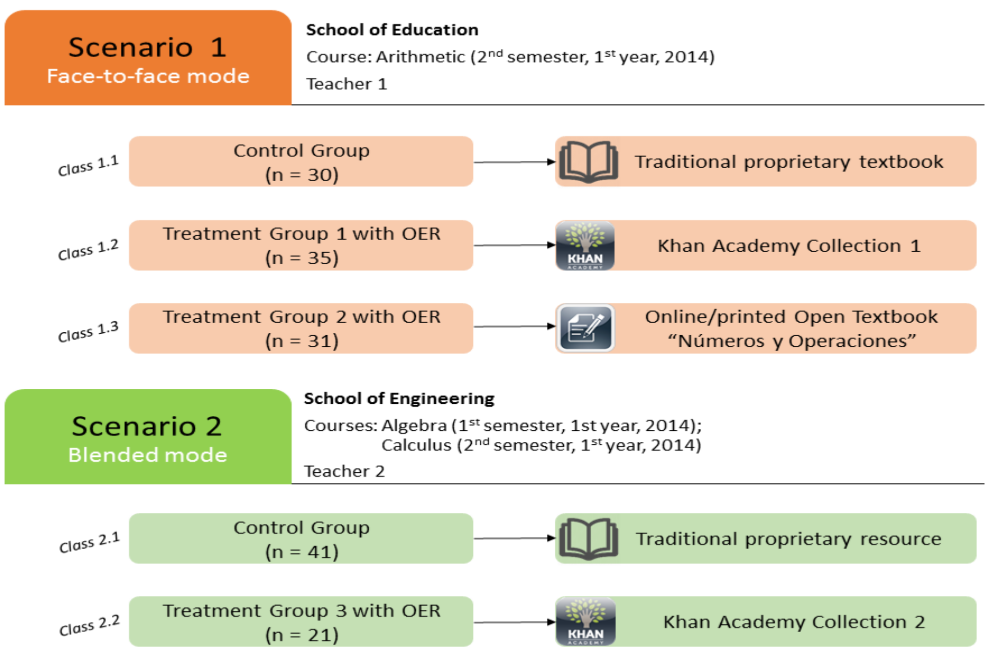

Figure 1. Overview of scenarios comprising the study.

As seen by the description of both specified scenarios, two types of OER were considered: the Khan Academy Collection and an open textbook. The Khan Academy is a Creative Commons Attribution, Non-Commercial (CC-BY-NC) licensed resource that delivers thousands of openly licensed resources through an unrestricted website. In this case, the Khan Academy operated as an additional resource that students were expected to use in order to fulfill their course requirements, alongside traditional course materials.

In the case of the second OER, an open textbook was developed. It was created by two participating teachers, based extensively on their own teaching materials and notes, and was published on Wikibooks (https://es.wikibooks.org/wiki/Matem%C3%A1ticas/N%C3%BAmeros_y_Operaciones). This open textbook was called *Números y Operaciones* (Numbers and Operations) and was provided to students in both printed and digital formats.

This textbook was specifically designed for this study and was exclusively used by students in Treatment Group 2 (see Figure 1). It was written by teachers and included numerous sources such as notes, study guides, assessments, and selected open content inspired or aligned with traditional/commercial textbooks. During classes, students were invited to build on and use exercises related to the content, thanks to the textbook's participatory features and open context.

To estimate the effectiveness of both resources on students' mathematical performance, the quasi-experimental Propensity Score Matching (PSM) methodology was used (Heckman, Ichimura, Smith, & Todd, 1999). This technique evaluates the impact of certain policies by estimating the probability of receiving a specific treatment. It was used because it allows the comparison of academic results between students that used OER and those that did not use these resources through a more unbiased method.

PSM was employed by using the Inverse Probability Weight method, which compares individuals by giving a greater weight in the estimations to people of the control group who have a higher probability of being treated (Imbens & Hirano, 2002). Specifically, the probability of having been taught with the help of an OER was initially modelled using students' sociodemographic characteristics (age, family income, and number of years the mother was educated). Then, the results of the treated and control students (final exam grades, final course grades, and attendance level) were compared.

Phase 2: Educational Actors' Views on the Use of OER

The second phase of the study examined students' and teachers' views on the process of using OER. This provided an opportunity to better understand the views of the end-user (learners and teachers) about the benefits and challenges related to their experience of using OER.

For this purpose, a qualitative approach was applied to teachers and students that used OER. This involved holding two semi-structured interviews with the teachers, two semi-structured interviews with the students, and one focus group with the students. An online survey was designed and applied to 49 students based on the qualitative results.

Using closed questions in two sections, the survey probed student perception of OER use, focusing specifically on their evaluation of a number of the resource's characteristics, the problems identified, and recommendations for the better use of these resources. The first section consisted of a Likert scale of 39 items that measured the students' evaluation of their OER experience, while the second section asked students to indicate the main perceived benefits and problems of this initiative, considering all the issues that had emerged in the qualitative phase. In terms of the survey's reliability, Cronbach's alpha for the 39-item scale was 0.92, which indicates a high level of reliability.

Results

Effectiveness of OER Use on Students' Performance

The first results section presents several analyses about the effect of using OER on students' performance in mathematical courses This was done by comparing different treatment and control groups using the PSM methodology in the two previously specified scenarios (see Figure 1).

In the following tables, each coefficient in the first row describes the effect of the use of an OER regarding a specific comparison group in terms of standard deviations, while the second row shows the standard errors of these effects. These coefficients indicate the average difference between the groups compared regarding the specified result variables when controlling for other relevant variables, namely age, family income, and number of years the mother was educated.

The first analyses of students' mathematical course performance only considered the academic results of freshmen enrolled in face-to-face arithmetic courses offered by the IPP's School of Education in the second semester of 2014 (Scenario 1).

In relation to this, Table 1 shows the effect of using OER when comparing students that used the Khan Academy Collection 1 to students that used traditional textbooks. It is seen that the use of the Khan Academy Collection 1 had a negative effect on attendance (0.86 *SD*s), at a 5% significance level. Likewise, it can be seen that the use of these resources had a positive effect on final exam scores (0.54 *SD*s), at a 10% significance level. Finally, there were no significant differences between students' final course scores.

Table 1

Estimation of the Effect of Using the Khan Academy Collection 1 Versus the Use of Traditional Textbooks (Scenario 1)

Attendance	**Final exam**	**Final course grade**
-0.86**	0.54*	0.13
(0.36)	(0.30)	(0.33)

Note. ** = $p < 0.05$; * = $p < 0.1$; n = 65.

This result suggests then that OER improve students' examination performance but have a negative effect on their attendance levels. Students taught using the Khan Academy produced better final exam grades on average than those who relied on traditional textbooks, indicating that open resources helped improve students' academic performance when considering this last indicator.

The second comparison considered Treatment Groups 1 and 2 from Scenario 1 (i.e., the class that used the Khan Academy Collection 1 and the class that used open textbooks). In this regard, Table 2 shows that students who used the Khan Academy Collection 1 had significantly lower attendance levels (at a 1% significance level) than those who used open textbooks. Additionally, it is seen that students who used the Khan Academy Collection 1 had significantly better exam results (at a 5% significance level) than those who used open textbooks (1.55 standard deviations). There were no significant differences between final course scores.

Table 2

Estimation of the Effect of Using the Khan Academy Collection 1 Versus the Use of Open Textbooks (Scenario 1)

Attendance	**Final exam**	**Final course grade**
-1.24***	1.55***	0.28
(0.25)	(0.20)	(0.24)

Note. *** = $p < 0.01$; n = 66

These results confirm that the Khan Academy Collection is an important resource for enhancing students' performance. Students who used the Khan Academy Collection obtained better results in their final exams on average than those who used either traditional proprietary textbooks or open textbooks, thus highlighting the importance of the type of OER used to improve students' skills.

The third analysis of Scenario 1 examined whether students taught using open textbooks had better results than those taught with traditional ones. In this respect, Table 3 shows that the only result where significant differences were found was the final exam grade, significant at a 1% level. This difference, however, was unexpected, as it can be seen that the use of open textbooks had a negative significant effect with a 0.08 standard deviation on students' final exam grade. This means that students who were taught with traditional textbooks had, on average, higher exam grades than students who were taught with the help of open textbooks.

Table 3

Estimation of the Effect of Open Textbooks Versus the Use of Traditional Textbooks (Scenario 1)

Attendance	**Final exam**	**Final course grade**
0.11	-0.08***	-0.14
(0.33)	(0.25)	(0.27)

Note. *** = $p < 0.01$; n = 61.

The last analysis of OER effectiveness compared students from Scenario 2 - in other words, students from a blended module on algebra and calculus offered by the School of Engineering in the first and second trimesters of 2014. In this scenario, a Control Group (n = 41) used a traditional proprietary resource, while Treatment Group 3 (n = 21) used the Khan Academy Collection 2. Results from this comparison are presented in Table 4.

Table 4

Estimation of the Effect of Using the Khan Academy Collection 2 Versus Traditional Resources (Scenario 2)

Final exam	Final course grade
-0.26	0.04

Note. n = 62.

As shown in Table 4, there were no significant differences between any of the result variables examined. This means that the use of OER did not result in any discernible improvement in students' mathematical performance in blended courses.

Student and Teacher Views on the Use of OER

Having examined the effect of OER on students' performance, this information must be complemented with data about the views of students and teachers on their experience of using OER. For this purpose, the findings presented are grouped into three main topics: overall evaluation, the positive aspects of OER use, and the negative aspects of OER use.

Overall Evaluation

Regarding an overall evaluation, it can be seen that students and teachers were very satisfied with the use of these resources. Qualitatively, it was pointed out that OER were important tools for them to develop their courses and that their use was beneficial to both students and teachers. It was stated that these resources provided vital support, helping to achieve different types of learning in the face-to-face classroom mode, as well as in the home environment. One student who were taught using the Khan Academy Collection, scenario 1, stated that "they are complementary, because they replace a teacher more efficiently. Because I can repeat, repeat and repeat and see the results and advance. Because sometimes texts are not the best motivation when you are tired." Another student, from scenario 2, explains that "they were very pedagogical, didactic. I liked them better, because other algebra classes - or classes related to mathematics – that I have attended included very little support material other than documents or texts."

Specifically, in the case of the Khan Academy Collection, both teachers and students positively highlighted that they included appropriate theoretical content, and the corresponding practical exercises, that allow students to easily understand the content. Moreover, students considered these resources to be user-friendly and felt that this platform facilitated the learning process.

As far as the use of open textbooks was concerned, this experience was also evaluated positively. Students indicated that they used open textbooks instead of traditional proprietary textbooks in order to study content covered in the course syllabus. Likewise, this resource was highlighted as a relevant means for continuing to study at home, and it was also emphasized that the use of this resource was voluntary and was never made compulsory by the teacher.

> Our teacher gave them to us and each person decided what they wanted to do (...) Sometimes he also recommended using the book, saying that on a certain page there were exercises about what we had studied that day. However, it was not compulsory. He made us see that it was a kind of help.

Information about the overall evaluation of this OER experience is evident in the survey data as students were asked to indicate their level of agreement with 39 statements on the use of these resources. Based on this information, a scale of 1 to 10 was calculated for each person who replied where higher values meant a more positive evaluation. Only 37 of the 39 survey statements were considered for this scale since two of the items did not directly reference an evaluation of these resources.

Table 5 displays the average results obtained by different groups of students in this 10 point scale that evaluates student experiences with OER. It can be noted that, although the averages of the groups being compared were generally similar, there were some relevant differences. First, it can be seen that open textbook users gave a better evaluation than Khan Academy Collection users (7.17 versus 6.97). At the same time, it can be seen that younger respondents had a greater appreciation of the use of OER, since the group aged between 19-24 had an average index of 7.25, while the group aged over 25 had an average index of 6.91.

Table 5

Mean OER Use Evaluation Index by Resource Type, Age Group, and Income Category ()

Variable	**Group**	**Mean (1 to 10 Scale)**
Resource type	Khan Academy Collection	6.97
	Open textbook	7.17
Age group	19–24	7.25
	25 and over	6.91
Monthly household income	USD 580 and under	6.91
	Over USD 580	7.24
Level of use	Once a week or less	6.95
	More than once a week	7.17
Total		7.06

**Note.* n=47.

Table 5 also shows that students with higher incomes and with a higher level of use had a more positive evaluation of OER. This could hypothetically be explained by the fact that those with a higher income used OER more frequently as they had the resources to do so. This might be the case since it was discovered that when OER were used in a student's home, those from higher incomes had more opportunities to engage with the resources.

Positive Aspects of OER Use

Regarding specific positive aspects of OER, the qualitative section data shows that responses vary significantly according to the resource used. In the case of the Khan Academy Collection, the website's high level of accessibility and stability are highlighted as its main positive features as described by two participants: "It was always available and did not crash. It would have been terrible to be in the middle of an exercise and have the page crash. That was important to me," and "It let us edit.... So, in some cases, I simplified a few things. I added exercises or changed definitions or added missing content."

In the case of open textbooks, the ability to edit content is one of their most positive features. Consistent with this, students reported that the aspects they liked most included the ability to edit and upload exercises, the fact also that the supplementary printed book provided valuable support, and that there were a lot of exercises available for study.

Positive aspects of OER are highlighted in the survey data that complemented this study, which asked students to select their top three positive OER aspects from a list of 12 options. Table 6 shows the results from all the students, separated by resource type. The most important aspect identified is that OER contributed to the understanding of class content, as mentioned by 65% of students. Other positive features include the fact that explanations are delivered in a more didactic and entertaining way with the use of practical exercises.

Table 6

Positive Aspects Highlighted Regarding the Use of OER by Resource Type

Aspect of OER use	Total sample	Khan Academy Collection	Open textbook
Helped with a better understanding of class content.	65.3%	62.1%	70.0%
Subject treated in a didactic and entertaining way.	34.7%	44.8%	20.0%
Access to a lot of practical exercises.	28.6%	20.7%	40.0%
Ability to study at home.	22.4%	31.0%	10.0%
Simple and user-friendly resource.	22.4%	20.7%	25.0%
Suitable to learning needs.	20.4%	17.2%	25.0%
Reduced anxiety about mathematics.	18.4%	20.7%	15.0%
Rapid feedback on performance.	16.3%	10.3%	25.0%
Teacher proficient in use of resources.	16.3%	6.0%	30.0%

Helped improve grades.	12.2%	13.8%	10.0%
Teacher can personally track performance.	6.1%	10.3%	0%
Exercises provide evidence and reading in cases of error.	6.1%	10.3%	0%
Nothing particularly positive.	6.1%	6.9%	5.0%

**Note.* n=49.

When these results were examined separately by resource type, important differences were observed. While dynamic/entertaining teaching and the fact that exercises could be carried out at home were more prominent for Khan Academy users, the possibility of using practical exercises and the level of teacher preparation was more important for users of open textbooks.

Main Perceived Problems of Using OER

In relation to the main perceived difficulties, the qualitative material shows that the lack of time to use these resources was a relevant factor. Moreover, teachers specifically highlighted that, in both scenarios, older students were not familiar with computers and did not know how to create or use these resources.

Students and teachers also highlighted problems with the IPP's infrastructure, and it was specifically stated that often there were not enough computers for students and that some of them were in poor condition, which negatively influenced optimal use of the OER. Teachers in scenario 1 explained that "(n)ot everyone used them. I was able to directly check each student's use of the Khan Academy.... I had to get angry and ask why. And it was because they didn't have enough time," and "I had students in that class that were slightly older. That in some way were reluctant to use Wikibooks. Then, when it came to editing their uploaded exercises, there was a certain degree of refusal because it was complicated."

When analyzing views separately for both OER, certain difficulties can also be highlighted. Specifically, for Khan Academy, that some aspects of the course content covered in class were not included and that some students did not understand the practical exercises, was a criticism of this resource. These resources were presented to students in this platform, which was different than how students were taught in traditionally face-to-face classes. Likewise, students from the blended courses pointed out that initially they were not adequately informed that use of the platform was to be assessed, which resulted in their lack of interest at the start of the course.

> I did not understand that it was another grade ... so at first I didn't take it seriously and got behind. In the end I had to start using it quickly. I used it in its entirety, but I wasn't really aware of what the final goal was.

In the case of open textbooks, the main difficulty was associated with understanding the Wikibooks editing platform. This platform was built using the *Latex* programming language and some students, particularly the older ones, identified this as a problem.

As with the positive aspects, Table 7 shows the difficulties associated with use of the OER by resource type, based on the survey results. As seen in this table, the main difficulties identified include the time lag in loading resources, the IPP's technological infrastructure, and, to a lesser extent, the lack of time for student use. What is more, it is important to note that only 2% of those who replied said that OER use required a level of knowledge they did not have.

Table 7

Main Perceived Difficulties of OER Use by Resource Type

Aspect of OER use	Total sample	Khan Academy Collection	Open textbook
Internet connectivity.	42.9%	37.9%	50.0%
Institutional infrastructure.	34.7%	37.9%	30.0%
No time for use at home.	26.5%	24.1%	30.0%
Some of the content covered in class not reflected.	18.4%	13.8%	25.0%
Encourages students to compete among themselves.	12.2%	6.9%	20.0%
Lack of sophistication.	10.2%	10.3%	10.0%
Teacher not adequately prepared.	8.2%	10.3%	5.0%
Required restrictive level of technological knowledge.	2.0%	0%	5.0%
Other.	8.2%	13.8%	0%
None.	30.6%	31.0%	30%

Note. n=49.

Regarding the differences according to the type of OER used, issues related to IPP infrastructure were more prevalent for users of the Khan Academy Collection, while difficulties associated with the website and the lack of certain kinds of content were identified by open textbook users.

Discussion

The main aims of this research were to examine the effect of OER use among higher education students and to analyze teacher and student views on OER use in order to better understand how these resources are used and valued. This was justified by the fact that there is a lack of empirical evidence to support expanding the use of OER. Moreover, recent societal demands to improve education quality in Chile have made this a relevant case study environment in which to examine the potentials of OER.

In relation to the first aim, the most important result is that students in face-to-face arithmetic/statistics courses using Khan Academy resources achieved significantly better exam grades than students who did not use any extra resources ($p < 0.05$) or those who used open textbooks as an extra resource ($p < 0.01$). The fact that the final exam was the same for everyone makes this a valid comparative measure of students' performance.

These findings indicate that OER could be valuable assets to Chilean students in a context where there is increased access to innovative resources and demand for higher quality education. It was observed that OER could be useful in specific contexts to improve students' results, which indicates that Chilean education could benefit from offering OER to more students in formal educational settings. What is more, these results are coherent with other examined studies about OER effectiveness in other contexts (Feldstein et al., 2012; Hilton & Laman, 2012).

Another important finding was the fact that face-to-face students who used OER had significantly lower attendance levels than students who relied on traditional educational methods. Further research should be done on this issue. For example, research could be carried out on whether this can be explained by the fact that when students have access to these resources, they tend to work more from home.

All these results, however, should be treated with caution, since they were obtained from small samples that represent a very specific group of Chilean students only. Moreover, it was also found that the use of open textbooks did not have any effect and that, among students on e-learning courses, the use of OER did not make any difference. In terms of representativeness, these findings do not mean that OER cannot have a positive effect on other student groups; it does, however, need to be made clear that these findings have little external validity and that more research on the effect of OER is required to justify the use of these resources in a broader context.

Regarding the research's second aim, the qualitative and quantitative materials examined reconfirmed the assumption that these resources can be a relevant asset to Chilean students. Qualitative data demonstrated that both actors had positive experiences when using these two OER types. These positive results were later ratified by the survey results, which demonstrated a very positive assessment of the OER used, since the majority of students indicated in the survey that OER made teaching more dynamic, that these resources were easy to use, and that they provided good explanations and practical exercises.

This positive evaluation of OER contrasts somewhat with the findings of the first part of this research, in which only one of the groups studied performed significantly better than those who did not use this type of resource. This discrepancy, however, should not be understood as an inconsistency of the examined data, since the results of and views about these results do not necessarily have to agree. The fact that, in some cases, OER were found to have a negative effect does not mean that these resources were not useful to students. It does mean that the positive effect perceived by students may not be reflected in higher grades, but could be shown in other ways, such as increased motivation or improved ICT skills. To prove this, however, would require further study that considers new outcome variables.

The second component of this research also showed some of the perceived problems regarding the use of these resources. It was highlighted that they did not work well when students lacked resources, such as adequate time and physical space. Furthermore, the fact that optimal use of resources relied on the IPP having computer laboratories in good condition was also noted. On the other hand, quantitative data identified areas for improvement, such as the institutional infrastructure challenge of learning how to use these resources properly and specific problems associated with OER websites. From these results, it is evident that any suggestions are aimed at enhancing the conditions in which OER strategies are implemented, rather than criticizing the usefulness of the resources, reconfirming the fact that students highly evaluated their OER experience.

Another important point addressed in the second part of this research relates to students' perceptions according to income level, age group, and levels of student use. Younger students and those with higher levels of resources valued the experience of using OER more and students with higher income had higher scores on the evaluation scale. This last point in particular deserves certain attention as it shows that a digital gap could play a role in the usefulness of OER. Although this issue needs to be researched in more depth, these results seem to indicate that open access is not always enough to enable students to successfully engage with an open educational environment (Lane, 2009).

Conclusion

From a public policy standpoint, both OER selected for this study show that these types of resources can contribute to an increase in national educational challenges. As a public strategy, OER can provide an educational context with enriched possibilities: equal access, quality enhancement of educational knowledge and resources, professional teacher development, institutional innovation, cost-effectiveness and public accountability (Atkins et al., 2007, Lane & McAndrew, 2010).

In this context, having measured both the effect of OER on academic performance and understood the views on the use of these resources, an important contribution to the debate about the relevance of OER was made. As was previously stated, in order to promote the expansion of these resources, their usefulness has to be proved. To this effect, this research positively promotes the development of OER initiatives, since it empirically shows how these resources deliver innovative tools to address educational challenges, encouraging new forms of interaction between educational actors in the process of knowledge generation (Orr & van Damme, 2015).

Another important point is that, if OER are to accomplish their aims, educational institutions have to take on certain responsibilities and have the infrastructure needed to take full advantage of these resources. To be precise, if OER are expected to promote integral methods of curricular communication and have a transformative value (Butcher, 2015), educational institutions must install the necessary infrastructure for students to benefit from these open initiatives.

Given the Chilean context, this research shows evidence of the potential benefits of applying OER as a public strategy to improve equity and quality. Chile's higher education system has been specifically described as having important equity problems because some institutions deliver low-quality education as a result of their limited resources. To this effect, OER could provide an important opportunity to tackle these problems, given their cost-effectiveness benefits. This would, however, require both the commitment of Chile's public institutions to promote and lead the application of these types of resources and the desire of educational institutions to adopt them and provide the required facilities.

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References

Atkins, D. E., Brown, J. S., & Hammond, A. L. (2007). A review of the open educational resources (OER) movement: Achievements, challenges, and new opportunities. *Report to the William and Flora Hewlett Foundation*. Retrieved http://hewlett.org/wp-content/uploads/2016/08/ReviewoftheOERMovement.pdf

Bliss, T. J., Hilton III, J., Wiley, D. & Thanos, K. (2013). The cost and quality of online open textbooks: Perceptions of community college faculty and students. *First Monday*, *18* (1). https://doi.org/10.5210/fm.v18i1.3972

Butcher, N. (2015). *A basic guide to open educational resources (OER).* Retrieved from http://unesdoc.unesco.org/images/0021/002158/215804e.pdf

Chiorescu, M. (2017). Exploring open educational resources for college algebra. *The International Review of Research in Open and Distributed Learning*, *18*(4). https://doi.org/10.19173/irrodl.v18i4.3003

European Commission. (2012). Rethinking education: Investing in skills for better socio-economic outcomes. Retrieved from http://ec.europa.eu/education/policy/multilingualism/rethinking-education_en

European Commission. (2013). 'Opening up education': Innovative teaching and learning for all through new technologies and open educational resources. Retrieved from http://ec.europa.eu/education/news/doc/openingcom_en.pdf

Downes, S. (2007). Models for sustainable open educational resources. *Interdisciplinary Journal of Knowledge and Learning Objects*, *3*(1), 29-44. Retrieved from http://www.learntechlib.org/p/44796/

Feldstein, A., Martin, M., Hudson, A., Warren, K., Hilton III, J., & Wiley, D. (2012). Open textbooks and increased student access and outcomes. *European Journal of Open Distance and E-Learning*, *2*(1). Retrieved from http://www.eurodl.org/?p=archives&year=2012&halfyear=2&article&article=533

Heckman, J. J., Ichimura, H., Smith, J. A., & Todd, P. E. (1999). Characterizing selection bias using experimental data. *Econometrica*, *66*(5), 1017–1098. Retrieved from https://www.jstor.org/stable/2999630

Hilton III, J.L., & Laman, C. (2012). One college's use of an open psychology textbook. *Open Learning: The Journal of Open, Distance and e-Learning*, *27*(3), 265-272. https://doi.org/10.1080/02680513.2012.716657

Imbens, G.W., & Hirano, K. (2002). Estimation of causal effects using propensity score weighting: An application to data on right heart catheterization. *Health Services and Outcomes Research Methodology*, *2*(1), 259–278. https://doi.org/10.1023/A:1020371312283

Keegan, H., & Bell, F. (2011). YouTube as a repository: The creative practice of students as producers of open educational resources. *European Journal of Open, Distance and E-learning*, *14*(2), 1–10. Retrieved from http://www.eurodl.org/materials/special/2011/Keegan_Bell.pdf

Lane, A. (2009). The impact of openness on bridging educational digital divides. *The International Review of Research in Open and Distributed Learning*, *10*(5). https://doi.org/10.19173/irrodl.v10i5.637

Lane, A., & McAndrew, P. (2010). Are open educational resources systematic or systemic change agents for teaching practice? *British Journal of Educational Technology*, *41*(6), 952–962. https://doi.org/10.1111/j.1467-8535.2010.01119.x

Mi Choi, Y., & Carpenter, C. (2017). Evaluating the impact of open educational resources: A case study. *Libraries and the Academy*, *17*(4), 685-693. https://doi.org/10.1353/pla.2017.0041

Orr, D., Rimini, M., & van Damme, D. (2015), *Open educational resources: A catalyst for innovation*. Paris: OECD Publishing. https://doi.org/10.1787/9789264247543-en

Santos-Hermosa, G., Ferrán-Ferrer, N., & Abadal, E. (2013). Recursos educativos abiertos: Repositorios y uso [Open Educational Resources: Repositories and use]. *El profesional de la información*, *21*(2), 136-145. Retrieved from http://openaccess.uoc.edu/webapps/o2/handle/10609/13601

Shear, L., Means, B., & Lundh, P. (2015). Research on open: OER research hub review and futures for research on OER. Menlo Park, CA: SRI International. Retrieved from https://www.hewlett.org/wpcontent/uploads/2016/08/OERRH%20Evaluation%20Final%20Report%20June%202015.doc

Smith, M. (2013). Ruminations on research on open educational resources. Menlo Park, CA: William and Flora Hewlett Foundation. Retrieved from http://www.hewlett.org/wp-content/uploads/2016/08/OER%20Research%20paper%20December%2015%202013%20Marshall%20Smith_1.pdf

UNESCO. (2006). Framework for the UNDESP international implementation scheme. Retrieved from http://unesdoc.unesco.org/images/0014/001486/148650E.pdf

UNESCO. (2011). Activity report 2010-2011. Retrieved from http://iite.unesco.org/publications/3214690/

Venegas, J. I. (2016). *¿Por qué los jóvenes chilenos rechazan la política? Desafección política juvenil en el Chile postransición*. [Why Chilean youth reject politics? Youth Political Disaffection in Chile's post-transition] Santiago, Chile: Ril Editores.

Wiley, D., Hilton III, J., Ellington, S., & Hall, T. (2012). A preliminary examination of the cost savings and learning impacts of using open textbooks in middle and high school science classes. *The*

International Review of Research in Open and Distributed Learning, *13*(3), 262-276. https://doi.org/10.19173/irrodl.v13i3.1153

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Distance Learners' Use of Handheld Technologies: Mobile Learning Activity, Changing Study Habits, and the 'Place' of Anywhere Learning

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Abstract

This study investigates how and where distance learners use handheld devices and the impact this has on learning habits, access to learning content and quality of work. It analyses the spatial dimension of anytime-anywhere learning and, with a focus on anywhere learning, it explores students' ongoing negotiation of the flow between and across study locations. The study concludes by proposing two new concepts: the *flow of places* and *place of space*. These should help direct the framing of future studies into the places, spaces, and mobility of formal and informal seamless learning. A dataset comprising 446 responses from undergraduate students enrolled at the UK's largest distance learning university was analysed in respect to three research questions. All age groups, study levels, and disciplines were represented. Five key findings are: most students now use handheld devices for study-related learning; the distribution of study-related learning tasks was similar in all seven study places; there is a strong, statistically-significant correlation between the number of study places in which handheld devices are used and the number of study task types performed; two fifths of students using a handheld device for learning have noticed a change in study habit and benefit to learning; and multiple regression analysis shows three variables (number of study places, number of study tasks, and change in study habits) are predictors of finding it easier to access learning materials and improved quality of learners' work.

Keywords: mobile learning, seamless learning, study space, handheld learning technologies, anywhere learning, distance education.

Introduction

The concept of anytime anywhere learning is over a decade old (Attewell & Savill-Smith, 2005) yet there remains much to be done in understanding what anywhere learning looks like and whether changes in the geographic reach of handheld technologies is impacting on study habits and quality of learning. As ownership and use of mobile handheld devices increases (Brooks, 2016; Newman & Beetham, 2017), how are the places of learning being transformed?

The potential contribution that mobile technology can make to Higher Education teaching and learning has become one of the most important and strategic areas of research (Ally & Prieto-Blazquez, 2014). Educators urgently need to understand how learning designs and teaching models must be reconfigured such that they are better compatible with the flexible, mobile needs of their students (Awadhiya & Miglani, 2016) and deliver richer, seamless learning experiences to those who want them (Chan et al., 2006). This is true for online and distance learning, yet there remains a paucity of research about how distance learners use mobile technologies. Reviews of the literature report that mobile learning research has too often been based on small sample sizes, involved early adopters and skewed to reporting positive results (Rushby, 2012; Wingkvist & Ericsson, 2009; Wu et al., 2012) and that just 10% of mobile learning research takes place in distance learning settings (Krull & Duart, 2017). The paucity of research into how distance learners use mobile devices needs addressing. More applied research is needed to move beyond consideration of user readiness or acceptance (e.g., Lam, Wong, Cheng, Ho, & Yuen, 2011) and towards use of mobile computing devices by teaching staff to teach, and of university students to learn (Gikas & Grant, 2013).

This paper responds to the need for research into distance learners' use of mobile technologies by seeking to problematise, map, and unpack the anywhere component of anytime-anywhere learning (Attewell & Savill-Smith, 2005). Using data from a survey of distance learners residing in the UK, this analysis is framed by the concept of seamless learning (Wong, Milrad & Specht, 2015) and Castells' theorisation of how physical space and online space interacts (Castells, 1997). Castells' conception of a dialectic between a *space of flows* and a *space of place* provides a guiding frame to situate the relationship between the virtual learning world—a global networked space of flows—and the bounded place in which the learner learns (Glassman & Burbridge, 2014; Martin & Madigan, 2006). When interpreted in the context of mobile learning, these concepts help foreground questions relating to the role that place and geographic mobility have on student learning and behaviour.

Distance learners represent a more mobile, more heterogenous, and more geographically dispersed group when compared to most campus-based student cohorts. For example, it is common for distance learners to be in full- or part-time employment and to have family or caring responsibilities thereby necessitating the use of multiple places for learning. Time is at a premium, and so understanding patterns of use to better support existing learning practices and find learners new opportunities to study—wherever and whenever this may be—is essential. At present, 12% of UK higher education students are enrolled in distance learning courses (Universities UK, 2016) with the Open University (OU) the largest distance learning provider. The curriculum is predominantly digital with teaching mostly taking place online using comprehensively-designed digital course materials and structured opportunities to interact with other students and tutors.

The focus of this paper is three key research questions relating to the places where learning by distance learning students occurs:

RQ1. Where and how are distance learning students using handheld devices for study and for non-study tasks?

RQ2. What is the relationship between the types of study-related learning tasks performed on handheld devices and the study spaces in which students use them?

RQ3. Are students experiencing a change in study habits and a positive impact on learning as a result of anywhere use of handheld devices?

This paper is structured in four sections. The first reviews the concept and challenges associated with anytime-anywhere learning, followed by a section describing the survey methodology and another presenting results. The concluding section discusses the research findings.

Towards Anywhere Seamless Learning

For over a decade, the concept of anytime-anywhere learning (Attewell & Savill-Smith, 2005) has been used in mobile and digital learning research to describe: how students access and learn from their course resources (Lowenthal, 2010), the patterns of interaction over time and space (Demsey, 2008), the opportunity for spontaneous learning in non-conventional situations (Vavoula & Sharples, 2009), and the potential for new pedagogies such as just-in-time learning or anywhere-anytime assessment (Nikou & Economides, 2017). Studies show that students value and notice these emerging potentials. For example, when asked what they liked best about using digital learning technology, 65% of students in a US study chose "mobility: I like being able to study anytime, anywhere" (p. 27) and 82% agreed that "I can spend more time studying because digital learning technology allows me to study anywhere" (p.28) (McGraw-Hill Education, 2016).

Mobile devices offer opportunities to students to commence and continue their learning across locations (Sharples, 2015; Wu et al., 2012), thereby allowing learners to "leverage mobile learning to facilitate holistic and perpetual learning experience that bridge different locations, times, technologies and social settings" (Chai, Wong & King, 2016, p. 170). Understanding the mobility of the learner, therefore, is associated with processes of meaning-making (Sharples, 2015), the weaving together of the formal and informal (Wrigglesworth & Harvor, 2017), and the interplay between physical and digital learning spaces (Chai, Wong & King, 2016).

Tablets, e-readers, and smartphones comprise three of the most common types of handheld device. The term handheld device is used in this paper in preference to mobile device (Brown & Mbati, 2015; Traxler, 2007) as it is a more objective description of the technology and avoids a presupposition that these devices travel between places. It is patterns of how students *make* handhelds mobile that this study seeks to examine.

Early research into the use of mobile devices often tended to focus on use for assimilative learning activities such as reading course content. This work identified a range of perceived benefits including convenience of access, portability, ease of finding resources, searching within documents, updating content, building personalised libraries, bookmarking, realising environmental benefits, incorporating interactivity, novelty, and ability to 'carry' more books (Jamali, Nicholas & Rowlands, 2009; Margolin, Driscoll, Toland, & Kegler, 2013; Wu et al., 2012).

As mobile handheld devices have become more capable, the range of learning activities that students can perform has increased. Students can now engage in collaborative and social learning activities such as personal publishing, starting conversations, joining social media, finding answers to questions from others, facilitating team collaboration, and knowledge sharing (Al-Emran, Elsherif, & Shaalan, 2016). Students can use productivity or media capture applications to assist in writing assignments, building portfolios, and taking notes, along with administrative tasks such as checking assessment scores, accessing timetables, and emailing tutors. Teachers' pedagogic options for using handheld devices have similarly increased (Brown & Mbati, 2015).

A range of limitations or challenges in use of handheld devices for learning have been identified including: form-factor and display quality, usability and navigation, no fixed page numbering, student preference for leisure rather than study-related use, and quality of teachers' knowledge and skills in using the technology (Cliatt, 2010; Dahlstrom, Brooks, Grajek, & Reeves, 2015). Consequently, print and electronic versions of a document may no longer be pedagogically equivalent (Bozkurt & Bozkaya, 2015) and even technologically savvy students may encounter significant challenges (Gikas & Grant, 2013).

Use of devices for both general leisure learning and study-related learning presents both challenges and opportunities for learners. Whilst potentially distracting leisure activities are merely a tap or swipe away, so are opportunities for informal learning. An ECAR survey found that 37% of undergraduate students admitted to being distracted from studying by social media and 35% by web surfing (Brooks, 2016). This finding is supported by open comment responses from Selwyn's (2016) survey of Australian undergraduates. Teachers in face-to-face contexts can regulate and control the learning space, yet in distance education it is mostly the learners themselves who face a constant state of negotiation with respect to establishing boundaries and deciding how to use the same device for both leisure and study activities.

Learners need support to understand how to manage their learning across locations and make positive adaptations to their study patterns and habits. Wong and Looi (2012) argue that utilisation of seemingly ubiquitous technologies is not a given, and a facilitated process of enculturation is required to help learners achieve a state of self-directed seamless learning. Situations where students move between formal and informal spaces may present additional challenges (Wong, King, & Chai, 2006). Furthermore, as Rushby (2012) notes, learner agency is sometimes limited in respect to where and when a handheld device can be used. The learning design here can be critical, working to either allow students to adapt designs to their mobility profile or close down and enforce specific sequences of learning tasks or study behaviours.

To understand how learners are responding to the emerging mobile learning opportunities opening to them, it is critical to understand the patterns, relationships, and transformations in use of study places. On the one hand, it may be that location and distance are becoming less relevant to the learner (Ally & Prieto-Blazquez, 2014). This may be of even greater relevance to distance learners because they study both at a distance from their university and, when mobile, at a distance from their home study space. On the other hand, perhaps context is becoming more important as the situated learner intentionally leverages the context and uniqueness of a particular place (Walker, 2006). Within the concept of anywhere learning therefore, there is a latent tension in respect to the theorisation of place wherein it is becoming both more ubiquitous (less relevant) and more unique (more relevant). It is these changing patterns in course-related, formal learning with handheld devices that provide the focus of the three research questions examined by this study.

Method

Survey Instrument

The survey instrument used in this study represents the product of four years of iterative development and testing. In 2012, a university-sponsored programme of research into student use of handheld devices developed and piloted a version of the survey with a sample of 1,000 postgraduate students. Where practicable, questions were adapted from the ECAR survey in the US (Dahlstrom, de Boor, Grunwald, & Vockley, 2011), NetGen survey in the UK (Jones, Ramanau, Cross, & Healing, 2010), and USQ survey in Australia (Sankey, Tynan & McKeon, 2013). A total of 185 responses were received and analysed. Seven follow-up telephone interviews further probed student responses to the questions, verified the appropriateness of the language used in the question wording, and helped ensure content validity. A year later, the survey was iterated and sent to 3,000 undergraduate students; 525 responses were received (Cross, Sharples & Healing, 2015). A further iteration of the survey was administered to a sample of postgraduates and undergraduates in 2014 and received 754 responses. After each survey, questions that were judged by a panel of three experts to give poor validity or low discrimination across the response range were either removed or revised and re-tested. In addition, each survey instrument was reviewed by the university's Student Research Projects expert panel. Regular review of relevant literature helped identify necessary minor additions or revisions to question wording in response to changes in technologies, teaching approaches, and virtual learning environment (VLE) functionality.

This paper reports data from undergraduate students who were sent the 2016 iteration of the survey (Cross, Sharples & Healing, 2016). This included questions about: (a) ownership of technologies; (b) frequency of use of handheld devices (tablet, e-readers, and smartphones) for specified leisure activities and for specified learning activities; (c) locations at which each device is used for study purposes; (d) perceived change in study habits; (e) statements about impact of use on learning; (f) reason for purchase; (g) length of time used; (h) benefits and challenges; and (i) preferences for future use of each technology for learning. Open comment questions were added to probe the types of learning used in distance learning contexts, reasons for use or non-use, and the locations of use. Students were asked separately about their use of tablets, smartphones, and e-readers so potential differences in use could be analysed. Students were contacted by email in April 2016 and sent a reminder a few weeks later.

Three key constructs used in this paper relate to the number of study tasks, the study locations used, and whether or not students perceived their study habits to have changed. To ensure the survey instrument adequately captured these data, respondents in all three surveys were given the opportunity to write in what other types of study tasks they performed, what other study locations they used (in addition to those specifically asked in the survey), and about the extent and nature of changes to their study habits. Along with two further open comment questions, these data were interrogated and triangulated to ensure the three questions did not fail to capture a representative range of study tasks and locations. Responses to the binary (yes-no) question about change in study habits were also compared to the follow-up open comment question that invited respondents to describe the nature of the change, or lack of it.

The focus of this paper is on the quantitative data collected by the survey. Details of the specific questions analysed are described in the Results section. Open comment data was also reviewed during the initial phase of analysis but will be analysed in detail elsewhere.

Sampling and Responses

A stratified sample of 3,000 undergraduate distance learners at the OU in 2016 were invited to answer an online questionnaire survey about their use of mobile handheld devices for learning. The sample was selected to ensure proportionate representation in respect to gender, subject of study, study level, and age. There were 446 responses giving a response rate of 14.9%. This compares favourably to similar surveys such as the 7% response rate for the US-based ECAR survey (Brooks, 2016) and 10.3–13.2% response rate for the Pew Research telephone survey (Rainie & Smith, 2013).

All age categories were well represented in the 2016 survey responses. 19.3% of respondents were 25 or under, 15.5% were 26–35 years old, 26.2% were 36–45, 17.7% were 46–55, and 21.3% were 56 or older. There was also good representation from learners studying first-, second-, and third-year level modules (26.9%, 35.2%, and 37.9%, respectively) and across disciplines: (a) 39.0% of respondents were from Arts, Humanities, and Social Sciences; (b) 37.9% from Mathematics, Science, or Technology; (c) 16.6% from Education, Health, and Languages; and (d) the remaining 6.6% from Business and Law. Students from each UK region served by the university were included. 61.4% were female and 38.6% were male.

Overall, the responses received are considered broadly representative of those contacted, apart from a slight over-representation in responses from older age groups. The response demographic is similar to that of earlier versions of the survey. The dataset was anonymised and loaded into SPSS for cleaning and analysis.

Results

RQ1. Patterns of Handheld Device Use for Study- and Non-Study Related Tasks

This section examines patterns of use of handheld devices by distance learners in the UK. In 2016, the majority of distance learners who responded had access to smartphones, tablet computers, and laptop computers (see Table 1). Access to tablet and smartphone devices was highest among the 26–35 years old age group and lowest among those over 56 years old. In respect to e-readers, the pattern is reversed with highest access among those over 56 years old and lowest among those under 25 years old. Results show that OU student access of tablets in 2016 is similar to that found in the US ECAR survey (57% ownership) (Brooks, 2016) but is higher than the 41% reported for the UK higher education sector by Newman and Beetham (2017).

Table 1

Undergraduate Access to Technology

	Age					Gender	
	Under 25	26–35	36–45	46–55	56 and over	Male	Female
Desktop computer	26%	43%	47%	42%	51%	52%	36%
Laptop	71%	68%	71%	73%	73%	66%	71%
Smartphone	86%	90%	85%	70%	64%	76%	73%
Tablet computer	53%	68%	59%	63%	57%	60%	58%
e-Reader	22%	23%	23%	27%	35%	25%	25%

Students were asked in which of seven location categories they had used their smartphone, tablet, and e-reader for study purposes in the last year. The item labels were: (a) home study room or other quiet room at home; (b) living room or other communal room at home, (c) at a workplace; (d) whilst travelling (e.g., by public or private transport) or walking; (e) café/pub/restaurant; (f) library; and (g) on holiday. For the purposes of this study these *study places* are described as: home private, home public, workplace, travelling, public communal, public quiet, and on holiday. Previous research tended to focus on a more limited range of locations (e.g., Wong, King, Chai, & Liu, 2016) so student responses to previous studies were important to category definition. Open comments in these surveys showed that students perceived a distinction between use in private and communal home spaces, and that many regarded holiday place as a distinct study place—one associated with non-regular, different, or unfamiliar locations for the primary purpose of breaking routine for a limited duration of time. Question piloting (n=6) determined the seven place descriptions provided a good range of locations and caused no confusion.

Survey results show variations in the use of handheld devices for study-related purposes between study places (Figure 1). Tablets are the device most commonly used at home, smartphones are more commonly used whilst travelling and in public communal places, and the use of tablets and smartphones are similar when on holiday, at work, and in public quiet places.

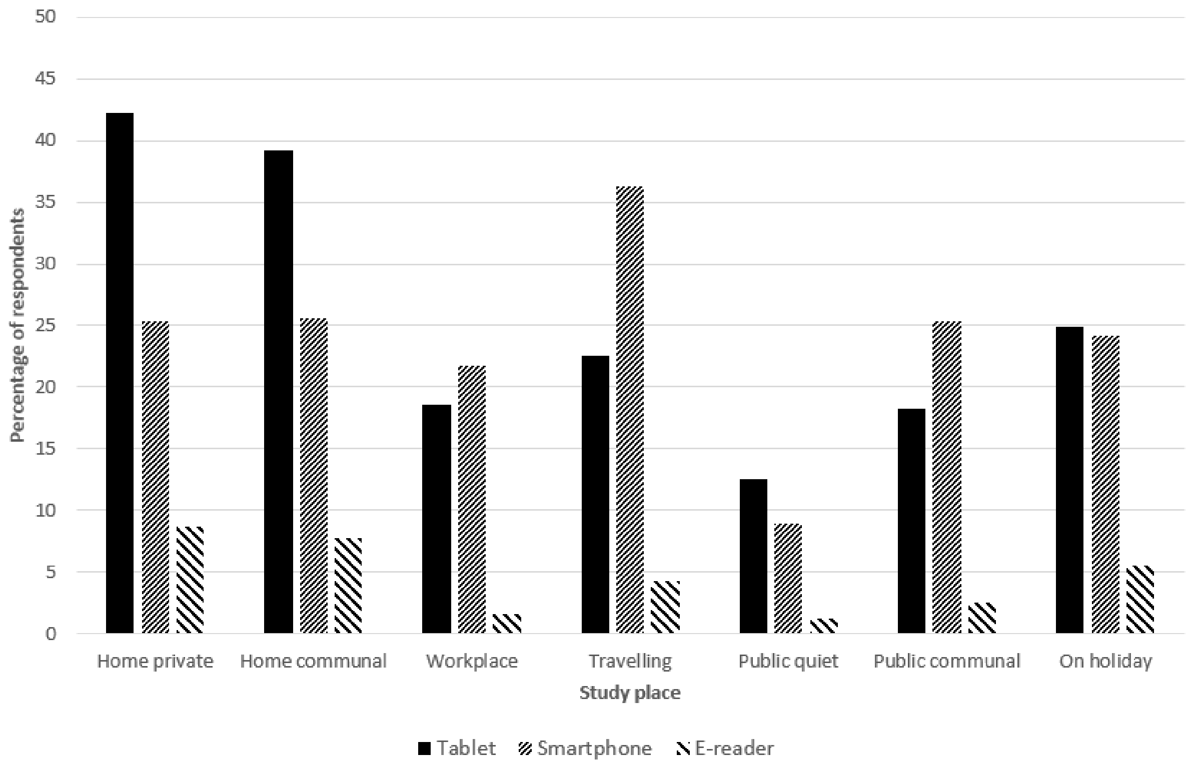

Figure 1. Student use of handheld devices in seven types of study place (*n*=446).

Of those students using a handheld device for studying, most use a single device in any one study place (Figure 2). Around 10–15% of students use two devices and 3–4% use all three (tablet, smartphone, and e-reader). Over half of all students (52.9%) used a handheld device for study-related purposes in home private spaces whilst just under half used at least one in a communal home place (49.8%) and whilst travelling (47.1%). Around the same proportion use handheld devices when on holiday and when at work.

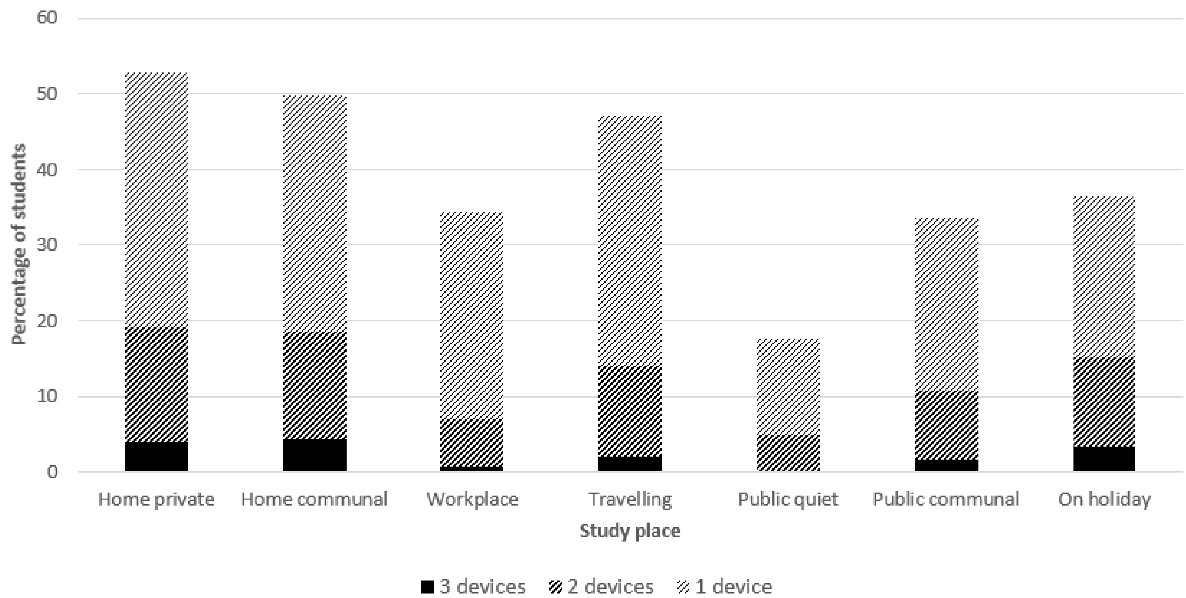

Figure 2. Percentage of handheld devices used (*n*=446).

Student use of handheld devices for 11 key study-related learning tasks is shown in Table 2. Nine of the 11 items map to learning activities described by other authors such as Wrigglesworth and Harvor (2017) and Al-Emran, Elsherif, and Shaalan (2016). The remaining two—use in assessment writing and exam revision—represent key stages of learning sometimes overlooked in other studies. These 11 items were mapped against a sub-set of the OU's learning activity categories (Conole, 2013) and represent a range of learning activity. Table 2 also reports the proportion of students using handheld devices to perform 12 non-study tasks—general or leisure tasks not directly related to study. These items were developed with reference to the ECAR survey (Brooks, 2016). Some study-related and non-study task items relate to similar types of activity such as reading digitally, using social media, or using video-conferencing technology.

Table 2

Proportion of Students Using Handheld Devices for Study-Related Learning Tasks and the Proportion Using Handheld Devices for Non-Study Tasks (n=446)

Type of learning activity	Study-related use of handheld devices		Non-study (i.e. general) use of handheld devices	
	Study-related task	%	Non-study task	%
Assimilative	(1) Reading module Materials	57.6	(1) Reading books	61.7
	(2) Watching module Materials	44.6	(2) Watching TV and film	59.4
	(3) Reading non-module study materials	52.0	(3) Listening to music or radio	69.3
	(4) Using social media	30.0	(4) Using social media	72.4
Communicative	(5) Using forums*	46.4	(5) Social networking	71.1
	(6) Online tutorial attendance**	16.1	(6) Video or audio calls	58.1
	(7) Using email	57.0		
Information handling	(8) Internet searching	37.4	(7) Reference	75.8
	(9) Revision for an Assessment	34.5	(8) News, sport and weather	81.4
			(9) Shopping or making bookings	74.9
Productive	(10) Notetaking	28.0	(10) Using productivity apps	59.2
	(11) Writing assessments	26.2		
			(11) Photography	78.5
Experiential	-		(12) Playing games online or offline	53.8

* Forums comprise a key social site for students to exchange views and network
** Online tutorials use synchronous video conferencing software

In 2016, over half of students were using handheld devices to read core study (module) materials, read other study-related materials, and email for study-related purposes (Table 2). Around a third used their device for exam revision, study-related Internet searching, and social media. Although the study-related and non-study tasks should not be considered equivalent, the data does appear to show that more students use their handheld devices for the latter (Table 2). For some types of tasks (e.g., reading digital content) the difference is slight, yet for other types of tasks (e.g., social media) the difference is greater.

RQ2. The Relationship Between Study-Related Learning Tasks and the Places Used for Study

The concept of flow between and across place is central to both Castells' conceptualisation of the space of flows and to that of anywhere and seamless learning. This provides the focus for RQ2. As described above, students were asked which of 11 types of learning tasks they performed on handheld devices whilst present in seven types of study place.

Four new variables were created from the survey data to help explore the relationship between what and where students are learning:

- Number of study places—indicates how many of the seven study places were used by the student to perform study-related learning tasks on a handheld device. This gives an indication of the geographic learning range of use on a scale of 0 to 7.
- Number of study tasks—indicates how many of 11 study-related learning tasks (see Table 2) were performed by the student using their handheld device. This gives an indication of the extent of learning taking place on handheld devices and has a scale of 0 to 11.
- Number of general tasks—indicates how many non-learning tasks (see Table 2) were performed by the student on a handheld device and has a scale of 0 to 12.
- Handhelds owned—indicates whether the student owned or had access to a tablet, smartphone, and/or e-reader. Measured on a scale of 1 to 3.

For students using handheld devices for learning (at least one learning task) (*n*=294), the relationships among study places, learning tasks, general tasks, and handhelds owned were investigated using Spearman Rho correlation coefficients. The results are shown in Table 3.

Table 3

Correlation Matrix for Students Using Handheld Devices for Learning (n=294)

		Correlations			
		1	2	3	4
(1)	Number of study places	1			
(2)	Number of study tasks	.472**	1		
(3)	Number of general tasks	.265**	.299**	1	
(4)	Handhelds owned	.131*	.037	.259**	1

*p < .05. **p < .01

A moderately strong statistically significant correlation of r_s=.472 was found between study places and study tasks (Table 3). The greater the number of study places a student learns in, the greater the variety of study-related learning tasks they undertake. This provides evidence for a strong correlation between the flow of use between places—the geographic mobility of students—and the range of their learning engagement via handheld devices.

The correlation between study places and general (non-study) tasks was also statistically significant, although weaker than that between study places and study tasks. The correlation between study tasks and general tasks was also of moderate significance. Whilst there was a statistically significant moderate correlation between handhelds owned and general tasks, the correlation between handhelds owned and study tasks was weak.

Ownership of specific handheld devices can vary by age and gender (e.g., Table 1; Chen, Seilhamer, Bennett, & Bauer, 2015) but does this impact on overall use for learning? A one-way ANOVA shows no significant effect for age groups in respect to number of study places ($F(4,394) = .876$, $p=.478$) or number of study tasks ($F(4,394) = .334$, $p=.855$). Independent-samples t-tests show no significant effect with respect to gender on number of study places ($t(397) = .952$, $p=.341$) or number of study tasks ($t(397) = -.482$, $p=.630$). These findings establish no significant variation in number of study places or study tasks with respect to age or gender.

The final table in this section reports the number of students using handheld devices to study in each of the seven places (Table 4). It also reports the percentage of students using a handheld in that place who used it for that study task. For example, 236 students used a handheld device in the private home space and of these 211, (89.4%) used it for reading course materials.

Table 4

Use of Handheld Devices for Study-Related Learning Tasks in Seven Study Places.

	Number of students using handheld devices to perform study-related tasks						
Study task	Home Private	Home Communal	Place of Work	Whilst Traveling	Public Communal	Public Private	On Holiday
(1) Reading module materials	211 (89.4%)	202 (91.0%)	143 (93.5%)	185 (88.1%)	139 (92.7%)	72 (91.1%)	146 (90.1%)
(2) Watching module materials	172 (72.9%)	163 (73.4%)	112 (73.2%)	146 (69.5%)	115 (76.7%)	63 (79.7%)	124 (76.5%)
(3) Reading non-module materials	195 (82.6%)	191 (86.0%)	131 (85.6%)	171 (81.4%)	132 (88.0%)	68 (86.1%)	137 (84.6%)
(4) Using social media	118 (50.0%)	113 (50.9%)	81 (52.9%)	100 (47.6%)	86 (57.3%)	48 (60.8%)	80 (49.4%)
(5) Using forums	174 (73.7%)	168 (75.7%)	119 (77.8%)	145 (69.0%)	114 (76.0%)	63 (79.7%)	116 (71.6%)
(6) Online tutorial attendance	63 (26.7%)	62 (27.9%)	50 (32.7%)	53 (25.2%)	49 (32.7%)	33 (41.8%)	47 (29.0%)
(7) Using email	205 (86.9%)	196 (88.3%)	136 (88.9%)	181 (85.2%)	135 (90.0%)	69 (87.3%)	141 (87.0%)

(8) Study-related Internet searching	145 (61.4%)	141 (63.5%)	97 (63.4%)	124 (59.0%)	105 (70.0%)	57 (72.5%)	103 (63.6%)
(9) Revision for assessment	138 (58.5%)	133 (59.9%)	91 (59.5%)	119 (56.7%)	99 (66.0%)	55 (69.6%)	105 (64.8%)
(10) Note-taking	113 (47.9%)	102 (45.9%)	77 (50.3%)	94 (44.8%)	81 (54.0%)	52 (43.7%)	83 (51.2%)
(11) Writing for assessment	107 (45.3%)	101 (45.5%)	74 (48.4%)	88 (41.9%)	75 (50.0%)	47 (59.5%)	113 (51.9%)
Total using device in study place	236	222	153	210	150	79	162

Note. Percentages expressed as a proportion of all students who used their devices (for whatever purpose) in that study space.

Comparison of the distributions of tasks performed in each study place shows a similarity in pattern across the seven places. A chi-square analysis shows that there is no statistically significant difference between the pattern of study task performed across the seven study places ($X^2(60) = 26.041$, $p<.01$).

RQ3. Changing Behaviours and Impacts on Learning

The final section of the analysis investigates whether use of handheld devices for study-related learning is having an impact on study habits, access to materials, and the quality of students' work.

Two in five students said that their study habits had changed since starting to use handheld devices for study-related learning tasks (40.0%, n=119). Table 5 shows the mean number of study places used by those who experienced a change in study habit and those who did not. Independent-samples t-tests were used to determine whether study behaviours differed between the student group reporting a change in study habits and the group that did not. Visual inspection of Q-Q plot confirmed the data distributions were acceptable for this test. Test results (Table 5) show a statistically significant difference with respect to both the number of study places used and number of study tasks performed. Students reporting a change in study habits used their devices to learn in more study places and for more types of study tasks than those reporting no change in habit.

Table 5

t-Test Results Comparing Students Reporting a Change in Study Habits and Those Who Did Not (n=297)

	No change in study habits		Changed study habits			
	M	*SD*	*M*	*SD*	t-test	*p*
Number of study places	3.57	2.01	4.85	1.72	5.70	<.001
Number of study tasks	5.47	3.31	7.53	2.82	5.57	<.001

Note. SD = standard deviation; M = mean.

Students were also asked whether using handheld devices for study had made it easier to access module materials and had improved the quality of their work. Whilst most students using handheld devices found it easier to access module materials, less than a third believed that such use had improved the quality of their work (Table 6).

Table 6

Student View About Impact of Handheld Device Use on Learning

	Definitely disagree (1)	Mostly disagree (2)	Neither agree nor disagree (3)	Mostly agree (4)	Definitely agree (5)	*M*	*SD*
(a) Using handheld devices made it easier for me to access module material	21 (7.3%)	24 (8.4%)	57 (19.9%)	79 (27.6%)	105 (36.7%)	3.78	1.23
(b) Using handheld devices has improved the quality of my work	34 (11.8%)	39 (13.6%)	130 (45.3%)	43 (15.0%)	41 (14.4%)	3.06	1.15

Note. SD = standard deviation.

Multiple regression analysis was used to determine whether the key variables used earlier in analysis were predictors of easier access to materials and improved quality of work. The results are shown in Table 7. The models predict 32.7% and 34.3% of the variance, respectively, and overall show a good fit to the model. Checks for collinearity and normal distribution of residuals were found to be satisfactory. Number of study tasks, number of study places, and a change in study habits are predictors in both models. The beta for age is negative, showing that younger students are more likely to report improved quality of their work than are older students.

Table 7

Summary of Regression Analysis (n=287)

	Easier to access module materials			Improved quality of work		
	B	*S.E. B*	*Beta*	*B*	*S.E. B*	*Beta*
Number of study tasks	.077	.021	.210**	.102	.023	.262**
Number of study places	.079	.034	.132*	.096	.036	.151**
Number of general tasks	.059	.030	.109*	.017	.031	.029
Change in study habits	.797	.120	.341**	.821	.127	.329**
Age	-.007	.004	-.085	-.010	.005	-.114*
Gender†	-.081	.117	-.034	.144	.124	.057
R^2		.327			.343	
F		24.189**			25.834**	

*p < .05. **p < .01.
†Gender coded: 1=Male, 2=Female

Discussion and Conclusion

This study has investigated where students study and how use of study places affects their mobile learning activity and habits. The research questions focus on aspects of anywhere learning—one of the two key terms in the concept of anytime-anywhere learning—such as how students move between places and translate the *potential* of anywhere into the practical somewhere. The dataset used comprises 446 responses from an online survey of undergraduate distance learners in the UK. Too narrow a focus on one group of learners can be problematic (Al-Emran, Elsherif, & Shaalan, 2017) so the sample included adult learners in all age groups and major discipline areas.

In respect to RQ1, it was found that by 2016, over half of learners were using handheld devices for study-related purposes. This represents a doubling in device use over three years since 2013 (Cross, Sharples & Healing, 2015). However, use for learning still appears to be less than use for leisure tasks.

Two key findings relate to RQ2. Firstly, the distribution or pattern of study-related tasks was similar amongst the seven study places investigated. For any of the 11 study tasks investigated, students do not appear to favour one type of study place over another. Of course, the learning achieved by performing any given task in different places may not be pedagogically equivalent (Wong, King, Chai, & Liu, 2016) and such patterns of use therefore require further qualitative study. Secondly, analysis confirms a strong and significant correlation between the number of study places used for handheld learning (what could be considered a student's geographic reach) and the number of different learning tasks performed on handheld devices (a measure of breadth of learning). As the number of study places increases, so too does the number of different learning tasks performed. These findings underscore the importance of helping students to maximise learning opportunity time; for example, by developing a learning design that can flex and allow mixing of learning tasks and technologies across locations.

The final research question (RQ3) explored the impact of handheld use on study habits and quality of learning. There were two key findings. Firstly, analysis shows that three variables—number of study places, number of study tasks performed, and change in study habits—are predicators of students finding it easier to access learning materials and reporting improved quality of work (r_s^2=.327 and r_s^2=.343, respectively). Students are more likely to notice a positive impact on their learning if they use handheld mobile devices in more locations and for a greater range of learning tasks. This finding seems consistent with observations from studies of campus-based students where approximately half said that using handheld devices helped them to find more time or save time (Gebb & Young, 2014; Rainie & Smith, 2013).

The second finding relating to RQ3 is that student experience of, and derived benefit from, using handheld devices for learning varies substantially. A majority of students said that handheld devices had made it easier to access study materials and 40% had experienced a change in study habits since starting to use handheld devices for study-related learning. However, this means that only a third of students felt that use of mobile handheld technologies had helped improve the quality of their work and 60% had yet to change their study habits. These data, therefore, illustrate how using mobile technologies to extend the geographic and temporal range of the potential learning space can mean a transformation in study habits for some whilst allowing others to maintain existing study behaviours. There may still be some way to go in ensuring all learners benefit from the mobile pedagogies deployed. Staff competency and skills (Dahlstrom et al., 2015) may be one limiting factor, as could student perceptions about the value and opportunities for use as well as decisions about when, or even if, they want to use handheld devices for learning. It is recommended that further qualitative investigation would help understand how students interpret the concepts of quality and habit in the context of mobile learning, and how positive perceptions that use benefits learning might map to student narratives relating to academic success (e.g., Brooks, 2016).

Taken together, these findings establish a link between the number of study places used for learning and the breadth of learning activity. In so doing, this study not only evidences a link between what Castells (1997) described as the space of place and the space of flows but also asks whether additional components need to be added to this concept of flow. Two additional concepts are proposed. The first is that the movement of learners between and through study locations could be viewed as a *flow of places*. This should look beyond the question of how the virtual and real are woven together (Traxler, 2010) and ask how learning flows between places, how students' perceptions of a place change once it becomes adopted as a learning place, and how such new perceptions materially transform that place. Certainly, for many learners, handheld devices have extended the range and reach of their physical study place, the opportunity time for learning, and potentially the range of digital learning activity.

The second concept relates to the constant negotiation students enter into in respect to the *place of space*—how they exert their agency as learners, and when and to what degree they grant this virtual place access to the real places in which they study. In particular, consider the subset of students who seldom, if at all, use handheld devices for study-related learning. It is this group for whom participation in Castells' space of flows is limited or even non-existent. Wriggleworth and Harvor (2017) argue that the level of engagement depends on student awareness of potential learning benefits and their disposition with respect to actively seeking out opportunities to learn with their mobile device. Further, anecdotal evidence from survey open comments shows many students are making conscious decisions to restrict or abstain from using handheld devices for learning. Whether justified or not, students are taking a view about the place that an online digital space should have in their learning.

This paper has explored relationships among learning activities, study habits, and the locations of learning. The two new concepts outlined above—the *flow of places* and *place of space*—provide further avenues for mobile learning research that complement those developed by Castells and the approach adopted by proponents of seamless learning. How do students negotiate emerging spatial opportunity—the place of space—in their digital and online learning? What are the patterns, dynamics, and disruptions in how students move between places? Do patterns vary between groups, such as those with disabilities? Understanding more about the use, and non-use, of handheld devices will help teachers and learning designers develop more effective and flexible pedagogies for the support of anywhere learning.

References

Al-Emran, M., Elsherif, H. M., & Shaalan, K. (2016). Investigating attitudes towards the use of mobile learning in higher education. *Computers in Human Behavior, 56*, 93–102.

Ally, M., & Prieto-Blazquez, J. (2014). What is the future of mobile learning in education? *International Journal of Educational Technology in Higher Education*, *11*(1), 142–151.

Attewell, J., & Savill-Smith, C. (2005). *Mobile learning anytime everywhere: A book of papers from mLearn 2004*. London: Learning and Skills Development Agency.

Awadhiya, A. K., & Miglani, A. (2016). Mobile learning: Challenges for teachers of Indian open universities. *Journal of Learning for Development*, *3*(2), 35–46.

Bozkurt, A., & Bozkaya, M. (2015). Evaluation criteria for interactive e-books for open and distance learning. *International Review of Research in Open and Distributed Learning*, *16*(5), 58–82.

Brooks, D. C. (2016). *ECAR study of undergraduate students and information technology, 2016*. Louisville, CO: ECAR.

Brown, T. H., & Mbati, L. S. (2015). Mobile learning: Moving past the myths and embracing the opportunities. *The International Review of Research in Open and Distributed Learning*, *16*(2), 115–135.

Castells, M. (1997). *The power of identity, the information age: Economy, society and culture* (Vol. II). Oxford, UK: Blackwell.

Chai, C. S., Wong, L. -H., & King, R. B. (2016). Surveying and modelling students' motivation and learning strategies for mobile-assisted seamless Chinese language learning. *Educational Technology and Society*, *19*(3), 170–180.

Chan, T-W., Roschelle, J., Hsi, S., Kinshuk, Sharples, M., Brown, T. ... Hoppe, U. (2006). One-to-one technology-enhanced learning: An opportunity for global research collaboration. *Research and Practice in Technology Enhanced Learning*, *1*(1), 3-29.

Chen, B., Seilhamer, R., Bennett, L., & Bauer, S. (2015, June 22). Students' mobile learning practices in higher education: A multi-year study. *Educause Review Online*. Retrieved from http://er.educause.edu/articles/2015/6/students-mobile-learning-practices-in-higher-education-a-multiyear-study

Cliatt, C. (2010, February 22). Kindle pilot results highlight possibilities for paper reduction. *News at Princeton*. Retrieved from https://www.princeton.edu/main/news/archive/S26/64/38E35/

Conole, G. (2013). *Designing for learning in an open world*. New York: Springer.

Cross S., Sharples, M., & Healing, G. (2015). e-pedagogy of handheld devices 2013 survey: Patterns of student use for learning. *IET Research and Innovation Report Series*, (ISSN: 2058-9867). Retrieved from http://proxima.iet.open.ac.uk/public/2015-01-RI-E-Pedagogy-of-handheld-devices-2013-survey.pdf

Cross, S., Sharples, M., & Healing, G. (2016). Learning with mobile devices: The changing place and space of distance learners' study. *Proceedings of EDULEARN 16: 8th International Conference on Education and New Learning Technologies* (pp. 5385–5393). Barcelona, Spain. *2016*. Retrieved from http://oro.open.ac.uk/46924/

Dahlstrom, E., de Boor, T., Grunwald, P., & Vockley, M. (2011). *ECAR national study of undergraduate students and information technology, 2011*. Boulder, CO: ECAR.

Dahlstrom, E., Brooks, D. C., Grajek, S., & Reeves, J. (2015). *ECAR study of undergraduate students and information technology, 2015*. Louisville, CO: ECAR.

Demsey, L. (2008). Always on: Libraries in a world of permanent connectivity. In G. Needham & M. Ally (Eds.), *M-libraries: Libraries on the move to provide virtual access* (pp.xxv–lii). London, UK: Facet Publishing.

Gebb, B. A., & Young, Z. (2014). Mobile resource use in a distance learning population: What are they really doing on those devices? *Journal of Library and Information Services in Distance Learning*, *8*(3-4), 288–300.

Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones and social media. *Internet and Higher Education, 19*, 18–26.

Glassman, M., & Burbidge, J. (2014). The dialectical relationship between place and space in education: How the Internet is changing our perceptions of teaching and learning. *Educational Theory*, *64*(1), 15–32.

Jamali, H. R., Nicholas, D., & Rowlands, I. (2009). Scholarly e-books: The views of 16,000 academics: Results from the JISC National e-Book Observatory. *Aslib Proceedings*, *6*(1), 33–47.

Jones, C., Ramanau, R., Cross, S., & Healing, G. (2010). Net generation or digital natives: Is there a distinct new generation entering university? *Computers & Education*, *54*(3), 722–732.

Krull, G., & Duart, J. M. (2017). Research trends in mobile learning in higher education: A systematic review of articles (2011–2015). *International Review of Research in Open and Distributed Learning*, *18*(7), 1–23.

Lam, P., Wong, K., Cheng, R., Ho, E., & Yuen, S. (2011). Changes in students' mobile learning readiness: Comparison of survey data collected over a nine-month period. In S. Barton, J. Hedberg, & K. Suzuki, (Eds), *Proceedings of global learn 2011* (pp. 180-189). Association for the Advancement of Computing in Education (AACE). Melbourne, Australia.

Lowenthal, J. N. (2010). Using mobile learning: determinates impacting behavioral intention. *American Journal of Distance Education*, *24*(4), 195–206.

Margolin, S., Driscoll, C., Toland, M., & Kegler, J. (2013). e-Readers, computer screens, or paper: Does reading comprehension change across media platforms? *Applied Cognitive Psychology, 27*, 512–519.

Martin, A., & Madigan, D., (2006). *Digital literacies for learning*. London: Facet.

McGraw-Hill Education (2016). *McGraw-Hill Education 2016 digital study trends survey*. Retrieved from https://www.slideshare.net/McGrawHillEducation/2016-digital-study-trends-survey

Newman, T., & Beetham, H. (2017). *Student digital experience tracker: The voice of 22,000 UK learners*. Bristol, UK: JISC.

Nikou, S. A., & Economides, A. A. (2017). Mobile-based assessment: Investigating the factors that influence behavioural intention to use. *Computers & Education*, *109*, 56–73.

Rainie, L. & Smith, A. (2013). *Tablet and e-reader ownership update*. Pew Research Center's Internet & American Life Project, Washington D.C. Retrieved from http://pewinternet.org/Reports/2013/Tablets-and-ereaders.aspx

Rushby, N. (2012). Editorial: An agenda for mobile learning. *British Journal of Educational Technology*, *43*(3), 355–356.

Sanky, M., Tynan, B., & McKeon, C. (2013). *Findings from the USQ students' experiences and expectations of technologies survey 2012*. Toowoomba, Australia: University of Southern Queensland. Retrieved from http://eprints.usq.edu.au/25922

Selwyn, N. (2016). Digital downsides: eExploring university students' negative engagements with digital technology. *Teaching in Higher Education*, *21*(8), 1006–1021.

Sharples, M. (2015). Seamless learning despite context. In L. -H. Wong, M. Milrad, & M. Specht (Eds.), *Seamless Learning in the Age of Mobile Connectivity* (pp. 41–55). Singapore: Springer.

Traxler, J. (2007). Defining, discussing, and evaluating mobile learning: The moving finger writes and having writ. *The International Review of Research in Open and Distance Learning*, *8*(2), 1–12.

Traxler, J. (2010). Distance education and mobile learning: Catching up, taking stock. *Distance Education*, *31*(2), 129–138.

Universities UK. (2016). *Patterns and trends in UK higher education* 2016 (interim update). Retrieved from www.universitiesuk.ac.uk/facts-and-stats/data-and-analysis/Documents/patterns-and-trends-2016.pdf

Vavoula, G., & Sharples, M. (2009). Meeting the challenges in evaluating mobile learning: A 3-level evaluation framework. *International Journal of Mobile and Blended Learning*, *1*(2), 54–75.

Walker, K. (2006). Introduction: Mapping the landscape of mobile learning. In M. Sharples (Ed.), *Big issues in mobile learning: Report of a workshop by the kaleidoscope network of excellence mobile learning initiative* (pp. 3–4). Nottingham, UK: Learning Sciences Research Institute.

Wingkvist, A., & Ericsson, M. (2009). Current practice in mobile learning: A survey of research method and purpose. In D. A. Metcalf, A. Hamilton, & C. Graffeo, C. (Eds.), *MLearn 2009: 8th world conference on mobile and contextual learning* (pp. 103–111). Orlando, FL: The University of Central Florida.

Wong, L. -H., King, R. B., & Chai, C. S., (2016). Surveying and modelling students' motivation and learning strategies for mobile-assisted seamless Chinese language learning. *Educational Technology & Society, 19*(3), 170-180.

Wong, L. -H., King, R. B., Chai, C. S., & Liu, M. (2016). Seamlessly learning Chinese: Contextual meaning making and vocabulary growth in a seamless Chinese as a second language learning environment. *Instructional Science, 44,* 399–422.

Wong, L. -H., & Looi, C. -K. (2012). Enculturing self-directed seamless learners: Towards a facilitated seamless learning process framework mediated by mobile technology. *Proceedings of 2012 IEEE Seventh International Conference on Wireless, Mobile and Ubiquitous Technology in Education* (pp. 1–8). Takamatsu, Kagawa Japan.

Wong, L. -H., Milrad, M., & Specht, M. (2015). *Seamless learning in the age of mobile connectivity*. Singapore: Springer.

Wrigglesworth, J., & Harvor, F. (2017). Making their own landscape: Smartphones and student designed language learning environments. *Computer Assisted Language Learning, 31*(4), 437–458.

Wu, W. -H., Wu, Y. -C. J., Chen, C. -Y., Kao, H. -Y., Lin, C-H., & Huang, S. H. (2012). Review of trends from mobile learning studies: A meta-analysis. *Computers and Education, 59*(2), 817–827.

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Mobile Technology: A Tool to Increase Global Competency Among Higher Education Students

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Abstract

The advancement of mobile communication technology has contributed to an increasingly interconnected world; however, these devices are not being used as effectively as they could be to improve global challenges. One challenging issue is the lack of preparation college graduates receive to positively contribute to the needs of an interdependent global society. Organizations such as the United Nations Educational Scientific and Cultural Organization (UNESCO), the Association of International Educators (NAFSA), and the Organization for Economic Cooperation and Development (OECD) have recently declared the critical need for the rising generation to strengthen their global competence, the capacity to examine societal issues, and work alongside those of various backgrounds to make a change. School instructors are crucial to preparing students to thrive in multicultural societies and address present day issues. With a staggeringly high rate of cellular device ownership among college students, mobile devices could be optimally positioned as a multi-functional tool ready to assist students in gaining these skills. This paper proposes that, while mobile devices may have contributed to a growing need for globally competent individuals, they can also be used to expand these capacities within university students. The PISA global competency framework developed by the OECD is used to propose how instructors can use mobile technology and research grounded practices to strengthen global competence in students.

Keywords: global education, global competency, mobile learning, mobile technology, mobile devices, higher education

Introduction

A glimpse at the status of mobile devices in higher education indicates that a high rate of university students possesses these devices (Krull & Duart, 2017). The advancement of new communication technologies has contributed to a growing interconnectedness and interdependence across the globe (Li, 2013; Poushter, 2016). Handheld mobile technologies may provide anytime and anywhere educational opportunities through a variety of functions (Crompton, 2013); however, as the United Nations Educational, Scientific, and Cultural Organization (UNESCO) declared, mobile devices are not being used as effectively as they could be to improve global issues in education (West, M., 2012).

One current educational concern is the lack of preparation graduating students receive to thrive in an interdependent world. Unpredictable economies, digital advancements, diverse societies, migration, and multicultural work environments demand a graduate with greater capacity to take action (Boix Mansilla & Jackson, 2013). Many people are not prepared to address societal issues in an interconnected world where hate speech, extremist ideas, and perceived misunderstandings are becoming more common (Barrett, Byram, Lazar, Mompoint-Gaillard, & Philippou, 2013). There is great need for students who are more prepared to investigate matters of global significance, understand others perspectives, and live in multicultural societies (Asia Society/OECD, 2018).

Consequently, it is of high importance that educators develop their students' global competence, or "the capacity and disposition to understand and act on issues of global significance" (Boix Mansilla & Jackson, 2013, p. 2). The Council of Europe shared that an "ability to understand and communicate with each other across all kinds of cultural divisions is a fundamental prerequisite for making such societies work" (Barrett et al., 2013, p. 2). Instructors can achieve global competence through practical approaches and innovative strategies using digital technologies (Li, 2013). Due to the high rate of mobile ownership among university students and their lack of global competence, these multifunctional devices are well situated to help instructors with these challenges. Successful use of mobile technology in higher education requires instructors who design learning experiences that harness the affordances of mobile devices (Krull & Duart, 2017). Therefore, the purpose of this paper is to describe how mobile devices are uniquely positioned to nurture global competence and give practical implications for instructors looking to expand these capacities within their university students.

Literature Review

Mobile Communication Technologies

Today's interdependent global society is dominated by information communication technologies that facilitate the exchange of ideas and information instantaneously from any location (Suárez-Orozco & Sattin, 2007). Evolving world technologies now surpass over 1.2 billion personal computers, 1.6 billion television sets, and 3.9 billion radio receivers (Ahonen, 2011). Nonetheless, mobile phones exceed all technologies with a network covering 95% of the global population (International Telecommunication Union, 2016) and a staggering seven billion subscriptions (ITU Key Indicators, 2017). College-age students headline mobile phone ownership levels globally (Brooks, 2016), with some countries such as the United States approximating 100% (Adams Becker et al., 2017; Pew Research Center, 2018).

Mobile technology yields vast opportunities for university students to culturally engage with entertainment, news, and music or to interact with others through text, social media, and email (Roberts, Yaya, & Manolis, 2014). As a result of these interactions, research focused on the integration of mobile technology in higher education has amplified over the last decade (Hwang & Tsai, 2011; Wu et al., 2012). However, with a worldwide view of education, UNESCO asserts that mobile devices, as the most ubiquitous information and communication technology, are not being used as effectively as they could be to improve global challenges and assist in education across the globe (West, M., 2012).

A Global Issue

One preeminent global problem faced by university-age students today is the lack of preparation they receive for the international challenges that lie ahead of them both as citizens and professionals (Chickering & Braskamp, 2009). The rapidly advancing wave of globalization and global interdependence calls for a rise in the number of students who can recognize global issues and simultaneously engage in effective problem solving in everyday life (Boix Mansilla & Jackson, 2011). These worldwide issues commonly surround environment, development, intercultural relations, peace, economics, technology, or human rights and further emphasize a need for those who are globally educated in interdependence, connections, and multiple perspectives (Hicks, 2003).

Foremost, educational associations such as the Center for Global Education at Asia Society, Organization for Economic Cooperation and Development (OECD), Association of International Educators (NAFSA), and the United Nations (UN) have detailed that establishing global competence in students is critical to live and succeed in today's global economy and multicultural societies (Asia Society/OECD, 2018; West, C., 2012). Global competence can be defined in multiple ways, but is often regarded as:

> The capacity to examine local, global, and intercultural issues; to understand and appreciate the perspectives and world views of others; to engage in open, appropriate and effective interactions with people from different cultures; and to act for collective well-being and sustainable development (Asia Society/OECD, 2018, p. 5).

The vital need for these competency skills is confirmed by the latest development of the OECD Program for International Student Assessment (PISA), a global competency framework that assesses these capacities in young people, implemented for the first time beginning in 2018 (Organization for Economic Cooperation and Development, 2018). It is clear that as schools instruct the rising generation on these skills students will be more apt to thrive in local, national, and global civic life (Asia Society/OECD, 2018).

The Role of Instructors

The Association for International Educators affirmed that global competence in students begins with instructors who must learn about existing technologies and how they might be used to enhance international partnerships or cross-cultural learning (West, C., 2012). Furthermore, the Asia Society confirmed that the average instructor can foster global competence in their students by helping them learn how to use present-day technologies (Asia Society/OECD, 2018). It is in part by employing the use of new media technologies as learning tools that teachers can effectively bridge gaps between theory and application and enhance cultural responsiveness and competency (Ntuli, & Nyarambi, 2018). Sussmuth (2007) shared that students need to strengthen their digital skills in order to help them "communicate and gather information from beyond their immediate environment and help them integrate into a global society" (p 204). Therefore, instructors can create a classroom environment with a global vision and culture that expand student experiences through the employment of technology (West, C., 2012). University instructors can use currently available digital technologies to develop these capacities in their students.

Purpose of Paper

Due to the high percentage of mobile ownership among college students and their lack of global competency, mobile technologies are uniquely positioned to enlarge these capacities within students. The multifunctionality of mobile devices could prove to be beneficial to university instructors, regardless of discipline, in preparing their students to thrive in today's diverse societies. Current research literature surrounding mobile technology integration describes numerous successful strategies to transform learning in higher education settings.

Therefore, the purpose of this paper is to address how university instructors can use mobile technology to improve global competence in their students. The adopted OECD four-part framework for establishing global competence is first described. Next, foundational principles for the four parts are discussed in greater detail with practical implications drawn from current mobile learning research provided for university instructors.

Global Competence Framework

In response to the growing need for students who can address global issues, the OECD proposed the 2018 PISA global competence framework (Asia Society/OECD, 2018). The principles in the PISA framework draw upon years of previous research and a variety of successful frameworks. For example, in 2011 the Council of Chief State School Officers (CCSSO) and the Asia Society commissioned a taskforce to define global competence complex skills. This taskforce, made up of numerous educational scholars, worked to build upon foundational research principles and best practices from numerous scholars such as Hanvey and Reimers (Boix Mansilla & Jackson, 2013). A seminal work by Robert Hanvey (1982) addressed the need for educators to promote the development of planet and cultural awareness. He added that as students increase in their knowledge of others and global dynamics they would develop a global perspective. Reimers (2009) shared that global competence is imperative in that it prepares students to "understand the nature of shared planetary challenges" (p. A29). Overall, this taskforce developed a framework that would help students increase in their "capacity and disposition to act on issues of global significance" (Boix Mansilla & Jackson, 2011, p. xiii). The OECD, recognizing the value of all these principles and previous frameworks, collaboratively constructed an updated framework similarly outlining critical components of global competence. Overall, the PISA framework for global competence draws upon the research of organizations such as UNESCO, Project Zero at Harvard University, the Asia Society, and CCSSO.

The purpose of the PISA framework is to assist in explaining, implementing, and assessing global competence in young people around the globe (Razavi, 2017). The OECD states that global competence includes combining and applying the foundational elements of students' values, knowledge, skills, and attitudes (Asia Society/OECD, 2018). They further explain that mixing these elements helps young people work with those of differing cultural backgrounds on global issues that can have a serious impact upon the future. The core of the framework is comprised of four dimensions, which when implemented properly, can provide structure for instructors looking to facilitate global competence in their students. The OECD (2018) proposed that global competence is the capacity and disposition to do the following:

- Examine issues of local, global, and cultural significance such as poverty, environmental risk, and conflict.
- Understand and appreciate the perspectives and world views of others.
- Engage in open, appropriate, and effective interactions with others across cultures.
- Take action for collective well-being and sustainable development.

Though these four skills appear to be independent they depend highly upon each other as building blocks in the construction of global competence (Boix Mansilla & Jackson, 2011). Each division of the PISA framework will now be described in greater detail. Following each description will be an explanation of how university instructors can use mobile technologies to support the development of global competence based on current research practices in higher education.

Examining Issues

University students today can benefit by developing the skills to comprehend and appreciate the world outside their own immediate setting (Boix Mansilla & Jackson, 2011). These higher-order thinking skills include effectively weighing evidence on global developments, analyzing information on current events, and arguing a position (Asia Society/OECD, 2018). Students need opportunities to embark on an external investigation of matters beyond their typical classroom environment. They must have learning environments that can facilitate inquiry and encourage them to develop persuasive arguments about issues of the day. As they tackle questions about the world, they will be more prepared for jobs that require them to work and communicate with those of differing perspectives (Boix Mansilla & Jackson, 2013). Students working to understanding global issues also develop a state of the planet awareness where they can actively seek to comprehend prevailing conditions, developments, trends, and problems that are faced worldwide (Burnouf, 2004). Effective pedagogical practices should allow for student discovery and creativity (Cochran & Narayan, 2017) as they use their devices to learn more about global challenges wherever they are. Instructors can provide practical opportunities for students to investigate the world with mobile devices through the use of Internet search engines, synchronous or asynchronous communications, digital books, and news applications.

The Internet

Increasing access to the Internet continues to be a highlight of advancing technologies across the globe.

With the goal of enabling economic and social development and fostering an inclusive global digital economy, the International Telecommunications Union recently published that now over 70% of the world's youth between ages 15-24 have Internet access, with mobile broadband subscriptions growing more than 20% annually the last five years (International Telecommunication Union, 2017). College students believe that the ubiquitous access to Internet information mobile technologies provide is a primary advantage of the device (Gikas & Grant, 2013). Anytime access to databases with audio, video, and text information allow examination of the world beyond classroom walls. Internet access through mobile devices unlocks the opportunities for student-generated content and student-directed projects (Cochran & Narayan, 2017) while they seek to investigate problems in the world. However, teachers must help students critically evaluate the material they encounter because of the vast amounts of information accessible (Buckingham, 2007).

Synchronous and Asynchronous Communications

New communication tools such videoconferencing at any location improve international collaboration and create unprecedented opportunities to examine issues of global significance with others around the globe (Boix Mansilla & Jackson, 2011). Instructors can adopt the use of synchronous and asynchronous communications allowing students to interact immediately with contacts across the globe. Information exchange occurs across borders through video, audio, and text mediums. For instance, students learning Chinese could interact directly with native speaking individuals in China. Mobile devices improve universal access to inexpensive applications such as Skype, Facebook Chat, WebEx, WeChat, WhatsApp, or learning management systems. One worldwide online master's program in development management used a learning management system to facilitate online synchronous and asynchronous collaboration between students in various countries as a core element of a course on global education (Rye & Stokken, 2012). Other areas once isolated are now reachable (Valk, Rashid, & Elder, 2010) and may yield critical insights from those experiencing firsthand global challenges such as human rights, economic development, or poverty. Students could gain greater perspective on global and intercultural issues as they hear personal experiences of those outside the classroom.

Digital Books

Some believe the mobile device may replace the textbook as the learning tool of choice for the future (Yu, Ally, & Tsinakos, 2018). Instructors can use electronic textbooks as an inexpensive and practical way to provide improved global access to information for students in both developing and developed areas (West & Chew, 2014). Mobile devices give students the advantage of a having a digital textbook that can conveniently be taken with them anywhere they go, making better use of time in accessing course materials (Nie, Bird, & Edirishingha, 2013). An example from research in Austria found that mobile encyclopedias can be effective at helping students learn new concepts when the application suggest articles and information about nearby topics based upon GPS positioning of the phone (Yu, Ally, & Tsinakos, 2018). Simple features such as an encyclopedia article sent to a student's phone could help the student develop an inclination to examine their surroundings wherever they are located.

Instructor provided access to literature about differing cultures, countries, and current events could expand student views and awareness with problems faced worldwide. Currently, hundreds of thousands of people in areas such as Ethiopia, Nigeria, and Pakistan are now reading on mobile devices (West & Chew, 2014).

South Korea recognized the power of flexible and inexpensive access and launched a nationwide movement for schools to provide digital textbooks tailored to students' needs (West, M., 2012). As students use mobile devices to increase their knowledge base via international and multicultural sources, they may ask more informed questions and create coherent responses that could answer issues prevalent to the global society.

News Applications

Instructors could also look to global news options and trusted social media sites to provide reliable information on the most current global trends and issues. In a developed country such as the United States, 70% of those aged between 18-29 prefer to, or only use, mobile devices to access the news (Mitchell, Gottfried, Barthel, & Shearer, 2016). Another study in developing Serbia found that over 60% of college students preferred a smartphone for staying informed about current events (Vulić & Mitrović, 2015). A worldwide network of information accessible through personal mobile devices gives students the chance for constant awareness of global issues, trends, and challenges in greater speed than previously possible. However, media is an area where caution needs to be exercised with forming global perspectives (Burnouf, 2004). With access to almost unlimited information on the Internet, students need to develop information literacy skills that will help them discern between truth and error when investigating various sources (Yarmey, 2011). When students engage these global topics with sophistication, they will be more competent and prepared to succeed in college, professional life, and civil society (Boix Mansilla & Jackson, 2011).

Understanding Perspectives

Globally competent students must be taught to look upon issues from different perspectives and encouraged to appreciate the beliefs and customs of others that are dissimilar from their own (Burnouf, 2004; Chickering & Braskamp, 2009). Boix Mansilla and Jackson (2011) state that the ability to recognize the perspectives of others is not an optional skill for students to learn in the 21st century because they will encounter those of differing beliefs in multi-cultural work environments, academic studies, or personal relationships. Students need to develop a "perspective consciousness" where they realize their outlook is not universally shared and the ideas of others are fundamentally different (Hanvey, 1982). Chickering and Braskamp (2009) summarized this principle stating that there needs to be an "understanding persons who differ widely in their political, religious, and spiritual orientations; in privilege and social class; and in ethnicity and national origin" (p. 28). As students reflect upon those elements that have influenced their own perspectives, it will give them deeper respect for the different positions or beliefs of others (Asia Society/OECD, 2018). Mobile programs that encourage student interaction, collaboration, and reflection can broaden mutual understanding. Instructors can facilitate an expanded student perspective by using mobile polling applications, reflection tools, and collaborative tools.

Polling Applications

Polling programs allow instructors to propose specific prompts and for students to anonymously submit their thoughts from a mobile phone. An application such as PollEverywhere could be used to facilitate discussion on difficult issues. Some researchers have found that using PollEverywhere to create discussion with mobile devices was effective for increasing student engagement and interaction in undergraduate psychology courses (Walklet, Davis, Farrelly, & Muse, 2016). These tools provide a variety of discussion-based strategies including word clouds, open ended response, or priority ranking. Students can explain their perspectives without being judged for their response and then easily examine the perspectives of others. Instructors desiring to increase global competence may guide students in discussing how perceptions may have been influenced possibly by culture, technology, quality of life, or even access to knowledge.

Reflection Tools

Mobile devices can help the learner's ability to be more mindful and understanding of their own needs as well of those of others in a learning setting (Yu et al., 2018). Moreover, college students can benefit from and perform better with the inclusion of reflection activities that can be delivered through a mobile medium (Martin & Ertzberger, 2016). Reflective thinking encourages students to actively chain together their personal ideas with previous knowledge and beliefs (Hatton & Smith, 1994) and could be aided through digital journaling or having students write notes to themselves. Numerous educational applications that promote meditation could aid global competence by encouraging students to embark on the process of better coming to know oneself, one's emotions, and how they experience the world. Fisher and Baird (2006) share that reflection can be an individual or collective process involving technological tools such as blogs, wikis, Flickr, and other social media platforms. Reflective strategies allow students to ponder those elements that have influenced their views while also allowing them to contemplate the perspectives of others.

Collaborative Tools

A major advantage of mobile technology is the ability to increase the collaborative exchanges of ideas between university students (Gikas & Grant, 2013; James, 2011; Vázquez-Cano, 2014). This is primarily due to built-in collaborative tools such as email, text messaging, audio calls, or downloadable applications that can promote student-to-student conversations. Many countries in Asia are already taking advantage of mobile technology as a collaborative tool to communicate teacher-to-student or student-to-student (West, M., 2012). In Taiwan, researchers found mobile phones effective in implementing a voice-based discussion between students on a collaborative web forum (Wei, Chen, & Wang, 2007). Digital collaboration is not limited by time and place; therefore, students can practice interacting and appreciating viewpoints from others across national borders that may be much different than their own. Students who develop the digital skills needed to harness these instant collaborative mobile technologies may be able cultivate relationships across great distances and gain access to opportunities to improve global issues that may have been previously inaccessible.

Effective Communication

Human communication is at the center of teaching and learning experiences across the globe (Warren & Wakefield, 2013). Vast worldwide differences in culture, faith, ideology, and wealth call for globally competent students who understand how to proficiently use of emerging technologies that are vital elements of communicating ideas in today's societies (Boix Mansilla & Jackson, 2011, Boix Mansilla &

Jackson, 2013). Globally competent students “understand the cultural norms, interactive styles and degrees of formality of intercultural contexts, and can flexibly adapt their behavior and communication to suit” (Asia Society/OECD, 2018, p. 10). There is a constant need for students to think about how various audiences will perceive what they communicate and then use appropriate verbal or nonverbal strategies (Boix Mansilla & Jackson, 2013). Ultimately the ability to communicate openly across cultures and be mutually understood is vital to helping a society progress (Barrett et al., 2013). Communication is the primary purpose of mobile devices (Warren & Wakefield, 2013) and they are advantageous in improving communication skills and fostering a sense of interdependence between college students (Cinque, 2013). Instructors could facilitate respectful and open interactions among students through the practical use of social networking and distance learning tools.

Social Networking

Social networking is a determining factor for those university students who desire to use mobile technology in the classroom (Liaw & Huang, 2015) and could provide practice grounds for complex communication with others across the world. Communication methods for college students have changed over the years and presently focus on connecting with their peers through social media technologies such as Facebook, Twitter, Youtube, and blogs (Khaddage & Knezek, 2011). Topics on social media often surround current real-world issues, creating an environment where instructors can help students recognize the perspectives of others and productively engage in exchanges with diverse groups. Ozan and Kesim (2013) found that social media on mobile platforms create a major impact on the teaching and learning process because of their ability to “create an atmosphere in which individuals can learn from their peers about communication norms and cultures” (p. 174). Integrating mobile social media into a college classroom can strengthen student’s language skills, literacy, and intercultural competence (Yeh & Swinehart, 2018). Students must recognize how various audiences can perceive different meanings from the information they share and instructors can even initiate this thinking process beginning with the diversity in their own classroom (Boix Mansilla & Jackson, 2011).

Distance Learning

Mobile technology has consistently demonstrated its ability to extend educational opportunities into areas that once were not possible (Traxler, 2012). One university in Mozambique found mobile devices were easier, more flexible, and quicker at improving communication between rural students involved in distance learning (Isaacs, 2012). Lee and Chan (2007) found it effective and efficient to communicate ideas with distance learning students via podcasting on mobile technology. A study in Mauritius showed the usefulness of delivering a distance education MOOC with audio learning materials capable of communicating in the native language of different learners (Yu et al., 2018). The rise of online learning programs and even MOOCs often provide discussion areas where student exchanges with various audiences are not limited by national borders. De Waard (2013) emphasized that in a MOOC, students can access a variety of mobile enabled social-media tools that allow learners to learn, communicate, and exchange knowledge with people all over the world about a mutual topic of interest. Instructors who facilitate an environment that involves complex interaction with various cultures could provide a needed push for students to communicate at a higher level of sophistication with differing backgrounds.

Taking Action

Globally competent students seek to courageously make a difference in the world as they reflect upon multiple ways to improve situations and place these ideas into action, either individually or collaboratively. in real life settings (Boix Mansilla & Jackson, 2011). Students must courageously take steps to have their voices be heard as responsible members of society (Asia Society/OECD, 2018) and not hesitate to take initiative, work with others, and solve critical issues in a global society and their community (Boix Mansilla & Jackson, 2013). Instructors can improve a student's ability to make a difference in their community by incorporating authentic and active learning contexts into the classroom (Boix Mansilla & Jackson, 2011; Chickering & Braskamp, 2009). Educational programs can also help students to take global action by harnessing technologies that expand a student's opportunities to learn world languages (Boix Mansilla & Jackson, 2011). Instructors can bolster student's abilities to take action by harnessing the power of mobile technology to implement active learning, create authentic contexts, and support language learning.

Active Learning

Mobile technologies could be used to implement active learning strategies such as situated, inquiry-based, and case-based learning in order to prepare students to make a difference in the global society. Jarvis, Tate, Dickie, and Brown (2016) found that using mobile devices to deliver multi-media based on geographical location was effective for helping undergraduate geography students explore economic, cultural, and social life in Dublin, Ireland. In this setting, students developed their observation skills and were encouraged take action through active exploration of the city. Mobile assisted case-based learning effectively helped students synthesize, apply, and integrate knowledge in real-life situations (Taradi & Taradi, 2016). Problem-based strategies could assist students in assessing options and planning actions on global issues. This is illustrated by researchers who examined how a mobile assisted inquiry-based approach facilitated active learning (Leelamma & Indira, 2017). As a result, it was discovered that students better understood critical issues in the environment and vowed to make a difference by using their understanding to raise awareness in their community

Authentic Learning

Mobile technology can support authentic learning contexts where students can engage relevant and interesting real-world problems (Traxler, 2007). Authentic learning is possible because mobiles create a direct link between theory and practice (Cochrane & Narayan, 2017). Harley, Poitras, Jarrell, Duffy, and Lajoie (2016) stated that "a mobile phone can be used to augment one's learning about the world around them, creating new and countless potential opportunities for informal learning as well as guided learning that takes place outside of the classroom" (p. 360). The portability of mobile technology allows students to actively learn by working on task and activities authentic to the environment in which they could be used (Crompton, 2013). Mobile virtual reality, augmented reality, and digital games are examples of this principle. Mobile augmented reality also empowers real-world learning for students with different abilities in a larger global society (Tesolin, & Tsinakos, 2018). Some researchers effectively used a mobile application to allow students to document and take pictures of trees while learning outside in nature (Land & Zimmerman, 2015), while others used augmented reality to effectively instruct students about the context of past and present historical locations in the world around them (Harley et al., 2016). Mobile digital games can help students learn about intricate situations in dynamic environments by giving students opportunities role play (Yu et al., 2018). In these authentic settings, students can practice improving given scenarios or a real-world problem.

Language Learning

Instructors can help students become more prepared to take action by making use of technologies that facilitate language learning (Boix Mansilla & Jackson, 2011). Mobile devices supply numerous language learning applications and significantly impact college students in areas such as comprehension of vocabulary and grammar (Alkhezzi, 2016; Dange, 2018). One university in China found the popular social media WeChat to be highly effective at helping students learn English as a second language (Shi, Luo, & He, 2017). University students in Istanbul significantly improved communication skills and vocabulary by collaboratively practicing English using the mobile application WhatsApp (Avci & Adiguzel, 2016). Popular applications like Duolingo gamify the learning process and are effective with mentoring and modeling by instructors (García Botero & Questier, 2016). Students who explore languages other than their primary language are equipped with essential 21st century skills in an interdependent world.

Conclusion

Ownership of mobile devices among university students is high, nevertheless they are not being used as effectively as they could be to help solve challenges in education. Currently, a notable issue is the lack of preparation students receive on interacting with diverse cultures, ideas, and perspectives in an interconnected global society. The path to increasing these capabilities in students begins with instructors who can harness modern technologies. Instructors can take action to create a classroom environment where global competency is expanded through the use of readily available mobile devices.

More specifically, instructors can help students examine global issues through effective use of the Internet, synchronous and asynchronous communications, digital books, and news applications. A student's ability to understand diverse perspectives can be improved by integrating polling applications, reflection tools, and collaborative tools into course activities. The capacity to communicate effectively with others could be enhanced via social networking and distance learning opportunities. Lastly, instructors can help students take action to improve society by implementing active learning, authentic learning, and language learning approaches. If a goal of higher education is to prepare students to succeed in the world, then strengthening global competency should be a high priority.

References

Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C., & Ananthanarayanan, V. (2017). *NMC horizon report: 2017 higher education edition*. Austin, Texas: The New Media Consortium. Retrieved from http://cdn.nmc.org/media/2017-nmc-horizon-report-he-EN.pdf

Ahonen, T. (2011). All the numbers, all the facts on mobile the trillion-dollar industry. Why is Google saying put your best people on mobile? (Blog post). Retrieved from http://communities-dominate.blogs.com/brands/2011/02/all-the-numbers-all-the-facts-on-mobile-the-trillion-dollar-industry-why-is-google-saying-put-your-b.html

Alkhezzi, F. (2016). The impact of mobile learning on ESP learners' performance. *Journal of Educators Online. 13*(2), 1547–500. http://doi.org/10.9743/JEO.2016.2.4

Asia Society/OECD. (2018). *Teaching for global competence in a rapidly changing world*. New York: OECD Publishing. http://dx.doi.org/10.1787/9789264289024-en

Avci, H., & Adiguzel, T. (2016). A case study on mobile-blended collaborative learning in an English as a foreign language (EFL) context. *International Review of Research in Open and Distributed Learning*, *18*(7), 45–58. http://dx.doi.org/10.19173/irrodl.v18i7.3261

Barrett, M., Byram, M., Lazar, I., Mompoint-Gaillard, P., & Philippou, S. (2013). *Developing intercultural competence through education*. Strasbourg: Council of Europe Publishing. Retrieved from https://www.coe.int/t/dg4/education/pestalozzi/Source/Documentation/Pestalozzi3.pdf

Boix Mansilla, V., & Jackson, A. (2011). *Educating for global competency*. New York: Asia Society. Retrieved from http://asiasociety.org/files/book-globalcompetence.pdf

Boix Mansilla, V., & Jackson, A. (2013). Educating for global competence: Learning redefined for an interconnected world. In H. Jacobs (Ed.), *Mastering global literacy, contemporary perspectives* (pp. 1-24). New York: Solution Tree. Retrieved from http://www.pz.harvard.edu/sites/default/files/Educating for Global Competence Short HHJ.pdf

Brooks, D. C. (2016). *ECAR study of undergraduate students and information technology*. Louisville, CO: Educause Center for Analysis and Research. Retrieved from https://library.educause.edu/~/media/files/library/2016/10/ers1605.pdf

Buckingham, D. (2007). Digital media literacies: Rethinking media education in the age of the Internet. *Research in Comparative and International Education, 2*(1), pp.43-55. http://dx.doi.org/10.2304/rcie.2007.2.1.43

Burnouf, L. (2004). Global awareness and perspectives in global education. *Canadian Social Studies, 38*(3). Retrieved from www.quasar.ualberta.ca/css

Chickering, A., & Braskamp, L. A. (2009). Developing a global perspective for personal and social responsibility. *Peer Review*, *11*(4). Retrieved from https://www.aacu.org/peerreview/2009/fall/chickering-braskamp

Cinque, M. (2013). The "reflective student": The use of mobile devices through seamless educational spaces and authentic learning scenarios. In Z. L. Berge & L. Y. Muilenburg (Eds.), *The handbook of mobile learning* (pp. 209–223). New York: Routledge.

Cochrane, T., & Narayan, V. (2017). Design considerations for mobile learning. In C. M. Reigeluth, B. J. Beatty, & R. D. Myers (Eds.), *Instructional-design theories and models: The learner-centered paradigm of education* (pp. 385-413). New York, NY: Routledge.

Crompton, H. (2013). A historical overview of m-learning: Toward learner-centered education. In Z. L. Berge & L. Y. Muilenburg (Eds.), *The handbook of mobile learning* (pp. 3-14). New York: Routledge.

Dange, J. K. (2018). Mobile-assisted-learning approach in enhancing the student teacher's vocabulary and usage of mobile phone. In J. Keengwe (Ed.), *Handbook of research on mobile technology, constructivism, and meaningful learning* (pp. 316–330). Hershey: IGI Global.

De Waard, I. (2013). Analyzing the impact of mobile access on learner interactions in a MOOC (Unpublished master's thesis). Athabasca University, Alberta, Canada.

Fisher, M., & Baird, D. (2006). Making mLearning work: Utilizing mobile technology for active exploration, collaboration, assessment, and reflection in higher education. *Journal of Educational Technology Systems*, *35*(1), 3–30. http://doi.org/10.2190/4T10-RX04-113N-8858

García Botero, G., & Questier, F. (2016). What students think and what they actually do in a mobile assisted language learning context: new insights for self-directed language learning in higher education. In S. Papadima-Sophocleous, L. Bradley, & S. Thouësny (Eds), *CALL communities and culture – short papers from EUROCALL 2016* (pp. 150-154). https://doi.org/10.14705/rpnet.2016.eurocall2016.553

Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *Internet and Higher Education*, *19*, 18–26. http://doi.org/10.1016/j.iheduc.2013.06.002

Hanvey, R. G. (1982). An attainable global perspective. *Theory into Practice*, *21*(3), 162–167. http://doi.org/10.2753/JEI0021-3624440403

Harley, J. M., Poitras, E. G., Jarrell, A., Duffy, M. C., & Lajoie, S. P. (2016). Comparing virtual and location-based augmented reality mobile learning: emotions and learning outcomes. *Educational Technology Research and Development*, *64*(3), 359–388. http://doi.org/10.1007/s11423-015-9420-7

Hatton, N., & Smith, D. (1994). Reflection in teacher education: Towards definition and implementation.

Teaching and Teacher Education, *11*(1), 33–49. https://doi.org/10.1016/0742-051X(94)00012-U

Hicks, D. (2003). Thirty years of global education: A reminder of key principles and precedents. *Educational Review*, *55*(3), 265–275. http://doi.org/10.1080/0013191032000118929

Hwang, G. J., & Tsai, C. C. (2011). Research trends in mobile and ubiquitous learning: A review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, *42*(4), 65–70. http://doi.org/10.1111/j.1467-8535.2011.01183.x

International Telecommunication Union. (2016). ICT facts and figures. Retrieved from http://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx

International Telecommunication Union. (2017). ICT facts and figures. Retrieved from http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf

ITU Key Indicators. (2017). Retrieved from https://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2017/ITU_Key_2005-2017_ICT_data.xls

Isaacs, S. (2012). Mobile learning for teachers in Africa and the Middle East - Exploring the potential of mobile technologies to support teachers and improve practice. *UNESCO Working Paper Series on Mobile Learning*. Retrieved from http://unesdoc.unesco.org/images/0021/002163/216358E.pdf

James, P. T. J. (2011). Mobile-learning: Thai HE student perceptions and potential technological impacts. *International Education Studies*, *4*(2), 182–194. http://dx.doi.org/10.5539/ies.v4n2p182

Jarvis, C., Tate, N., Dickie, J., & Brown, G. (2016). Mobile learning in a human geography field course. *Journal of Geography*, *115*(2), 61–71. http://doi.org/10.1080/00221341.2015.1026373

Khaddage, F., & Knezek, G. (2011) Device independent mobile applications for teaching and learning: Challenges and barriers, and limitations. In S. Barton, J. Hedberg, & K. Suzuki (Eds.), *Proceedings of Global Learn Asia Pacific 2011—Global Conference on Learning and Technology* (pp. 1-7). Melbourne, Australia: Association for the Advancement of Computing in Education (AACE). Retrieved from https://www.learntechlib.org/primary/p/37143/

Krull, G., & Duart, J. M. (2017). Research trends in mobile learning in higher education: A systematic review of articles (2011 – 2015). *International Review of Research in Open and Distributed Learning*, *18*(7). http://dx.doi.org/10.19173/irrodl.v18i7.2893

Land, S. M., & Zimmerman, H. T. (2015). Socio-technical dimensions of an outdoor mobile learning environment: a three-phase design-based research investigation. *Educational Technology Research and Development*, *63*(2), 229–255. http://doi.org/10.1007/s11423-015-9369-6

Lee, M. J. W., & Chan, A. (2007). Pervasive, lifestyle-integrated mobile learning for distance learners: An analysis and unexpected results from a podcasting study. *Open Learning*, *22*(3), 201–218.

http://doi.org/10.1080/02680510701619810

Leelamma, S., & Indira, U. D. (2017). My pocket technology: Introducing a mobile assisted inquiry learning environment (MAILE) to promote inquiries among secondary students. *Journal of Education and Learning*, *6*(3), 107. http://doi.org/10.5539/jel.v6n3p107

Li, Y. (2013). Cultivating student global competence: A pilot experimental study. *Decision Sciences Journal of Innovative Education*, *11*(1). http://doi.org/10.1111/j.1540-4609.2012.00371.x

Liaw, S. S., & Huang, H. M. (2015). How factors of personal attitudes and learning environments affect gender difference toward mobile distance learning acceptance. *International Review of Research in Open and Distance Learning*, *16*(4), 104–132. http://doi.org/10.19173/irrodl.v16i4.2355

Martin, F., & Ertzberger, J. (2016). Effects of reflection type in the here and now mobile learning environment. *British Journal of Educational Technology*, *47*(5), 932–944. http://doi.org/10.1111/bjet.12327

Mitchell, A., Gottfried, J., Barthel, M., & Shearer, E. (2016, July 7). The modern news consumer. *The Pew Research Center*. Retrieved from http://assets.pewresearch.org/wp-content/uploads/sites/13/2016/07/07104931/PJ_2016.07.07_Modern-News-Consumer_FINAL.pdf

Nie, M., Bird, T., & Edirisingha, P. (2013). E-book readers and PDAs for work-based learners. In Z. L. Berge & L. Y. Muilenburg (Eds.), *The handbook of mobile learning* (pp. 209–223). New York: Routledge.

Ntuli, E., & Nyarambi, A. (2018). Instructional technology and meaningful learning: A synthesis for teacher educators for the 21st century. In J. Keengwe (Eds.), *The handbook of research on mobile technology, constructivism, and meaningful learning* (pp. 44–67). Hershey: IGI Global.

Organization for Economic Cooperation and Development. (2018). Preparing our youth for an inclusive and sustainable world: The OECD PISA global competence framework. Retrieved from https://www.oecd.org/education/Global-competency-for-an-inclusive-world.pdf

Ozan, O., & Kesim, M. (2013). Rethinking scaffolding in mobile connectivisit learning environments. In Z. L. Berge & L. Y. Muilenburn (Eds.), *The handbook of mobile learning* (pp. 166–175). New York: Routledge.

Pew Research Center. (2018). Mobile fact sheet (Blog post). Retrieved from http://www.pewinternet.org/fact-sheet/mobile/

Poushter, J. (2016, February 22). Smartphone ownership and internet usage continues to climb in emerging economies. *The Pew Research Center*. Retrieved from https://www.pewresearch.org/wp-content/uploads/sites/2/2016/02/pew_research_center_global_technology_report_final_february_22__2016.pdf

Razavi, T. (2017, December 7). PISA 2018 to assess global competence (Blog post). *The International Educator*. Retrieved from https://www.tieonline.com/article/2246/pisa-2018-to-assess-global-competence

Reimers, F. (2009). "Global competency" is imperative for global success. *Chronicle of Higher Education*, *55*(21), A29. Retrieved from https://www.tieonline.com/article/2246/pisa-2018-to-assess-global-competence

Roberts, J. A., Yaya, L. H. P., & Manolis, C. (2014). The invisible addiction: Cell-phone activities and addiction among male and female college students. *Journal of Behavioral Addictions*, *3*(4), 254–65. http://doi.org/10.1556/JBA.3.2014.015

Rye, S. A., & Stokken, A. M. (2012). The implications of the local context in global online education. *International Review of Research in Open and Distance Learning*, *13*(1), 191–206. Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/1010/2084

Shi, Z., Luo, G., & He, L. (2017). Mobile-assisted language learning using WeChat instant messaging. *International Journal of Emerging Technologies in Learning*, *12*(2), 16–26. http://doi.org/10.3991/ijet.v12i02.6681

Suárez-Orozco, M. M., & Sattin, C. (2007). Learning in the global era. In M. M. Suarez-Orozco (Ed.), *Learning in the global era: International perspectives on globalization and education*. Los Angeles: University of California Press.

Sussmuth, R. (2007). On the need for teaching intercultural skills: Challenges for education in a globalizing world. In M. M. Suarez-Orozco (Ed.), *Learning in the global era: International perspectives on globalization and education* (pp. 195–211). Los Angeles: University of California Press.

Taradi, S. K., & Taradi, M. (2016). Making physiology learning memorable: A mobile phone-assisted case-based instructional strategy. *Advances Physiology Education*, *40*(3), 383–387. https://doi.org/10.1152/advan.00187.2015

Tesolin, A., & Tsinakos, A. (2018). Opening real doors: Strategies for using mobile augmented reality to create inclusive distance education for learners with different-abilities. In S. Yu, M. Ally, & A. Tsinakos (Eds.), *Mobile and ubiquitous learning: An international handbook* (pp. 59–80). Singapore: Springer.

Traxler, J. (2007). Defining, discussing, and evaluating mobile learning: The moving finger writes and having writ. *International Review of Research in Open and Distance Learning*, *8*(2). http://doi.org/10.19173/irrodl.v8i2.346

Traxler, J. (2012). Ethics and ICTD research. In A. Chib & R. Harris (Eds.), *Linking research to practice in Asia: ICT for development research, management and perspectives* (pp. 68–81). Ottawa: International Development Research Centre.

Valk, J.-H., Rashid, A. T., & Elder, L. (2010). Using mobile phones to improve educational outcomes: An analysis of evidence from Asia. *International Review of Research in Open and Distance Learning*, *11*(1), 117–140. Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/794/1487

Vázquez-Cano, E. (2014). Mobile distance learning with smartphones and apps in higher education. *Educational Sciences: Theory & Practice*, *14*(4), 1505–1520. http://doi.org/10.12738/estp.2014.4.2012

Vulić, T., & Mitrović, M. (2015). Smart phone apps as a source of information for students. *eLearning and Software for Education*, *1*, 320–326. http://doi.org/10.12753/2066-026X-15-047

Walklet, E., Davis, S., Farrelly, D., & Muse, K. (2016). The impact of student response systems on the learning experience of undergraduate psychology students. *Psychology Teaching Review*, *22*(1), 35–48. Retrieved from http://eprints.worc.ac.uk/4523/

Warren, S. J., & Wakefield, J. S. (2013). Learning and teaching as communicative actions. In Z. L. Berge & L. Y. Muilenburg (Eds.), *The handbook of mobile learning* (pp. 70–81). New York: Routledge.

Wei, F., Chen, G., & Wang, C. (2007). Ubiquitous discussion forum: Introducing mobile phones and voice discussion into a web discussion forum. *Journal of Educational Multimedia and Hypermedia*, *16*(2), 125–140. Retrieved from http://www.editlib.org/index.cfm?fuseaction=Reader.ViewAbstract&paper_id=21751

West, C. (2012). *Toward globally competent pedagogy*. Washington, DC: NAFSA, Association of International Educators. Retrieved from http://www.nafsa.org/uploadedFiles/Chez_NAFSA/Find_Resources/Publications/Periodicals/Epublications/epub_toward_globally.pdf

West, M. (2012). Turning on mobile learning: Global themes. *UNESCO Working Paper Series on Mobile Learning*. Retrieved from http://unesdoc.unesco.org/images/0021/002164/216451E.pdf

West, M., & Chew, H. E. (2014). Reading in the mobile era: A study of mobile reading in developing countries. *UNESCO Working Paper Series on Mobile Learning*. Retrieved from http://unesdoc.unesco.org/images/0022/002274/227436e.pdf

Wu, W. H., Jim Wu, Y. C., Chen, C. Y., Kao, H. Y., Lin, C. H., & Huang, S. H. (2012). Review of trends from mobile learning studies: A meta-analysis. *Computers and Education*, *59*(2), 817–827. http://doi.org/10.1016/j.compedu.2012.03.016

Yarmey, K. (2011). Student information literacy in the mobile environment. *Educause Quarterly*

Magazine, *34*(1). Retrieved from https://er.educause.edu/articles/2011/3/student-information-literacy-in-the-mobile-environment

Yeh, E., & Swinehart, N. (2018). A model for mobile social media integration in constructivist ESL classrooms. In J. Keengwe (Ed.), *The handbook of research on mobile technology, constructivism, and meaningful learning* (pp. 68–88). Hershey: IGI Global.

Yu, S., Ally, M., & Tsinakos, A. (Eds.). (2018). *Mobile and ubiquitous learning: An international handbook*. Singapore: Springer.

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Exploring High School Students' Educational Use of YouTube

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Abstract

YouTube is one of the most prevalent social media sites across the globe. However, there is a lack of research on factors influencing educational use of YouTube. This study examines high school students' educational use of YouTube with unified theory of acceptance and use of technology (UTAUT). Using structural equation modeling, the proposed model is tested. Results demonstrate that performance expectancy and social influence are the significant predictors of behavioral intention to use YouTube. Furthermore, behavioral intention is the significant predictor of actual usage. The results suggest that students intend to use YouTube for improving their academic performance. Social influence also contributes to their intention. Based on previous literature, the results are discussed.

Keywords: YouTube, high school students, unified theory of acceptance and use of technology (UTAUT), structural equation model

Introduction

Information and communication technologies (ICTs) are one of the most prominent integral assets of contemporary education. Teaching and learning activities that incorporate different digital devices and platforms are becoming more prevalent, such as using YouTube for educational purposes (Jung & Lee, 2015; Terlemez, 2016). First released in 2005, YouTube has become the world's largest online video platform in which users can upload, share, watch, and discuss video clips across the globe (Lin & Polaniecki, 2009). Youth frequently spend their time on digital media (Erstad, 2012; Ünlüsoy, de Haan, Leander, & Volker, 2013); according to the Pew Internet and American Life Project (Madden, 2009), 89% of 18-29-year-olds use online video platforms like YouTube, with 36% of them watching movies or educational videos on a daily basis.

Numerous studies emphasize that videos have an inherent instructional affordance for teaching and learning processes. For instance, Adhikari, Sharma, Arjyal, and Uprety (2016) posited that YouTube is a widely used source of information, and that when quality videos are posted by professional organizations and governments, they can add value by providing detailed and accurate information. Bonk (2008) suggested that online video content may help students increase their grasp of educational concepts and arouse an overall interest in learning.

The existing literature emphasizes the value and importance of the use and potential of YouTube as an educational source of information (Jung & Lee, 2015; Terlemez, 2016). However, there is a lack of research on high school students' educational use of YouTube. This study examines the factors influencing the educational use of YouTube by high school students in Turkey with unified theory of acceptance and use of technology (UTAUT).

Theoretical Background

There are various theoretical models available to assist practitioners in understanding the factors that might influence a student's acceptance and use of technology. In this study, factors influencing students' acceptance and use of YouTube for educational purposes were drawn from the unified theory of acceptance and use of technology (UTAUT) proposed by Venkatesh, Morris, Davis, and Davis (2003). There are four pivotal constructs in UTAUT (performance expectancy, effort expectancy, social influence, and facilitating conditions) along with four moderators (gender, age, experience, and voluntariness). Venkatesh, Thong, and Xu (2012) extended the original model by proposing UTAUT2, which included three more constructs; namely, price value, hedonic motivation, and habit. Venkatesh, Thong, and Xu (2016) analyzed UTAUT and its extensions by suggesting a multi-level framework to further refine the explanatory power of the model. In the context of this study, the four core constructs; namely, performance expectancy, effort expectancy, social influence, and facilitating conditions, were drawn to understand students' educational use of YouTube.

Previous studies tested UTAUT for various user behavior with different participants and different technological features, for example, interactive whiteboards (Šumak & Šorgo, 2016; Wong, Teo, & Goh, 2015), e-learning systems (El-Masri & Tarhini, 2017; Ngampornchai & Adams, 2016) and mobile learning (Abu-Al-Aish & Love, 2013; Hao, Dennen, & Mei, 2017). The existing literature demonstrates that UTAUT is being validated to explain and predict behavioral intention and user behavior concerning technology acceptance. However, Venkatesh et al. (2012) suggested that it is important to test UTAUT within different cultures, technological features, and settings, since factors influencing the adoption of a technology might vary with respect to different cultural backgrounds, technological features, and target populations. In this regard, it is conceivable to expect and accept that the factors influencing students' educational use of YouTube might differ from general information systems usage contexts.

Given the importance of exploring possible factors that might influence a student's acceptance and use of YouTube for educational purposes, and the need to extend theories and models of technology adoption to new contexts to advance generalizability and applicability, this study investigated the determinants of the educational use of YouTube in the margin of UTAUT.

The Study

Previous research suggests that UTAUT is one of the rigorous models that explains determinants of technology use (e.g., Ngampornchai & Adams, 2016; Nistor, Göğüş, & Lerche, 2013). Using UTAUT, this study examines determinants of high school students' educational use of YouTube. Figure 1 illustrates the research model and the predictors of educational use of YouTube. As it is indicated in Figure 1 below, performance expectancy (PE), effort expectancy (EE), and social influence (SI) are determinants of behavioral intention (BI) to use YouTube. Behavioral intention and facilitating conditions (FC) are the determinants of the actual usage. Each predictor is explained under the subsequent sections.

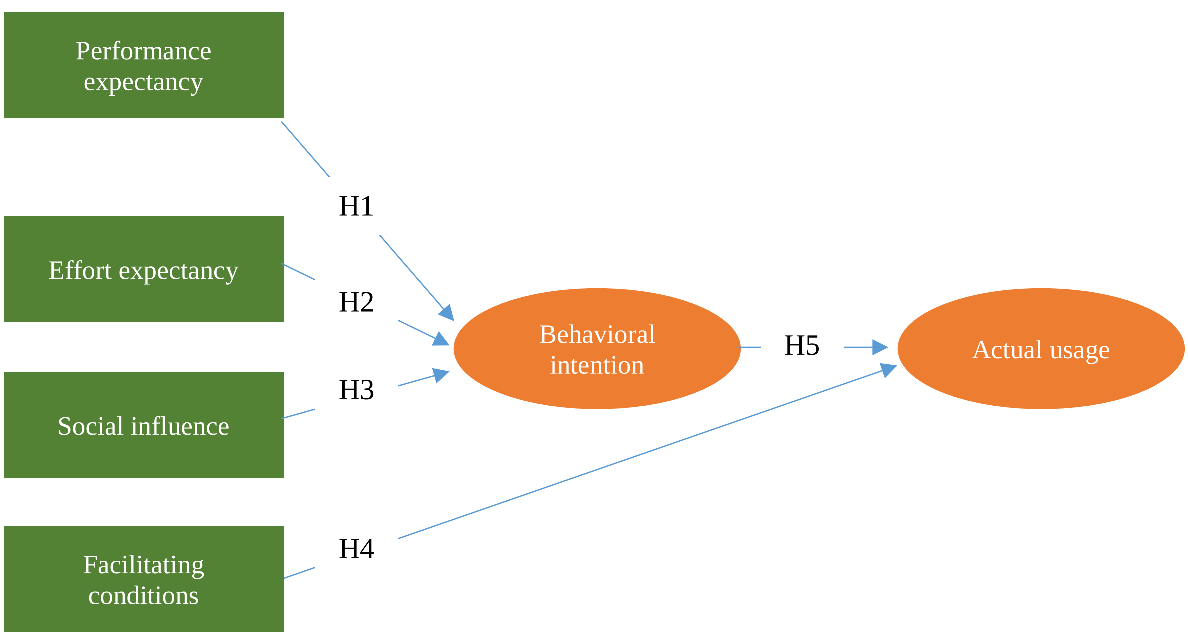

Figure 1. The research model and hypothesis for predicting high school students' educational use of YouTube.

Performance Expectancy

Performance expectancy (PE) is defined as “the degree to which an individual believes that using the system will help him or her to attain gains in job performance” (Venkatesh et al., 2003, p. 447). UTAUT postulated PE as one of the direct determinants of behavioral intention (BI) to use technology. Detailed information about BI is provided after facilitating conditions. There are numerous studies that validated PE as a significant determinant of BI, for instance, El-Masri and Tarhini (2017) examined the e-learning adoption with university students from Qatar and the USA. They found that in both samples, PE was one of the significant predictors of BI. Similarly, Jung and Lee (2015) investigated factors influencing university students’ and educators’ YouTube acceptance with UTAUT. They found that PE had a significant positive effect on BI for both groups. In this study, PE was conceptualized as students’ perceptions concerning the potential benefits of using YouTube for educational purposes. In accordance with previous studies on UTAUT, this study postulated that if students perceive YouTube as useful and might add value to their educational experience, then they will be more likely to adopt it. On the other hand, if they are more skeptical regarding the educational value of YouTube, then they are more resistant to adopt it. Therefore, this study proposed the following hypothesis:

> H1: Performance expectancy is a significant predictor of students’ behavioral intention to use YouTube for educational purposes.

Effort Expectancy

Effort expectancy (EE) is defined as “the degree of ease associated with the use of the system” (Venkatesh et al., 2003, p. 450). UTAUT proposed that EE is one of the direct determinants of BI. Many studies reported that EE is a significant determinant of BI. For instance, Teo and Noyes (2014) examined pre-service teachers’ self-reported intentions to use information technology by UTAUT. They found that EE was a significant determinant of BI to use information technology. Similarly, Ngampornchai and Adams (2016) carried out a study to investigate undergraduate students’ readiness for online learning within the margin of UTAUT along with extending the model with multiple variables. The researchers found that EE had a strong positive relationship and strong indicator of technology acceptance. In accordance with existing studies on UTAUT, this study included EE to investigate students’ perceptions of whether the use of YouTube for educational purposes is free of effort and to predict BI. In other words, EE is conceptualized as the degree of ease associated with the use of YouTube for educational purposes. It is proposed that if students think that YouTube is easy to use for educational purposes, then they are more likely to adopt it. Therefore, this study postulated the following hypothesis:

> H2: Effort expectancy is a significant predictor of students’ behavioral intention to use YouTube for educational purposes.

Social Influence

Social influence (SI) is defined as “the degree to which an individual perceives that important others believe he or she should use the system” (Venkatesh et al., 2003, p. 451). According to El-Masri and Tarhini (2017), the reason why SI is a direct determinant of BI is the fact that people might be influenced by others’ ideas and might involve in certain action even if they do not want to. SI is emphasized to have different effect size on BI with respect to different cultural backgrounds, particularly in collectivist cultures (e.g., Venkatesh & Zhang, 2010). There are numerous studies validated that SI is one of the direct determinants of BI (e.g., Hao et al., 2017; Im, Hong, & Kang, 2011). Venkatesh et al. (2003) argued that SI is not a significant predictor of BI in voluntary or utilitarian contexts, yet it becomes significant in case of a mandatory setting. Although students' behavioral intention to use YouTube for educational purposes is a case of voluntary use of technology, this study tested direct effect of SI on BI. In the context of this study, students will be more likely to adopt YouTube for educational purposes if it is valued by one's social environment or by important others, such as, family members, friends, or teachers. Hence, the following hypothesis was proposed:

> H3: Social influence is a significant predictor of students' behavioral intention to use YouTube for educational purposes.

Facilitating Conditions

Facilitating conditions (FC) are defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2003, p. 453). This study conceptualized FC as students' perceptions on whether they have access to required resources and necessary support to use YouTube for educational purposes. In fact, FC is not proposed as a direct determinant of BI in the original UTAUT model (see Venkatesh et al., 2016). However, previous studies investigated FC in several different ways as context, participants, and technological features vary within these studies (e.g., Lin, Zimmer, & Lee, 2013; Wong, 2016). For instance, Wong (2016) investigated primary school teachers' use of education technology in Hong Kong and found that FC is a strong dominating factor compared to perceived ease of use and perceived usefulness. This study included FC to propose that students will be more likely to adopt YouTube for educational purposes if they have access to required resources and necessary support. Hence, this study postulated the following hypothesis:

> H4: Facilitating conditions is a significant predictor of students' actual usage of YouTube for educational purposes.

Behavioral Intention to Use YouTube

According to Ajzen (1991) "intentions are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior" (p. 181). BI is determined as a proxy factor for users' acceptance and use of a technology (e.g., Venkatesh et al., 2003; Venkatesh et al., 2012). In the context of this study, BI measures high school students' preferences and intentions toward the use of YouTube for educational purposes. UTAUT postulated that BI is a significant predictor of actual usage of a technology. In this regard, a hypothesis was tested on whether BI is a significant determinant of actual use of YouTube.

> H5: Behavioral intention is a significant predictor of students' actual usage of YouTube.

Based on previous studies and developed hypotheses, the research model was proposed as illustrated in Figure 1. High school students' behavioral intention toward the use of YouTube for educational purposes is determined by subsequent factors as in the UTAUT.

Method

To be able to examine the research model, the study used a survey design, which included demographic information and items related to educational use of YouTube. The items were adapted from existing scales previously validated (e.g., Venkatesh et al., 2003). Structural equation modeling (SEM) approach was underpinned to verify the associations between the indigenous (BI and AU) and exogenous (PE, EE, SI, and FC) constructs. In this regard, stages for employing SEM were followed as suggested by Schreiber, Nora, Stage, Barlow, and King (2006). The pre-analysis stage of SEM includes the reporting of sample size, normality, outliers, linearity, multicollinearity, software program, and estimation method. The statistical analysis was carried out in IBM SPSS Statistics 22 and LISREL v.8.71 and the maximum likelihood estimation method was performed to test the associations between indigenous and exogenous relationships.

First, missing data (n = 32) were discarded from the data set. These included items that had more than one response to 5-point Likert scale and no response to survey items related to measuring participants' educational use of YouTube (Çokluk, Şekercioğlu, & Büyüköztürk, 2016). This resulted in data collected from 367 participants. Second, using z scores that are outside of the range of ± 3 (n = 32) were discarded from the data set, as well (Çokluk et al., 2016). This resulted in a data set that is collected from 335 participants. Third, the sample size (n = 335) is above the threshold to conduct SEM (Hair, Black, Babin, Anderson, & Tatham, 2006; Hoe, 2008). Fourth, the normality of the data set was tested using skewness, kurtosis, and linearity values. The skewness (ranged from -1.388 to 0.381) of the data was in the range of ± 3 and satisfied the recommended threshold (Kline, 2005). The kurtosis of the data (ranged from -0.933 to 1.954) was in the range of ± 10 and satisfied the recommended threshold (Klein, 2005). The linearity ranged from 0.079 to 0.824 that are bigger than 0.05. This also satisfied the recommended threshold value for the linearity of the data. Finally, the multicollinearity of the data is tested using the variable inflation factor (VIF). The multicollinearity values were smaller than 3.0 (ranged from 1.024 to 2.839) and satisfied the recommended threshold (O'Brien, 2007). These values suggest that the data is appropriate to test SEM.

Measurements

This study underpinned the process of preparing and administering a survey instrument. The items used to collect the data from high school students were drawn from previous studies that are published both in English and Turkish (e.g., Venkatesh et al., 2003; Venkatesh et al., 2012). Using previously validated items enabled an extent of content and face validity. Furthermore, three experts from the field of educational sciences and six experts from the field of educational technology provided feedback concerning the content and face validity. Based on experts' suggestions, slight modifications were completed in order to satisfy the content and face validity of the survey instrument. Specifically, along with demographics, the survey instrument included 22 items in total: performance expectancy (PE - 5 items), effort expectancy (EE - 3 items), social influence (SI - 4 items), facilitating conditions (FC - 4 items), behavioral intention (BI - 3 items), and actual usage (AU - 3 items). The items were anchored on a 5-point Likert-scale ranging from "1 - strongly disagree" to "5 - strongly agree."

Factor Structure

The data set were controlled for the suitability of factor analysis. Kaiser-Meyer-Olkin (KMO) tests and Bartlett's test of sphericity were used as a measure of sampling adequacy. The results show that KMO values ranged between 0.605 and 0.892, which was above the recommended threshold value of .50 (Kaiser, 1974). Bartlett's test of sphericity also ensured that the constructs were independent. Table 1 illustrates the results that verified the appropriateness of data for factorability. These results suggested testing the data for exploratory factor analysis using principal components extraction. Operationalization of a unidimensional solution for each construct appeared to be the most appropriate measurement based on the scree-plot eigenvalues.

Table 1

Suitability of the Data for Factor Analysis

Constructs	KMO	Chi-Square	Sig.
PE	0.892	1,218.837	0.000
EE	0.605	188.139	0.000
SI	0.794	509.838	0.000
FC	0.708	358.047	0.000
BI	0.755	658.583	0.000
AU	0.758	798.182	0.000

Participants and Procedures

A total of 399 high school students were recruited through convenience sampling method. Table 2 illustrates the demographic information about the participants of the study. Missing values and outliers were discarded from statistical analyses. The statistical analyses were employed with data collected from 335 responses. As it is illustrated in Table 2, there were 178 (53,1%) female and 157 (46,9%) male participants. The age of the participants ranged from 14 to 19 (Mean = 16.21, *SD* = 1.217) and the majority of the participants reported that they have a mobile phone (304, 90.7%). Furthermore, 298 (89.0%) of the participants had Internet access over their mobile phones. This demographic information illustrates a point concerning the accessibility of mobile technology by the majority of the respondents. While the daily average Internet usage was 4 hours, the participants indicated that they spend 1 hour on the Internet for educational purposes on a daily basis. The demographic information as indicated in Table 2 also provided a ground for further discussion about how participants' characteristics may contribute to associations between the constructs.

Table 2

Demographics of the Participants

	Frequency	%
Gender		
Female	178	53.1
Male	157	46.9
Total	335	100.0

*Age**		
Mean	16.21	
Standard deviation	1.217	
Minimum	14	
Maximum	19	
Mobile phone ownership	304	90.7
Internet access from the mobile phone*	298	89.0
Daily average Internet usage (hours)*	4	
Daily average Internet usage for educational purposes (hours)*	1	

*Has a missing value.

Results

Descriptive Statistics

The descriptive statistics of the constructs (PE, EE, SI, FC, BI, AU) are illustrated in Table 3. The mean values of the constructs on a 1-to-5 scale ranged from 2,2918 (SI; *SD* = 0,99987) to 4,3940 (EE, *SD* = 0,63756).

Table 3

Descriptive Statistics, Skewness, and Kurtosis Values for Normality Assumptions of SEM

Constructs	Item	Mean	Standard deviation	Skewness	Kurtosis
PE	5	3.0794	1.12203	-0.081	-0.872
EE	3	4.3940	0.63756	-1.088	0.641
SI	4	2.2918	0.99987	0.381	-0.678
FC	4	4.4881	0.56422	-1.388	1.954
BI	3	3.4199	1.23063	-0.362	-0.933
AU	3	3.0408	1.16873	-0.005	-0.867

As it is indicated in Table 3, the normal distribution of the data was satisfied with the kurtosis and skewness values. The standard kurtosis value was smaller than 10 (ranged from -0.678 to 1.954) and the standard skewness value was smaller than 3 (ranged from -1.388 to 0.381; Kline, 2005). These values suggest that the data is appropriate to use structural equation modeling for testing associations between the constructs.

Convergent Validity

To test the convergent validity of the measurement items under each construct, three conditions as suggested by Fornell and Larcker (1981) were investigated. These three conditions are: (1) the item reliability of each construct, (2) the composite reliability of each construct, and (3) the average variance extracted (AVE). According to Hair et al. (2006), the factor loadings should be higher than .50, the composite reliability should exceed 0.60, and AVE should be higher than 0.50. As illustrated in Table 4, the factor loadings of each item were higher than 0.50 except FC19, which has a factor loading of 0.353. Since it is also at an acceptable level (Hair et al., 2006) the authors did not leave the item. The composite reliability exceeds the threshold value of 0.60, and the value of AVE was also higher than the recommended value of 0.30. Hence, the three conditions for convergent validity were satisfied. In addition to these three conditions, Cronbach's alpha values were also reported. As it is provided in Table 4, it ranged between 0.58 and 0.93. From Table 4, all the measures fulfill the recommended threshold values and indicates that the convergent validity for the measurement items and constructs are validated.

Table 4

Convergent Validity of the Constructs

Items	Factor loads	CR	AVE %	Cronbach's alpha
AU				
1. I follow instruction about my courses on YouTube.	0.920			
2. I use YouTube to learn about my courses.	0.940	0.95	0.87	0.93
3. I watch videos about my courses on YouTube.	0.944			
PE				
4. YouTube makes it easy to understand my courses.	0.903			
5. YouTube helps me to become more successful in my courses.	0.917			
6. I learn more quickly using YouTube.	0.865	0.94	0.76	0.92
7. I find using YouTube for educational purposes useful.	0.858			
8. YouTube improves my effectiveness in my courses.	0.810			
EE				
9. Learning how to use YouTube for educational purposes is easy for me.	0.846			
10. I find YouTube easy to use.	0.842	0.82	0.61	0.63
11. It is easy to learn something on YouTube.	0.635			
SI				
12. My friends think that I should use YouTube for educational purposes.	0.779			
13. My parents think that I should use YouTube for educational purposes.	0.801	0.89	0.67	0.83
14. My teachers think that I should use YouTube for educational purposes.	0.811			

15. People around me / in my social life think that I should use YouTube for educational purposes.	0.874			
FC				
16. I have the resources necessary to use YouTube for educational purposes.	0.795			
17. I have the skills / knowledge necessary to use YouTube for educational purposes.	0.846			
18. YouTube is compatible with the technology (e.g., my mobile phone, desktop computer, etc.) that I use.	0.877	0.82	0.56	0.58
19. I can get help from others when I have difficulties using YouTube for educational purposes.	0.353			
BI				
20. I think that I will use YouTube for educational purposes.	0.911			
21. I plan to use YouTube for educational purposes.	0.926	0.94	0.84	0.91
22. I intent to use YouTube as a student for the courses that I do not understand / I find difficult to understand.	0.919			

* *Note.* The items were in Turkish, and the language validity for English was not established

Discriminant Validity

Discriminant validity is satisfied when two conceptually different constructs exhibit sufficient difference. There are two indicators for discriminant validity: (1) The Fornell-Larcker criterion, and (2) cross-loadings. To ensure the discriminant validity, Fornell-Larcker criterion suggests that the AVE of each latent variable should be higher than the squared correlations with all other latent variables. Cross-loadings also suggest another way to check the discriminant validity. It is satisfied when all the cross-loadings of individual items under each construct were higher than their factor loadings under other variables. Table 5 demonstrates correlation coefficients and the values of the square root of AVE.

Table 5

Discriminant Validity of the Constructs

Constructs	PE	EE	SI	FC	BI	AU
PE	(0.87)*					
EE	0.288**	(0.78)*				
SI	0.553**	0.210**	(0.82)*			
FC	0.160**	0.69**	0.069**	(0.75)*		
BI	0.784**	0.506**	0.195**	0.195**	(0.92)*	
AU	0.715**	0.417**	0.154**	0.154**	0.680**	(0.93)*

*$p < 0.05$; **$p < 0.01$
Note. Diagonal in parentheses are the values of the square root of AVE; off-diagonal are the values of correlation coefficients.

As it is indicated in Table 5, the square roots of AVE for all the constructs (the values in the parentheses) are greater than the correlation coefficients (the values outside of parentheses); hence, the constructs also satisfy discriminant validity.

Test of the Proposed Model

Hooper, Coughlan, and Mullen (2008) suggested three categories of fit indices to test the measurement model. These indices are: (1) absolute, (2) incremental, and (3) parsimony fit indices. First, absolute fit indices include chi-square ($\chi 2$), relative / normed chi-square ($\chi 2/df$), goodness-of-fit (GFI), adjusted goodness-of-fit (AGFI), root mean square residual (RMSEA), and standardized root mean square residual (SRMR). Second, incremental fit indices include normed-fit index (NFI), non-normed fit index (NNFI), and comparative fit index (CFI). Lastly, parsimony fit indices include parsimony goodness-of-fit index (PGFI) and parsimonious normed fit index (PNFI). Table 6 illustrates the criterion value for each index along with the results obtained in this study. The overall results as illustrated in Table 6 ensured an acceptable fit between the data and proposed model.

Table 6

Model Fit Indices for the Proposed Model

Fit indices	Values	Recommended values
Absolute		
$\chi 2$	422.13	
p value	0.00	≥ .05 (Hair et al., 2006; Hoyle, 1995)
$\chi 2$ / df	2.37	≤ 3 (Kline, 2005)
GFI	.89	≥ .85 (Jöreskog & Sörbom, 1988)
AGFI	.86	≥ .80 (Marsh, Balla, & McDonald, 1988)
RMSEA	.06	≤ .10 (MacCallum, Widaman, Preacher, & Hong, 2001; Bentler & Bonnet, 1980)
SRMR	.08	≤ .10 (Kline, 2005)
Incremental		
NFI	.96	≥ .90 (Bentler &Bonett, 1980)
NNFI	.97	≥.90 (Vidaman & Thompson, 2003; Bentler &Bonett, 1980)
CFI	.98	≥.90 (Vidaman & Thompson, 2003; Bentler, 1990; Bentler &Bonett, 1980)
Parsimony		
PNFI	.82	>.50 (Mualik, James, Van Alstine, Bennett, Lin, & Stilwel, 1989)
PGFI	.69	>.60 (Byrne, 2010)

Test of the Structural Model

To be able to test the proposed hypotheses, standardized path coefficients and their significance were investigated. As it is illustrated in Table 7, BI was predicted by PE and SI, but EE was not a significant predictor of BI. Hence, H1 and H3 was supported, meanwhile H2 was not supported. Furthermore, AU was predicted by BI, but FC was not a significant predictor of AU. In this regard, while H5 was supported, H4 was rejected. PE and SI together explained 91% of the total variance in BI, and BI explained 77% of the variance in AU.

Table 7

Path Coefficients and Their Significance for Hypothesis Testing

Hypothesis number	Proposed hypothesis	Path coefficient	t-value	Study results
H1	PE → BI	.80	13.55	Supported
H2	EE → BI	.05	1.29	Not supported
H3	SI → BI	.11	2.30	Supported
H4	FC → AU	.02	.35	Not supported
H5	BI → AU	.77	14.66	Supported

Discussion and Conclusion

In response to prevalence of YouTube as one of the most common digital resources in educational praxis, this study aimed at investigating high school students' educational use of YouTube. The study underpinned UTAUT as the theoretical framework to identify predictors of acceptance behavior. To this end, performance expectancy (PE), effort expectancy (EE), and social influence (SI) were tested as predictors of behavioral intention (BI), and in turn BI and facilitating conditions (FC) were tested as predictors of actual usage (AU).

Consistent with the prediction of this study, PE was found to be the strongest predictor of BI. In fact, this result is consistent with a plethora of studies that found PE as a dominant predictor of BI (e.g., Chaka & Govender, 2017; Khechine & Lakhal, 2018; Padhi, 2018; Suki & Suki, 2017). For instance, Padhi (2018) investigated faculty perception with respect to open educational resources (OER) by applying UTAUT. The results indicated that PE positively influenced the intentions to use OER. Similarly, Suki and Suki (2017) examined the determinants of students' behavioral intention to use animation and storytelling through UTAUT. The results demonstrated that PE was the strongest predictor of BI to use animations and storytelling within lessons. This implies that participants will be more likely to use YouTube for educational purposes if they perceive learning through this digital resource would improve their academic performance.

In the present study, SI was also found to be significant predictor of BI. In fact, this result is consistent with numerous previous studies (e.g., Abu-Al-Aish & Love, 2013; Isaias, Reis, Coutinho, & Lencastre, 2017; Nicholas-Omoregbe, Azeta, Chiazor, & Omoregbe, 2017; Prasad, Maag, Redestowicz, & Hoe, 2018). For instance, Nicholas-Omoregbe et al. (2017) investigated the factors that have an influence on the adoption of e-learning management system (e-LMS) in higher education. The results demonstrated that SI was one of the strong predictors of BI to adopt e-LMS. Similarly, Prasad et al. (2018) investigated learners' BI to use a blended learning program employed with post-graduate international information technology students. The results showed that SI is a strong predictor on both PE and EE as well as BI. The researchers concluded that SI is one factor to mitigate the barriers to technology adoption. In the context of this study, this result implies that students' educational use of YouTube will more likely to be influenced in case it is accepted by their peers, teachers, and family members, or within their social environment.

This study did not find significant associations between EE and BI, along with FC and AU. EE was measured with three items in accordance with previous studies and comprised participants' perceptions concerning the ease associated with educational use of YouTube. In other words, the educational use of YouTube will be effortless. In fact, the insignificant results concerning EE has been discussed in several studies (e.g., Ali & Arshad, 2018; Doleck, Bazelais, & Lemay, 2017; Isaias et al., 2017; Liu, Chang, Huang, & Chang, 2016). For instance, Isaias et al. (2017) examined the acceptance of an educational forum, which includes empathic and affective characteristics. The results of the study demonstrated that EE was not a significant predictor of BI. Similarly, Doleck et al. (2017) investigated students' computer-based learning environment use by comparing two different models: The Technology Acceptance Model (TAM) and UTAUT. The results demonstrated that the hypothesis developed under the UTAUT model concerning the relationship between EE and BI was not significant. There are two possible factors for the insignificant relationship in the context of this study. First, the participants may perceive YouTube as an easy-to-use platform, and second, the participants may not attribute a degree of difficulty in using YouTube for educational purposes. This generation of students is classified as digital natives who are generally comfortable with using technology. In this regard, their demographic characteristics might also contribute to insignificant association between EE and BI.

Contrary to the prediction of this study, the results showed that FC was not a significant predictor of AU. In fact, the original model of UTAUT posited that FC is a significant determinant of AU. However, there are several studies that did not find significant association between FC and AU (e.g., Khechine & Lakhal, 2018; Yueh, Huang, & Chang, 2015). For instance, Khechine and Lakhal (2018) investigated university students' acceptance of webinar technology and the results of the study demonstrated that FC was not a significant predictor of AU. Yueh et al. (2015) examined factors that influence students' adaptation and continued use of a Wiki system and the results of the study demonstrated that FC was not a significant predictor of AU. There might be three plausible explanations of the insignificant association between FC and AU in the context of this study. This study conceptualized FC as participants' perceptions on whether they have access to resources and support to use YouTube for educational purposes. First, the majority of the participants reported that they have mobile phones and access to the Internet. Hence, they have the required hardware and software to access YouTube as one of the required resources. Furthermore, these participants are categorized as digital natives that could easily navigate on a digital world without any assistance from others. In this regard, the lack of a specific person or group for assistance with difficulties on the use of YouTube for educational purposes might not contribute to explaining the extent of variance in AU. Third, the usability of YouTube might not create system difficulties and as a result it may not be a barrier to AU.

This study also tested the hypothesis that BI is a significant predictor of AU as originally validated in UTAUT model. In fact, there are several studies found that BI is a significant determinant of AU (e.g., Liu et al., 2016; Doleck et al., 2017). For instance, Liu et al. (2016) investigated students' BI to use social networking services (SNS) and found that BI was a significant predictor of AU. Similarly, Doleck et al. (2017) investigated students' computer-based learning environment use and they found a significant positive relationship between BI and AU. Consistent with the prediction of this study, the structural equation analysis demonstrated that BI was a significant predictor of the AU of YouTube for educational purposes. In the context of this study, this implies that the stronger the intention, the more likely that participants will use YouTube for educational purposes.

Limitations and Future Research

This study has numerous limitations concerning several stages, including but not limited to, the theoretical framework of the study, the data collection, and the sampling method, which can potentially create an avenue for future studies. First, this study underpinned the core constructs as postulated and tested by UTAUT. Hence, future studies can further synthesize the model by including various constructs from other technology acceptance theories that will possibly increase the predictive power. For instance, media richness might be used to extend the potential of YouTube in educational settings as it assumes that users will be more likely to adopt rich media, including immediate feedback or language variety. Second, the data of the study were collected by means of a self-report measure without any triangulation of the data sources. Thus, future research needs to include different sources of data in order to gain deeper insights. Third, this study underpinned the convenience sampling method, which has a potential bias as the participants were within the same age level and demographics. Thus, the results might not be a representative of other age levels and may not be generalizable. In this regard, future studies should try to include participants from different age levels and cultural backgrounds. Finally, teachers are one of the most important role models for students studying at the high school level and they might play a significant role in the adoption of YouTube as an educational resource. Considering the significant determinant of SI in this study, teachers have the potential of improving students' perception toward the use of YouTube for their educational needs. From this perspective, there is a need to investigate teachers' perceptions toward educational use of YouTube.

References

Abu-Al-Aish, A., & Love, S. (2013). Factors influencing students' acceptance of m-learning: An investigation in higher education. *The International Review of Research in Open and Distance Learning, 14*(5), 82-107. DOI: 10.19173/irrodl.v14i5.1631

Adhikari, J., Sharma, P., Arjyal, L., & Uprety, D. (2016). YouTube as a source of information on cervical cancer. *North American Journal of Medical Sciences, 16*(8), 183-186. DOI: 10.4103/1947-2714.179940

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211. DOI: 10.1016/0749-5978(91)90020-T

Ali, R. A., & Arshad, M. R. M. (2018). Empirical analysis on factors impacting on intention to use m-learning in basic education in Egypt. *International Review of Research in Open and Distributed Learning, 19*(2), 253-270. DOI: 10.19173/irrodl.v19i2.3510.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*(2), 238–246. DOI: 10.1037/0033-2909.107.2.238

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness-of-fit in the analysis of covariance structures. *Psychological Bulletin, 88*(3), 588–606. DOI: 10.1037/0033-2909.88.3.588

Bonk, C. J. (2008, March). *YouTube anchors and enders: The use of shared online video content as a macrocontext for learning*. Paper presented at the American Educational Research Association (AERA) 2008 Annual Meeting, New York, NY.

Byrne, B. M. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming (2nd edition).* MA: Routledge.

Chaka, J. G., & Govender, I. (2017). Students' perceptions and readiness towards mobile learning in colleges of education: A Nigerian perspective. *South African Journal of Education, 37*(1), 1-12. DOI: 10.15700/saje.v37n1a1282

Çokluk, Ö., Şekercioğlu, G., & ve Büyüköztürk, Ş. (2016). *Sosyal bilimler için çok değişkenli istatistik SPSS ve LISREL Uygulamaları* [Multivariate statistics for social sciences: SPSS and Lisrel applications]. Ankara: Pegem Akademi Yayıncılık.

Doleck, T., Bazelais, P., & Lemay, D. J. (2017). Examining CEGEP students' acceptance of computer-based learning environments: A test of two models. *Education and Information Technologies, 22*, 2523-2543. DOI: 10.1007/s10639-016-9559-9

El-Masri, M., & Tarhini, A. (2017). Factors affecting the adoption of e-learning systems in Qatar and USA: Extending the unified theory of acceptance and use of technology 2 (UTAUT2). *Educational Technology Research and Development*, *65*(3), 743-763. DOI: 10.1007/s11423-016-9508-8

Erstad, O. (2012). The learning lives of digital youth – beyond the formal and informal. *Oxford Review of Education, 38*(1), 25-43. DOI: 10.1080/03054985.2011.577940

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50. DOI: 10.2307/3151312

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis.* New Jersey: Pearson Education Inc.

Hao, S., Dennen, V. P., & Mei, L. (2017). Influential factors for mobile learning acceptance among Chinese users. *Educational Technology Research and Development, 65*(1), 101-123. DOI: 10.1007/s11423-016-9465-2

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modelling: Guidelines for determining model fit. *The Electronic Journal of Business Research Methods, 6*(1), 53-60.

Hoyle, R. H. (1995). *Structural equation modeling: concepts, issues, and application*. London: Sage.

Im, I., Hong, S., & Kang, M. S. (2011). An international comparison of technology adoption: Testing the UTAUT model. *Information & Management, 48*(1), 1-8. DOI: 10.1016/j.im.2010.09.001

Isaias, P., Reis, F., Coutinho, C., & Lencastre, J. A. (2017). Empathic technologies for distance/mobile learning: An empirical research based on the unified theory of acceptance and use of technology (UTAUT). *Interactive Technology and Smart Education, 14*(2), 159-180. DOI: 10.1108/ITSE-02-2017-0014

Jöreskog, K. G., & Sörbom D. (1988). *LISREL 7: A guide to the program and applications*. Chicago, IL: SPSS Inc.

Jung, I., & Lee, Y. (2015). YouTube acceptance by university educators and students: A cross-cultural perspective. *Innovations in Education and Teaching International, 52*(3), 243-253. DOI: 10.1080/14703297.2013.805986

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika, 39*(1), 31–36. DOI: 10.1007/bf02291575

Khechine, H., & Lakhal, S. (2018). Technology as a double-edged sword: From behavior prediction with UTAUT to students' outcomes considering personal characteristics. *Journal of Information Technology Education, 17,* 63-102. DOI: 10.28945/4022

Kline, R.B. (2005). *Principles and practice of structural equation modeling (2nd ed.).* New York, NY: Guilford Press.

Lin, C. C., & Polaniecki, S. (2009). From media consumption to media production: Applications of YouTube™ in an eighth-grade video documentary project. *Journal of Visual Literacy*, *28*(1), 92-107. DOI: 10.1080/23796529.2009.11674661

Lin, S., Zimmer, J. C., & Lee, V. (2013). Podcasting acceptance on campus: The differing perspectives of teachers and students. *Computers & Education, 68,* 416-428. DOI: 10.1016/j.compedu.2013.06.003

Liu, L. -W., Chang, C. -M, Huang, H. -C., & Chang, Y. -L. A. (2016). Verification of social network site use behavior of the university physical education students. *Eurasia Journal of Mathematics, Science & Technology Education, 12*(4), 793-805. DOI: 10.12973/eurasia.2016.1232a

MacCallum, R. C., Widaman, K. F., Preacher, K., & Hong, S. (2001). Sample size in factor analysis: The role of model error. *Multivariate Behavioral Research, 36*, 611–637. DOI: 10.1207/S15327906MBR3604_06

Madden, M. (2009, July 29). The audience for online video-sharing sites shoots up (Blog post). Retrieved from http://www.pewinternet.org/2009/07/29/the-audience-for-online-video-sharing-sites-shoots-up/

Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin, 103*, 391–410. DOI: 10.1037/0033-2909.103.3.391

Mualik, S. A., James, L. R., Van Alstine, J., Bennett, N., Lin, S., & Stilwel, C. D. (1989). Evaluation of goodness of fit Indices for structural equation models. *Psychological Bulletin, 105*(3), 430–445. DOI: 10.1037/0033-2909.105.3.430

Ngampornchai, A., & Adams, J. (2016). Students' acceptance and readiness for E-learning in Northeastern Thailand. *International Journal of Educational Technology in Higher Education, 13*(34), 1-13. DOI: 10.1186/s41239-016-0034-x

Nicholas-Omoregbe, O. S., Azeta, A. A., Chiazor, I. A., & Omoregbe, N. (2017). Predicting the adoption of e-learning management system: A case of selected private universities in Nigeria. *Turkish Online Journal of Distance Education*, *18*(2), 106-121. DOI: 10.17718/tojde.306563

Nistor, N., Göğüş, A., & Lerche, T. (2013). Educational technology acceptance across national and professional cultures: A European study. *Educational Technology Research and Development, 61*(4), 733-749. DOI: 10.1007/s11423-013-9292-7

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity*, *41*(5), 673-690. DOI: 10.1007/s11135-006-9018-6

Padhi, N. (2018). Acceptance and usability of OER in Indian higher education: An investigation using UTAUT model. *Open Praxis, 10*(1), 55-65. DOI: 10.5944/openpraxis.10.1.623

Podsakoff P. M., MacKenzie, S. B., Lee, J. –Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879-903. DOI: 10.1037/0021-9010.88.5.879

Prasad, P.W.C., Maag, A., Redestowicz, M., & Hoe, L. S. (2018). Unfamiliar technology: Reaction of international students to blended learning. *Computers & Education, 122,* 92-103. DOI: 10.1016/j.compedu.2018.03.016

Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of Educational Research, 99*(6), 323–337. DOI: 10.3200/JOER.99.6.323-338

Suki, N. M., & Suki, N. M. (2017). Determining students' behavioral intention to use animation and storytelling applying the UTAUT model: The moderating roles of gender and experience level. *The International Journal of Management Education, 15,* 528-538. DOI: 10.1016/j.ijme.2017.10.002

Šumak, B., & Šorgo, A. (2016). The acceptance and use of interactive whiteboards among teachers: Differences in UTAUT determinants between pre-and post-adopters. *Computers in Human Behavior, 64*, 602-620. DOI: 10.1016/j.chb.2016.07.037

Teo, T., & Noyes, J. (2014). Explaining the intention to use technology among pre-service teachers: A multi-group analysis of the unified theory of acceptance and use of technology. *Interactive Learning Environments, 22*(1), 51-66. DOI: 10.1080/10494820.2011.641674

Terlemez, M. S. (2016). YouTube channels as support materials in distance learning. *Journal of Educational and Instructional Studies, 6*(4), 77-88.

Ünlüsoy, A., de Haan, M., Leander, K., & Volker, B. (2013). Learning potential in youth's online networks: A multilevel approach. *Computers and Education, 68,* 522-533. DOI: 10.1016/j.compedu.2013.06.007

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478. DOI: 10.2307/30036540

Venkatesh, V., & Zhang, X. (2010). Unified theory of acceptance and use of technology: US vs. China. *Journal of Global Information Technology Management, 13*(1), 5-27. DOI: 1097198X.2010.10856507

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly, 36*(1), 157-178. DOI: 10.2307/41410412

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the Association for Information Systems, 17*(5), 328-376. DOI: 10.17705/1jais.00428

Vidaman, K. F., & Thompson, J. S. (2003). On specifying the null model for incremental fit indices in structural equation modeling. *Psychological Methods, 8*(1), 16–37. DOI: 10.1037/1082-989X.8.1.16

Wong, G. K. W. (2016). The behavioral intentions of Hong Kong primary teachers in adopting educational technology. *Educational Technology Research and Development, 64*(2), 313-338. DOI: 10.1007/s11423-016-9426-9

Wong, K. T., Teo, T., & Goh, P. S. C. (2015). Understanding the intention to use interactive whiteboards: Model development and testing. *Interactive Learning Environments, 23*(6), 731-747. DOI: 10.1080/10494820.2013.806932

Yueh, H. –P., Huang, J. –Y., & Chang, C. (2015). Exploring factors affecting students continued Wiki use for individual and collaborative learning: An extended UTAUT perspective. *Australasian Journal of Educational Technology, 31*(1), 16-31. DOI: 10.14742/ajet.170

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Octennial Review (2010-2018) of Literature on M-Learning for Promoting Distributed-Based Medical Education in Sub-Saharan Africa

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Abstract

Medical education in Africa is in desperate need of reforms, evident in widespread diseases, and an inability to mobilise and train the required medical workforce to deal with these health issues. However, the exponential rise in the use of mobile technologies due to the spread of the Internet and increased telecommunication networks offer an opportunity for the transformation of medical education and practice through the deployment of mobile devices as a medium for learning and conveying health care services to the remote and resource-constrained locations of Sub-Saharan Africa (SSA). This paper reviewed articles on the affordances of m-learning for distributed medical education in SSA published between 2010-2018. Results from 18 articles identified in the review revealed a slow-paced ascendancy of practice and research in the field; it further exposed competing priorities, infrastructural deficit, and chronic workforce shortages as the bane of m-learning implementation in the subregion. This paper makes recommendations that will enhance the growth of mobile-based distance medical education and practice in SSA.

Keywords: mobile learning, distributed learning, medical education, Sub-Saharan Africa

Introduction

Globally, the advent of the Internet has led to a progressive transformation in all facets of human activities. Amongst these, is the impact of Internet-driven technologies that have reshaped the educational landscape. It has become apparent that the traditional form of teaching and learning confined to the classroom is no longer efficient due to limited out of class collaboration and inadequate infrastructure (Africa-America Institute (AAI), 2015; Organisation for Economic Co-operation and Development (OECD), 2009). However, electronic learning (e-learning) has the affordances to accommodate more people, especially those with limited access to regular schooling (Yunusa & Dalhatu, 2014) as an alternative medium to education. The increasing rate of the remote and mobile workforce has resulted in the emergence of the use of mobile technologies for communication, collaboration, and exchange of occupational knowledge practices and training. Consequently, this has evolved into various forms of technology-enhanced learning solutions across human endeavour and the ubiquity of mobile devices for mobile learning is now potentially more revolutionary than e-learning (Okai-Ugbaje, Ardzejewska, & Ahmed, 2017).

Keegan (as cited in Ally, 2009) predicted that the future of mobile learning is "wireless," and today virtually all human activities are gradually transforming into online using several mobile devices and platforms. Sub-Saharan Africa (SSA) has the most significant number of adolescents and young adults in the world. The International Telecommunication Union (ITU) report (2016) on mobile cellular penetration indicate a mobile penetration rate of 65% in SSA. Relatedly, Masita-Mwangi, Mwakaba, Ronoh-Boreh and Impio (2012) note that 43% of the population in SSA is below the age of 15 years making the region the youngest region in the world. Consequent upon which many African countries are making efforts in widening access and creating opportunities for the expansion of the Higher Education institutions to accommodate these young adults. However, these efforts are ineffective due to the rising number of students with an average of 50% more students per professor in African universities compared to the global average AAI (as cited in Bervell & Umar, 2017).

One key aspect of education in sub-Saharan Africa that needs a technological intervention due to the problem above is medical education. The use of mobile learning offers opportunities for training more medical staff and promoting distance-based medical practices in Sub-Saharan Africa. Recently, authors such as Chaya, Pilot, and Urassa (2018); Lazarus, Sookrajh, and Satyapal (2017a) and Witt et al. (2016) had echoed the need for reforms in medical education and practice in SSA when they suggested the mobile learning paradigm. Recognising the need for mobile learning, these African medical practitioners have suggested that the adoption of mobile technologies and online courses will enable class sizes to increase dramatically in a short space of time and could potentially be significant in mobilising a medical workforce that is struggling with traditional modalities that cannot produce the desired results. The growth of these technologies across the world and Africa, in particular, has prompted some studies on the use of mobile devices in medical education in SSA (Adebara, Adebara, Olaide, Emmanuel, & Olanrewaju, 2017; Chaya, Pilot, & Urassa, 2018; Frehywot et al., 2013; Ibrahim, Salisu, Popoola, & Ibrahim 2014; Lazarus, Sookrajh, & Satyapal, 2017b; Masika et al., 2015; Witt et al., 2016b).

Koole (2009) defines mobile learning as "a process resulting from the convergence of mobile technologies, human learning capacities, and social interaction" (p.25). Accordingly, this definition placed m-learning within four central constructs namely, technological tools, context and social interactions buttressed by Krull and Duart (2017) and Naismith, Lonsdale, Vavoula, and Sharples

(2004). Tsinakos and Ally (2013) explain m-learning as "the processes of coming to know through conversations across multiple contexts amongst people and personal interactive technologies" (p. 225). Mobile medical education referred to as mobile health education (m-health) is the process in which smartphones are used to help educate and inform students in the medical field (Ayemoba, 2017). According to Urassa et al. (2018), m-health is an emerging trend in the Health Information System, and defined as the use of mobile technology, such as cellular phones, wireless devices, or radio frequency identification tags, for health care or health services.

Despite the growing amount of research on m-learning in Higher Education across the world (Kaliisa & Picard, 2017; Koole, 2009; Krull & Duart 2017; Tsinakos & Ally, 2013) there are few studies on its use in promoting medical education and practice in Sub-Saharan Africa. The World Health Organization (WHO) (2011) conducted a global survey on the explosion of m-health and telemedicine activities around the world. Even though the report provided some extracts on efforts at using mobile technologies to deliver health services and information to remotely located and resource-constrained communities, the outcome of this report indicated that out of the 114 countries surveyed, SSA had the least positive indices on initiatives in m-learning in medical education (WHO, 2011). Against this background, this paper reviewed published articles based on studies carried out in the subregion between 2010-2018, bringing to fore the trends, milestones, and barriers to effective implementation of mobile technology-based learning solutions in medical education and contributes a reference that will guide policy and practice in the subregion.

Forthrightly, the study sought to answer the following questions:

1. What is the distribution of studies in m-learning initiatives in Sub-Saharan Africa?
2. What are the research models and designs reported in articles on m-learning in medical education and practice in Sub-Saharan Africa?
3. What are the methodologies used to investigate m-learning in medical education and practice in SSA?
4. What are the determinant factors reported in m-learning studies in medical education in SSA?
5. What are the barriers to effective implementation of m-learning in medical education and practice in Sub-Saharan Africa?

Methodology

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol by Moher, Liberati, Tetzlaff, Altman, and Prisma Group. (2009). The PRISMA protocol is a step-by-step process to search, collect, analyse, synthesise, and report findings from the literature (see Figure 1). The first step was to search databases for studies on Mobile learning and Medical Education research in SSA. Search terms such as "m-learning," "m-health," "e-health," "mobile technologies," "medical education," "telemedicine," "adoption," "implementation," "mobile learning," and "Africa," were explored in prominent databases such as Google Scholar, Science Direct, Scopus, IEEE, PubMed, Microsoft Academic, and Institutional database. Reference pages of retrieved articles were screened for relevant studies for the review materials. The obtained articles were then sorted based on inclusion, exclusion, and eligibility criteria, and set out for the review (see Table 1). While, Table 2 depicts the summary of the reviewed studies.

Table 1

Eligibility Criteria for the Systematic Review of Studies of M-Learning in Medical Education in SSA

Inclusion criteria	**Exclusion criteria**
• Articles published in the English Language	• Articles published outside the SSA
• Articles based on m-learning, mHealth, and Telemedicine use in medical education and practice	• Articles that focused on Mobile Technology as a broad concept published earlier than 2010
• Articles published between 2010-2018	• Articles that focused on e-learning and open and distance learning usage and perception not in medical education
• Articles that are focused on sample size, subjects, and country of study	• Articles that focused on m-learning in third circle institutions (secondary schools)
• Articles that focused on research in m-learning research in medical education institutions in SSA	• Articles that were merely literature reviews on mobile technologies, e-learning, open and distance learning in Africa

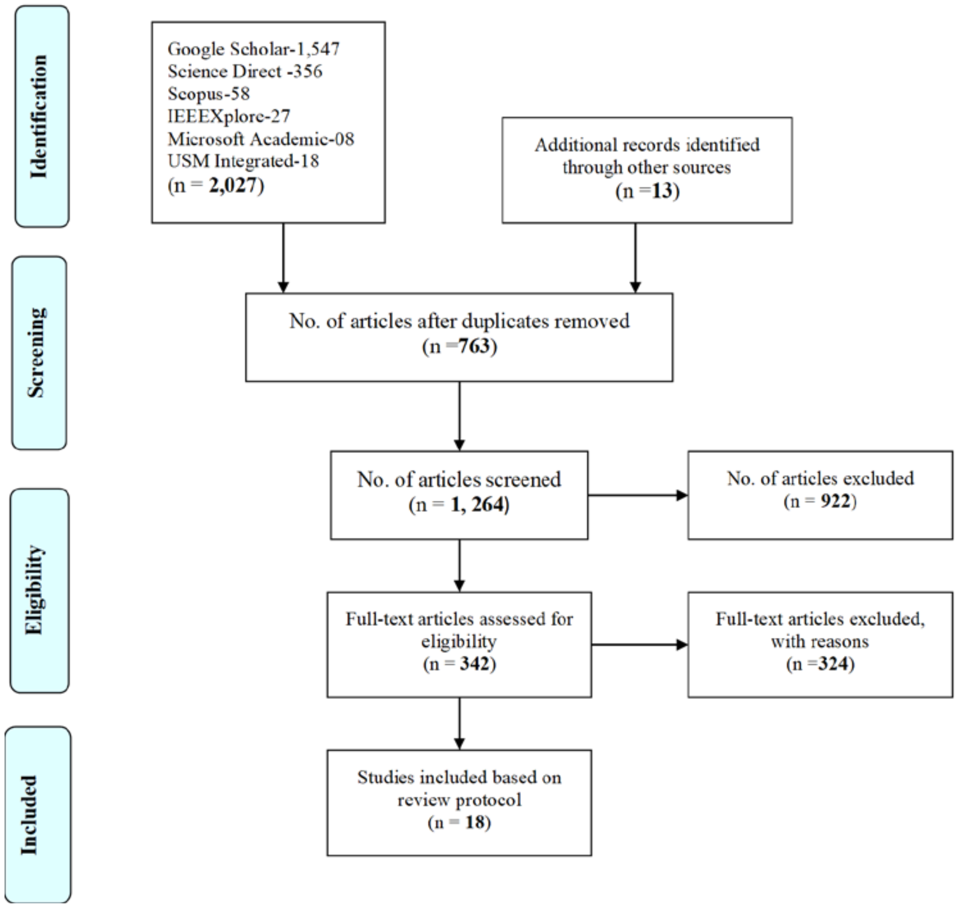

Figure 1. PRISMA article selection flowchart.

Analysis

Coding technique

1. Country: The articles were sorted based on the context of the studies and classified according to the geographical location of the subregion.

2. Design of the study: The review focused on three broad study designs namely; qualitative, quantitative, and mixed method (Creswell, 2013).

3. Theoretical framework: The review focused on the theories adopted or adapted for the studies on m-learning in medical education in sub-Saharan Africa.

4. Sample size: The sample size of subjects grouped into; small, medium, and large. coded as (≤150=small), (>150≤250=medium), and (>250=Large).

5. Subjects of the study: Subjects were; instructors, students (Interns), nurses, other health professionals or both.

6. Statistical tools: Instruments employed for data analysis were; qualitative thematic/narrative (Creswell,2013) and experimental and pilot studies; descriptive statistics; correlation, regression/General Linear Models /MANOVA; and Structural Equation Modelling technique-SEM (Kline, 2015).

7. Effective factors (milestones): significant achievements and factors determining the use of m-learning based on the findings of the studies.

8. Challenges: Challenges outlined by the findings of the studies in the use, adoption, or implementation of m-learning in medical education in thematic areas; system related; IT infrastructure; skills/training; technical support; leadership/management support; policy issues; personal issues; e-content/e-curriculum; and time constraints.

Table 2

Summary of Reviewed Studies

Author/ date	**Paper title**	**Country**	**Research design & instrument**	**Sample & subjects**	**Statistical analysis adopted in the studies**
Adebara et al. (2017)	Knowledge, Attitude and Willingness to Use mHealth Technology Among Doctors at a Semi-urban Tertiary Hospital in Nigeria	Nigeria	Quantitative. Questionnaire.	220 medical doctors.	Descriptive and inferential statistics (Chi-square).

Anokwa (2010)	Delivering Better HIV Care in Sub-Saharan Africa Using Phone-Based Clinical Summaries and Reminders	Sub-Saharan Africa (SSA; Kenya).	Design of software framework that delivers summaries and reminders to HIV patients.	4,500 patients.	Thematic narrative analysis.
Aryee (2014)	The Role of Mobile Phones in Health Education for Rural Communities in Ghana: An Exploratory Study in Digital Technologies	Ghana	Mixed Method (Questionnaire and interviews).	92 health workers.	Descriptive statistics.
Barteit et al. (2015)	Self-Directed E-Learning at a Tertiary Hospital in Malawi -A Qualitative Evaluation & Lessons Learnt	Malawi	Qualitative study, using face-to-face interviews, guided group discussions, and observations.	14 medical doctors, interns, and clinical officers.	Narrative analysis.
Bediang et al. (2013)	Computer Literacy and E-learning Perception in Cameroon: The Case of Yaounde Faculty of Medicine and Biomedical Sciences	Cameroon	Quantitative. Questionaire.	307 students, residents, and lecturers.	Descriptive statistics and chi-square.
Biruk, Yilma, Andualem, & Tilahun (2014)	Health Professionals Readiness to Implement an Electronic Medical Record System at Three Hospitals in Ethiopia: A Cross-Sectional Study	Ethiopia	Quantitative Cross-sectional design. Questionnaire.	606 medical health professionals.	Descriptive statistics, bivariate, and multivariate logistic regression.
Chang et al. (2012a)	Smartphone-Based Mobile Learning With Physician Trainees in Botswana	Botswana	Quasi-experimental design.	Trainee physicians (sample not specified)	Descriptive statistics.

Chang et al. (2012b)	Use of Mobile Learning by Resident Physicians in Botswana	Botswana	Quantitative. questionnaire.	Seven resident physicians	Descriptive statistics, and narrative analysis.
Feldacker et al. (2017)	Continuing Professional Development for Medical, Nursing, and Midwifery. Cadres in Malawi, Tanzania and South Africa: A Qualitative Evaluation	SSA (Malawi, Tanzania, and South Africa)	Mixed method (focus group discussion [FGD], key informant interview, and questionnaire).	89 healthcare workers.	Descriptive statistics.
Gupta, Marsden, Oluka, Sharma, & Lucas (2017)	Lessons Learned from Implementing E-Learning for the Education of Health Professionals in Resource-Constrained Countries	Uganda	Qualitative, using a case study approach (key informant interviews).	Three universities in Uganda.	Thematic narrative analysis.
Ibrahim et al. (2014)	Use of Smartphones Among Medical Students in the Clinical Years at a Medical School in Sub-Sahara Africa: A Pilot Study	Nigeria	Quantitative cross-sectional study. Questionnaire.	123 medical students.	Descriptive statistics.
Lazarus, et al. (2017)	Tablet Technology in Medical Education in South Africa: A Mixed Methods Study	South Africa	Mixed method/ questionaire, (open and closed-ended).	178 medical students.	Descriptive statistics and thematic analysis. for the open-ended questionnaire.
Masika et al. (2015)	Use of Mobile Learning Technology Among Final Year Medical Students in Kenya	Kenya	Cross-sectional descriptive study.	292 medical, nursing, pharmacy, and dental students.	Chi-square and t-test for bivariate analysis (regression).
Obi et al. (2018)	E-Learning Readiness From Perspectives of Medical Students: A Survey in Nigeria	Nigeria	Quantitative cross-sectional survey. Questionnaire.	284 medical students.	Descriptive statistics, analysis of variance (ANOVA), correlation, and multiple regression.

Olajubu, Odukoya, & Akinboro, (2014)	LWAs Computational Platform for E-Consultation Using Mobile Devices: Cases From Developing Nations	Nigeria	Experimental study, the design, development, and testing of a light weight agent (lwa) in mobile devices used for medical e-consultation in vulnerable areas of SSA.	Sample and subjects not specified.	Descriptive narrative.
Pimmer et al. (2014)	Informal Mobile Learning in Nurse Education and Practice in Remote Areas: A Case Study From Rural South Africa	South Africa	Qualitative study (interview and content analysis).	16 nurses, facilitators, and clinical managers.	Qualitative content analysis.
Urassa et al. (2018)	Addressing Knowledge Gaps among Nurses in Health Care in Tanzania: Use of Mlearning Platforms in Tanzania	Tanzania	Mixed method, questionnaire, and interview	428 active and dormant mobile-device users among nurses, and nursing officers.	Descriptive statistics.
Witt et al. (2016)	The Role of Tablets in Accessing Information Throughout Undergraduate Medical Education in Botswana	Botswana	Mixed method.	82 undergraduate medical students.	Descriptive statistics.

**Note.* Refer to the reference list for the full details of the publications in the table.

Results

Countries and Parts of Sub-Saharan Africa That Contributed to M-Learning Studies in Medical Education and Practice

Table 3 presents the results on the geographical spread of articles on m-learning in medical education in Sub-Saharan Africa:

Table 3

Spread of Articles on M-Learning, M-Health, and Telemedicine in Medical Education in SSA

Country	Subregion	No. of studies	%	No. of studies by subregion	%
Cameroon	Central Africa	01	5.6	01	5.6

Kenya	Eastern Africa	02	11.1	04	22.2
Tanzania	Eastern Africa	01	5.6	-	
Uganda	Eastern Africa	01	5.6	-	
Malawi	South-Eastern Africa	01	5.6	01	5.6
Botswana	Southern Africa	03	16.6	05	27.8
South Africa	Southern Africa	02	11.1	-	-
Sub-Saharan Africa	SSA	02	11.1	02	11.1
Ghana	Western Africa	01	5.6	05	27.8%
Nigeria	Western Africa	04	22.2	-	
Total		18	100%	18	100%

Table 3 shows that studies on m-learning spanned across nine countries with two studies that were on the state of m-learning in Sub-Saharan Africa in general, without country specification. Southern and western Africa had five studies, eastern Africa produced four, while central Africa and south-eastern Africa had a study each. Based on countries, Nigeria had four studies (22.2%) which were the highest number of studies followed by Botswana with three (16.6%). Kenya and South-Africa had two studies each, which is (11.1%). Tanzania, Uganda, Malawi, and Ghana had one study each (5.6%). The spread of the studies is in Figure 2.

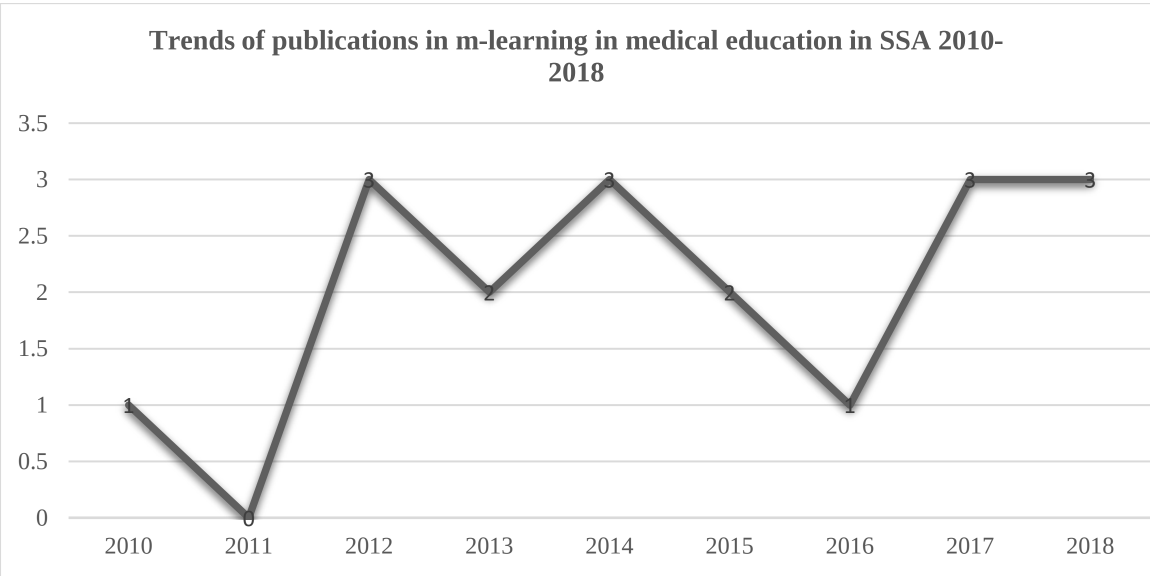

Figure 2. Trends of articles on m-learning in SSA 2010-2018.

The graphical details in Figure 2 show a relative consistency in the number of studies published on a yearly basis between 2010 and 2018. In 2011, there were no studies on m-learning in medical education, but the rest of the years had two studies, with a maximum of three studies recorded in 2018. In totality, this represents an average of one study per year for m-learning in medical education within the subregion.

The Methodology Employed in Studies of M-Learning in Medical Education in SSA

Regarding research question three, the methodologies or approaches employed included; research design, data collection, subjects, sample size, and statistical tools used for the analysis.

Study Design and Instruments

The aspects of the methodology assessed were the research design and instruments adopted by the various studies, as presented in Table 4.

Table 4

Research Design and Instruments for the Reviews of M-Learning in Medical Education (ME) in SSA

Design	No. of Studies	%	Instruments		
			Questionnaires	Interview	Both questionnaire & interview
Qualitative	03	16.7%	03(16.7%)		
Quantitative	07	38.8%		07(38.8%)	
Mixed Method	05	27.8%			05(27.7%)
Experimental (Feasibility/Pilot)	03	16.7%			03(16.7%)
Total	18	100%			

Table 4 shows that a quantitative research design dominated most of the studies as seven (38.8%) out the total studies employed this research design, followed by the mixed method approach with five (27.8%), while qualitative and experimental design were the least used design. For data collection, the questionnaire was the most dominant instrument, used in seven studies representing 38.8%. A mixed method (i.e. survey and interview) was used in five studies (27.8%) while the least used research design was experimental (16.7%).

Subjects and Sample Size

The subjects selected for the studies and their corresponding sample sizes are featured in Table 5.

Table 5

Subjects and Sample Sizes

Subjects format	No. of studies	%	Sample size		
			≤100=Small	>150≤250=Medium	>250=Large
Medical doctors (instructors)	02	11.1%	01(5.55%)	-	01(5.55%)
Trainee physicians, doctors (interns) students	05	27.8%	03(16.7%)	01(5.56%)	01(5.56%)
Both instructors (doctors) &	02	11.1%	01(5.55)	-	01(5.55%)

medical students					
Doctors, health professionals including nurses (combined)	**06**	**33.3%**	**03(16.65%)**	**-.**	**03(16.65%)**
Patients & institutions (experimental studies)	**03**	**16.6%**	**02(11.1%)**	**-**	**01(5.53%)**
Total	**18**	**100%**	**10 (55.5%)**	**01(5.5%)**	**07 (38.9%)**

Table 5 indicates that six studies (33.3%) used medical doctors, healthcare workers, and interns/ physician trainees as subjects of their studies, followed by five studies with trainee physicians and doctors only as their subjects. Two studies constituting 27.8%, used medical doctors only as their subjects (i.e. 11.1%), while another two studies used both instructors (doctors) and medical students (11.1%). Other studies that focused on medical institutions, in general, were experimental and based on pilot testing. This method constituted three studies (16.6%) of the total number of studies. With regards to sampling sizes, ten studies used small sample sizes (55.5%) while seven studies used large samples (38.9%), and only one study used medium size sample for their research. The results revealed that most of the studies used small sample sizes.

Statistical Tools Employed for the Analysis

The quality and reliability of research findings lie with the analytical tools used for the analysis of the study. In that respect, this study sought to find out and aggregate the analytical tools used in the studies on m-learning in medical education in SSA as depicted in Table 6.

Table 6

Statistical Tools in the Research and Data Analysis

Statistical tool	No. of studies	%
Thematic/ narrative	05	27.7%
Descriptive	08	44.4%
Correlation	01	5.7%
Regression/Chi-square/GLMs/ MANOVA	04	22.2%
Structural equation modelling (SEM)	Nil	00%
Total	18	100%

As shown in Table 6, eight studies (44.4%) used descriptive statistics, i.e. simple frequencies and percentages to analyse their data. Five studies used thematic and narrative analysis for their data analysis, especially for qualitative data. Four studies employed predictive and group difference analysis tools to analyse their data (22.2%). The least used statistical tool was a correlation which was featured in only one study (5.7%).

Effective Factors/Milestones Determining M-Learning in Medical Education in SSA

In response to research question four of this review, the study catalogued various factors reported across the reviewed studies as determinants or milestones of m-learning use or adoption. Results from the analysis produced ten elements and their frequencies of occurrence as represented in Figure 3.

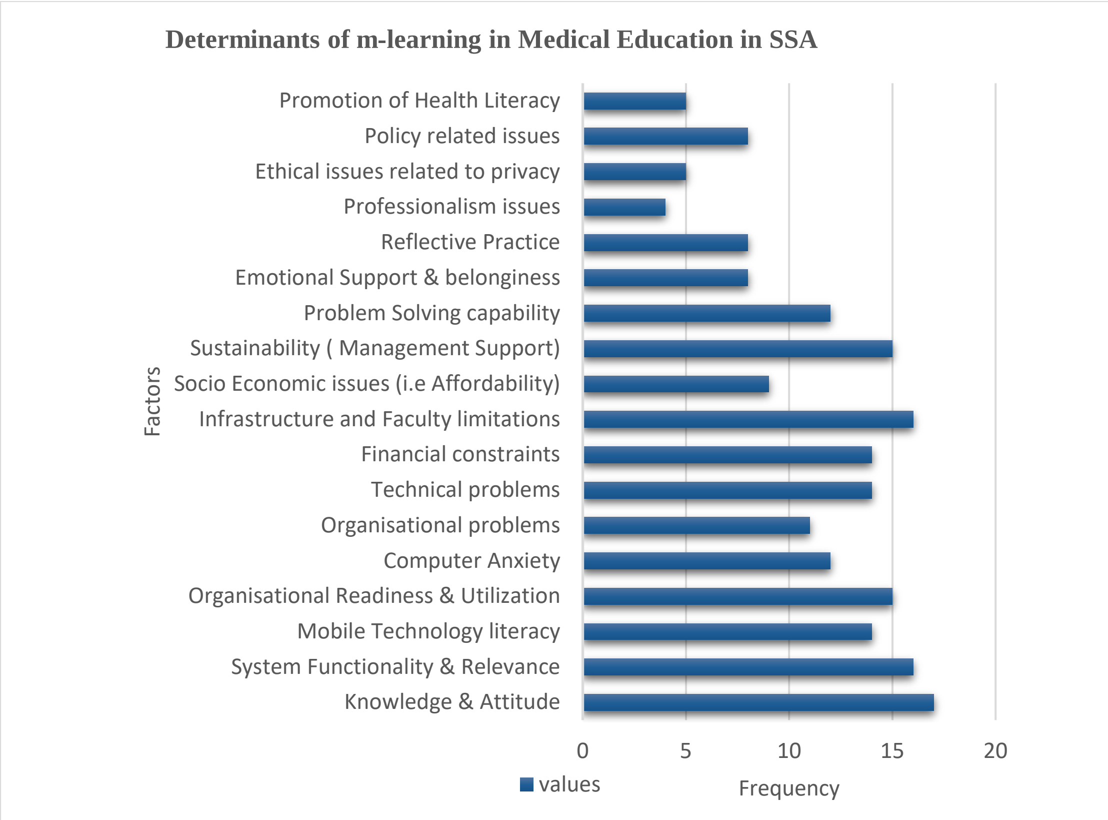

*Figure 3***.** Determinants of m-learning in SSA.

Figure 3 represents the frequency of factors that determine the use and adoption of m-learning in Sub-Saharan Africa. Knowledge and attitude had the highest rate of occurrence of 17, followed by system functionality, relevance, and infrastructural and faculty limitations with 16. Organisational readiness and sustainability 15, mobile technology literacy, financial constraints, and technical problems had 14, while professionalism and ethical issues related to the use of m-learning had the least frequency of 4 and 5 respectively.

Challenges Involved in M-Learning Implementation in Medical Education in SSA

The outcome of problems in the reviewed studies is depicted in Figure 4.

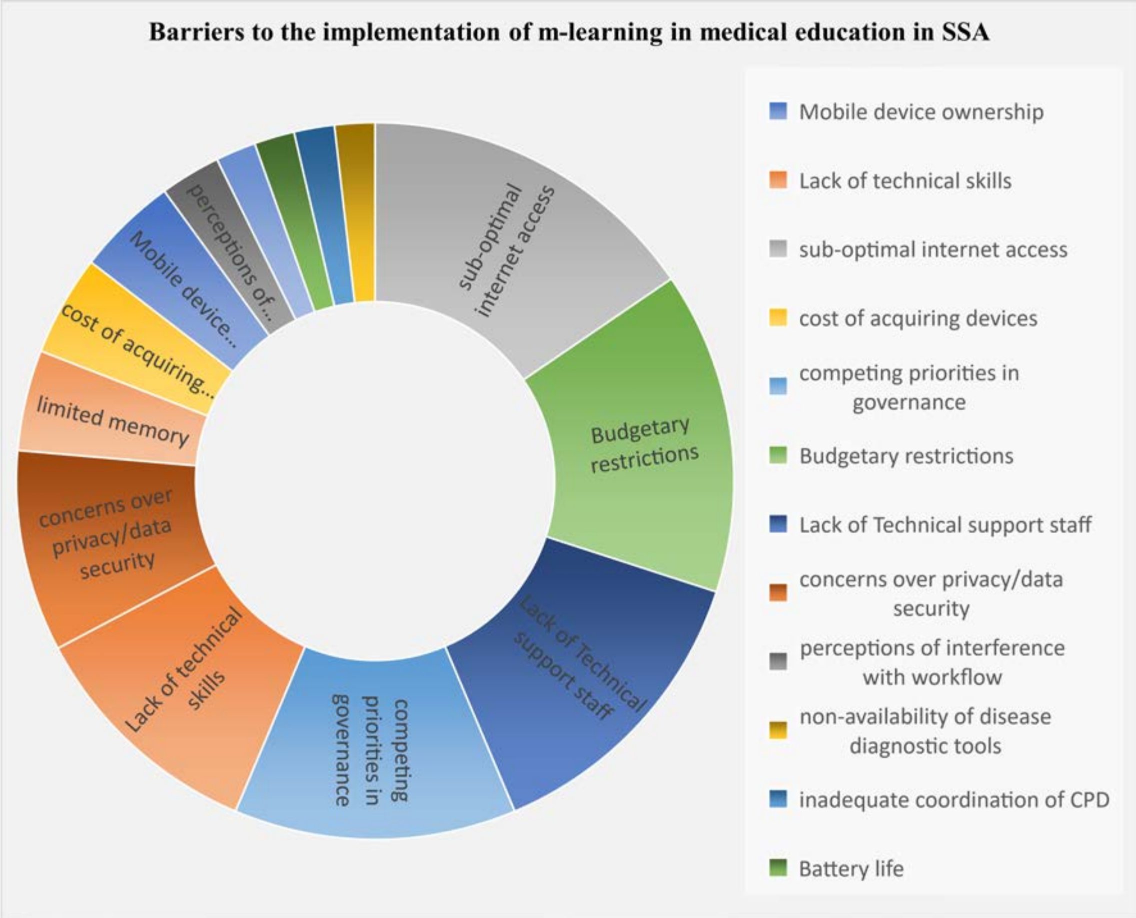

*Figure 4***.** Sunburst chart of barriers to the implementation of m-learning in SSA.

Figure 4 highlights the challenges to effective implementation of m-learning in medical education in Sub-Saharan Africa. These challenges include: mobile device ownership; lack of technical skills; sub-optimal Internet access; cost of acquiring the devices; competing priorities in governance; budgetary restrictions; technical staff shortages; concerns over privacy; perception of interference with clinical workflow; absence of disease diagnostic tools; inadequate coordination of continuous professional development; battery life; small screen; and limited memory. Out of this broad range of challenges, 17 studies (94.4%) reported sub-optimal Internet access as a significant barrier, while 16 studies (88.9%) reported budgetary restrictions as a major hindrance to implementing m-learning in medical education in SSA. Fifteen studies (83%) said technical staff shortages was a barrier. Additionally, 14 (77.8%) reported competing priorities in governance as a determinant factor with 12 studies (66.7%) reporting a lack of technical skills. The least challenges in the reviewed studies include: battery life 2 (11.1%) and small screen 2 (11.1%).

Discussion, Recommendations, and Conclusion

The aggregate of the reviewed studies on m-learning in medical education in Sub-Saharan Africa indicated that western and southern Africa contributed more studies in m-learning in medical education. The outcome was because four studies were from Nigeria, and one was from Ghana, while

Botswana and South Africa had three studies and two studies respectively. These subregions; southern and western Africa, are home to two of the most economically advanced countries in Africa as corroborated by Okai-Ugbaje, Ardzejewska, and Ahmed (2017) and Bervell and Umar (2017). The authors reported that world bank classification of countries in the region by income placed South Africa as an upper middle-income country while Ghana, Nigeria, Kenya, Tanzania, Uganda, and Botswana as lower-middle-income countries with potentials for further growth (Bervell & Umar, 2017). Since the significant determinants of effective implementation of technological innovation are infrastructure, financial constraints and competing priorities, possessing higher income means that the governments have committed enough resources in providing support for Information Technology and ICT resources in Higher Education. Consequently, this has resulted in more projects and research activities in e-learning and the integration of technologies in Higher Education, especially in medical education and practice.

Another reason for the seemingly encouraging interest in research on m-learning in medical education in Sub-Saharan Africa is the exponential rise in Internet penetration in the region (Anokwa, 2010). It is also instructive to note the relatively inexpensive features coupled with the affordances of mobile technologies also contributed to facilitating patient care and collaboration. Overall, the need to provide access to health services in remote and resource-constrained communities makes continuous research efforts in mobile technologies in medical education and practice defendable. Authors such as Chen et al. (2012), Feldacker et al. (2017), Pimmer et al. (2014), and Urassa et al. (2018), were all in agreement that m-learning programs have made significant impacts in places deployed. Furthermore, the World Health Organization (2011) reported that the quantum of mobile network penetration in SSA had surpassed infrastructure and Internet deployment. Nonetheless, higher income countries show more e-health activities than low-income countries. These advances may have culminated in the innovative application of mobile technologies to address health needs, thereby making the intersection of networked technology and health in developing countries become of utmost importance.

Instances of these remarkable innovative studies were in Ghana, where Aryee (2014) reported the practical use of mobile phones for inquiring about health concerns, practising teleconsultation, and for scrutinising counterfeit medications. The activity directly contributed to the successes recorded in the Mobile Doctors Network (MDnet) in 2009 (WHO, 2011). In a similar vein, Wasserman (2012) reported a significant increase in medical school enrolment in SSA which prompted the use of m-learning as a solution for providing easy access to learning materials and encouraging interaction amongst nurses in Tanzania. However, to have an effective continuous professional development program that will help in mitigating the impact of chronic diseases such as tuberculosis and HIV, there must be sustainable financial resources to provide the infrastructure that will lead to increased capacity and skills of the healthcare workers (Feldacker et al., 2017).

The results as presented in this study may be considered abysmal against the background that sub-Saharan Africa comprises of 48 countries out of which only nine states produced the number of reviewed articles (18). This supposedly indicates the low level of m-learning use in medical education in the subregion and holds promise for further research in that domain.

On models and designs adopted in research on m-learning, the review found out that there were no research models or conceptual models used in all the studies included in the report. Models are important because they provide powerful ways to address key information system research problems such as understanding information technology usage (Chin & Todd, 1995). Also, Borner (as cited in, Baltimore, Charo, & Kevles, 2016) asserts that models of technology and innovation help to inform policy decisions in education, health care, and other sectors which empower experts to make informed recommendations and predictions. Against this backdrop, model-based research will be constructive since m-learning is an attempt to improve the teaching and learning process in medical education, an approach that involves the use of mobile technologies for instructional, collaboration, and remote access to materials for just-in-time learning (Frehywot et al., 2013). However most of the studies in this review dwelled on practical solutions such as testing the effectiveness of smartphone (Android-based) applications with point-of-care programs for seeking medical information (Chang et al., 2012) and expert system developed to ease communication between doctors and health personnel across remote locations (Olajubu et al. 2014).

Regarding research design and instruments used in m-learning in medical education research in SSA, most of the reviewed studies applied the quantitative research design. Although the quantitative design is a standard measure and an excellent way of finalising results in the scientific field, its limitation is not accommodating findings that could augment the analysis Creswell (as cited in Bervell and Umar, 2017). However, a qualitative design was used in three of the studies, while a mixed method design was featured in five of the reviews. The authors are of the view that mixed method research approaches offer better ways to explain and understand the complexities of the organisational, social, and scientific phenomenon.

The study also revealed the use of all health personnel within the health care system as the most recurring subjects in the studies. This is understandably so as the interrelationship that exists between these actors in the implementation of any technology intervention in the health sector is critical to its success.

The dominant statistical tool adopted for data analysis in the studies on m-learning in medical education in SSA was descriptive statistics. The thematic narrative was the next most used statistical tool, and regression and Chi-square analysis appeared in only four studies. As outlined by Trochim (2006), descriptive statistics are used to describe the essential features of the data in a survey by porviding simple summaries about the sample and the measures. Using simple graphical analysis, they form the basis of virtually every quantitative analysis of data (Trochim, 2006). Perhaps, it is the most prevalent in health and medical research because it addresses visible and practical scientific evidence regarding what is or what the data shows or represents. However, relying only on descriptive statistics eliminates important relationships within mobile learning and even further makes it difficult in predicting the occurrence of other variable based on their predictors (Miles, Huberman, & Saldaña, 2014).

The significant determinants of m-learning in medical education implementation revealed were infrastructure and faculty limitations; competing priorities; budget constraints; system functionality and relevance; sustainability; socio-economic issues (affordability); promotion of health literacy; ethical issues related to privacy; emotional support and belongingness; knowledge and attitude; and mobile technology literacy and technical issues. Some of the studies reported on efforts to satisfy these factors or overcome the constraints. Gupta, Marsden, Oluka, Sharma, and Lucas (2017) suggested that to overcome issues of sub-optimal Internet connectivity (IT infrastructure) and network performance, intervention models like fair usage policy; network monitoring; effective enforcement of access regulations; and the use of user authentication systems should be adopted. For these interventions to succeed, there must be international solidarity and public/private partnerships to tackle the problems of shortage as recommended by Chenault (2011).

Recognising the critical role of evaluation on the success of policy implementation and change management across contexts, the WHO Global Observatory (2011) recommended continual evaluation of health systems, to come up with empirical evidence upon which policymakers, administrators and other stakeholders in SSA, can base their policy decisions. Investigating attitudes towards mobile technology in medical education, Adebara, Adebara, Olaide, Emmanuel, and Olanrewaju (2017), Ibrahim, Salisu, Popoola, and Ibrahim (2014), and Obi et al. (2018) reported participants demonstrated a positive attitude towards the of use mobile technology in medical education and practice. Conversely, this has a substantial effect on the acceptance of the technology and vice versa (Adebara et al., 2017; Ibrahim et al., 2014; Obi et al., 2018). However, the attitude of medical students and physicians or doctors is influenced by some specific factors such as; awareness, skills, training, and availability of the relevant infrastructure (Adebara et al., 2017; Ibrahim et al., 2014; Obi et al., 2018). With this, the success or otherwise of m-learning in medical education implementation in SSA depends on how to overcome the myriads of problems identified by the studies in the review.

Despite the challenges to the integration of mobile learning in health education in SSA, authors such as Pimmer et al. (2014) and Masita-Mwangi et al. (2012) identified the ways in which mobile learning contributes to health education such as; authentic problem solving; reflective practice; realisation of unpredictable teaching situations and lifelong learning. Mobile and smartphones support a broad range of educational practices in informal and clinical environments, especially for clinical examination and capturing of clinical events. Relating the outcome of their studies, Urassa et al. (2018) assert that mobile learning encourages more interaction in education and enhances self-directed learning. Adjorlolo and Ellingsen (2013) indicate that the use of mobile phones facilitates ICT support in patient care and collaborations that have their foundation on m-learning in health personnel training. This underscores the need for leadership across the Higher Education landscape, especially in medical education in sub-Saharan Africa, to do a comprehensive evaluation of the existing system. A thorough analysis of the research on ICT and technology-based solutions will inform decisions that will galvanise effort towards improved access and health care delivery at all levels (especially in resource-constrained communities). In furtherance of these objectives, Masika et al. (2015) recommends the public-private-partnership model, which considers the scarcity of resources in most SSA countries.

Recommendations for Future Research

Based on the findings of the review the following recommendations are proposed:

1. Given that our study revealed simple descriptive statistics as the most used analysis, we suggest that future studies focus on studies in m-learning adoption and acceptance that may reveal the use of advanced statistical tools in medical and healthcare education research in SSA.

2. There is a need for more research in medical education and practice primarily in the use of mobile technologies as only nine countries out of 48 African sub-Sahara nations met the inclusion criteria. Also, future studies should address the limitation of our study by extending the scope to include other African countries and beyond.

Recommendations for Policy and Practice

1. Governments across the sub-Sahara region and institutional leadership in Higher Education Institutions should realign their priorities for human capital development by allocating more funds for critical infrastructural provision (that addresses poor bandwidth, sub-optimal Internet access etc.) and training and retraining of the workforce to foster the growth and development of m-learning in medical education and practice in the region.

2. Oyo and Kalema (2014)'s postulated baseline requirements for the adoption of any form of e-Learning technology are worth noting here, and include:

    - The formation and funding of a hub for the coordination of the e-learning platform (be it m-learning in medical education, or in any other technology-mediated platform);

    - Development of contents, curricula, and program accreditation for m-learning;

    - The content delivery mechanism for m-learning in ODL;

    - Provision of access to computers, the Internet, and mobile technologies and applications; and

    - Adequate funding of mobile learning projects.

Conclusion

This paper reviewed articles on mobile learning research trends and challenges to its implementation in medical education in SSA between 2010 to 2018. It identified the research designs, subjects, sample size, and instruments and statistical tools employed for the analysis in the studies. Additionally, the paper focused on the factors determining m-learning adoption and associated barriers to medical education in SSA. The study provided an overview of the state of the literature in that domain and sought to guide the direction of future studies, policy, and practice. Mtebe and Raphael (2018) opined that the proliferation of mobile phones in SSA and the emergence of fibre optical marine cable and adoption of various electronic learning systems would continue to increase, making the need for effective strategies to leverage these technologies very critical. However, we conclude this discussion anchoring on Traxler (2009)'s view on mobile learning: "mobile learning is uniquely suited to support context-specific and immediate learning, it is a major opportunity for distance learning since mobile technologies can situate learners and connect learners" (p.18). Mobile learning is indeed an opportunity for addressing the challenges of educational, social, political, and economic development of all resource constrained economies in general and of SSA in particular.

Limitations

1. The review concentrated on articles written in the English language on mobile learning, mobile health, and Telemedicine based on research in medical education and practice in SSA without considering studies done in other African languages.

2. The review focused on m-learning without considering other aspects of technology intervention in Healthcare systems in Africa.

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References

Adebara, O., Adebara, I., Olaide, R., Emmanuel, G., & Olanrewaju, O. (2017). Knowledge, attitude, and willingness to use m-health technology among doctors at a semi-urban tertiary hospital in Nigeria. *Journal of Advances in Medicine and Medical Research*, *22*(8), 1-10. Retrieved from http://www.journalrepository.org/media/journals/JAMMR_64/2017/Jul/Adebara2282017JAMMR33232.pdf

Adjorlolo, S., & Ellingsen, G. (2013). Readiness assessment for implementation of electronic patient record in Ghana: A case of University of Ghana hospital. *Journal of Health Informatics in Developing Countries 7*(2), 128-140. Retrieved from http://www.jhidc.org/index.php/jhidc/article/view/104

Africa-America Institute. (2015). AAI-SOE-report-2015-final. *The State of Education in Africa Report 2015*. Retrieved from http://www.aaionline.org/wp-content/uploads/2015/09/AAI-SOE-report-2015-final.pdf

Ally, M. (2009). Mobile learning is transforming the delivery of education and training. *MIS Quarterly*, *3*(2), 137-152. https://doi.org/10.1111/j.1467-8535.2007.00809.x

Anokwa, Y. (2010). Delivering better HIV care in sub-Saharan Africa using phone-based clinical summaries and reminders. *America*, 1-27. Retrieved from http://anokwa.com/publications/2010_UW_Generals_Paper.pdf

Aryee., K. L. (2014). *The role of mobile phones in health education for rural communities in Ghana: An exploratory study in digital technologies*. Retrieved from https://ir.lib.uwo.ca/etd/2030/

Baltimore, D., Charo, R. A., & Kevles, D. J. (2016). Summit on human gene editing. *National Academies of Sciences*, 61-69. Retrieved from https://www.nbp.pl/badania/seminaria/25x2016_2.pdf

Barteit, S., Hoepffner, P., Huwendiek, S., Karamagi, A., Munthali, C., Theurer, A., & Neuhann, F. (2015). Self-directed e-learning at a tertiary hospital in Malawi–A qualitative Evaluation and Lessons learnt. *GMS Zeitschrift für medizinische Ausbildung [GMS journal for medical education]*, *32*(1). doi: 10.3205/zma000949

Bediang, G., Stoll, B., Geissbuhler, A., Klohn, A. M., Stuckelberger, A., Nko'o, S., & Chastonay, P. (2013). Computer literacy and E-learning perception in Cameroon: the case of Yaounde Faculty of Medicine and Biomedical Sciences. *BMC Medical Education*, *13*(1), 57. https://doi.org/10.1186/1472-6920-13-57

Bervell, B., & Umar, I. N. (2017). A decade of LMS acceptance and adoption research in sub-Sahara African Higher Education: A systematic review of models, methodologies, milestones, and main challenges. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(11), 7269-7286. https://doi.org/10.12973/ejmste/79444

Biruk, S., Yilma, T., Andualem, M., & Tilahun, B. (2014). Health professionals' readiness to implement electronic medical record system at three hospitals in Ethiopia: A cross sectional study. *BMC medical informatics and decision making*, *14*(1), 115. https://doi.org/10.1186/s12911-014-

0115-5

Chang, A. Y., Littman-Quinn, R., Ketshogileng, D., Chandra, A., Rijken, T., Ghose, S. ... Kovarik, C. L. (2012a). Smartphone-based mobile learning with physician trainees in Botswana. *International Journal of Mobile and Blended Learning*, *4*(2),1-14. https://doi.org/10.4018/jmbl.2012040101

Chang, A. Y., Ghose, S., Littman-Quinn, R., Anolik, R. B., Kyer, A., Mazhani, L. ... & Kovarik, C. L. (2012b). Use of mobile learning by resident physicians in Botswana. *Telemedicine and e-Health*, *18* (1), 11-13. https://doi.org/10.1089/tmj.2011.0050

Chen, C., Buch, E., Wassermann, T., Frehywot, S., Mullan, F., Omaswa, F., ... Olapade-Olaopa, E. O. (2012). A survey of sub-Saharan African medical schools. *Human Resources for Health*, *10*(1), 4. https://doi.org/10.1186/1478-4491-10-4

Chenault, J. (2011). Investigating and improving medical education and library resources at the Tamale teaching hospital in Northern Ghana : A case report. *Kentucky Libraries*, *76*(2), 16-24. Retrieved from https://ir.library.louisville.edu/faculty/11

Chin, W. W., & Todd, P. A. (1995). On the use, usefulness, and ease of use of structural equation modelling in MIS research: A note of caution. *MIS Quarterly*, *19*(2), 237-246. https://doi.org/10.2307/249690

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, California, US: Sage Publications.

Feldacker, C., Pintye, J., Jacob, S., Chung, M. H., Middleton, L., Iliffe, J., & Kim, H. N. (2017). Continuing professional development for medical, nursing, and midwifery cadres in Malawi, Tanzania, and South Africa: A qualitative evaluation. *PLoS ONE*, *12*(10), 1-16. https://doi.org/10.1371/journal.pone.0186074

Frehywot, S., Vovides, Y., Talib, Z., Mikhail, N., Ross, H., Wohltjen, H., ... Scott, J. (2013). E-learning in medical education in resource-constrained low- and middle-income countries. *Human Resources for Health*, *11*(1), 1. https://doi.org/10.1186/1478-4491-11-4

Gupta, M., Marsden, S., Oluka, T., Sharma, R., & Lucas, H. (2017). Lessons learned from implementing E-learning for the education of health professionals in resource-constrained countries. *Electronic Journal of E-Learning*, *15*(2), 144-155. Retrieved from http://www.ejel.org/volume15/issue2

Ibrahim, N. A., Salisu, M., Popoola, A. A., & Ibrahim, T. I. (2014). Use of smartphones among medical students in the clinical years at a medical school in Sub-Sahara Africa: A pilot study. *Journal of Mobile Technology in Medicine*, *3*(2), 28-34. https://doi.org/10.7309/jmtm.3.2.5

International Telecommunications Union. (2016). ICT facts and figures 2016. Retrieved from http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf

Kaliisa, R., & Picard, M. (2017). A systematic review of mobile learning in Higher Education: The African perspective. *The Turkish Online Journal of Educational Technology*, *16*(1), 1-18. https://doi.org/10.1017/CBO9781107415324.004

Koole, M. L. (2009). A model for framing mobile learning. In M. Ally (Ed.), *Mobile learning: Transforming the delivery of education and training*. (*1*(2), pp. 25-47). Edmonton, Canada: Athabasca University Press. Retrieved from https://books.google.com.ng/books?id=Itp60WteuJsC

Krull, G. E., & Duart, J. D. (2017). Research trends in mobile learning in Higher Education: A systematic review of articles (2011-2015). *The International Review of Research in Open and Distributed Learning*, *18*(7), 1-23. https://doi.org/10.19173/irrodl.v18i7.2893

Lazarus, L., Sookrajh, R., & Satyapal, K. S. (2017a). Tablet technology in medical education in South Africa: A mixed methods study. *BMJ Open*, *7*(7), 1-10. https://doi.org/10.1136/bmjopen-2016-013871

Lazarus, L., Sookrajh, R., & Satyapal, K. S. (2017b). Tablet technology in medical education in South Africa: A mixed methods study. *BMJ Open*, *7*(7), 1-10. https://doi.org/10.1136/bmjopen-2016-01387

Masika, M. M., Omondi, G. B., Natembeya, D. S., Mugane, E. M., Bosire, K. O., & Kibwage, I. O. (2015). Use of mobile learning technology among final year medical students in Kenya. *Pan African Medical Journal, 21*, 1-12. https://doi.org/10.11604/pamj.2015.21.127.6185

Masita-Mwangi, M., Mwakaba, N., Ronoh-Boreh, F., & Impio, J. (2012). Building a case for m-learning in Africa. *Proceedings of the 2012 ACM Annual Conference Extended Abstracts on Human Factors in Computing Systems Extended Abstracts - CHI EA '12*, 521. https://doi.org/10.1145/2212776.2212827

Miles, M. B., Huberman, M. A., & Saldaña, J. (2014). Qualitative data analysis. A methods sourcebook. *Zeitschrift Für Personalforschung [Journal For Personal Research], 28*(4), 485-487. https://doi.org/10.1136/ebnurs.2011.100352

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Prisma Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Medicine*, *6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Mtebe, J. S., & Raphael, C. (2018). Key factors in learners' satisfaction with the e-learning system at the University of Dar es Salaam, Tanzania. *Australasian Journal of Educational Technology*, *34*(4), 107-122. https://doi.org/10.14742/ajet.2993

Naismith, L., Lonsdale, P., Vavoula, G., & Sharples, M. (2004). Literature review in mobile technologies and learning. *Educational Technology*, *11*, 1-25. https://doi.org/ISBN:0-9548594-1-3

Obi, I. E., Charles-Okoli, A. N., Agunwa, C. C., Omotowo, B. I., Ndu, A. C., & Agwu-Umahi, O. R. (2018). E-learning readiness from perspectives of medical students: A survey in Nigeria.

Nigerian Journal of Clinical Practice, *21*(3), 293-300. https://doi.org/10.4103/njcp.njcp_108_17

Okai-Ugbaje, S., Ardzejewska, K., & Ahmed, I. (2017). A systematic review of mobile learning adoption in Higher Education: The African perspective. *I-manager's Journal on Mobile Applications and Technologies*, *4*(2), 1. doi: 10.26634/jmt.4.2.13830

Olajubu, E. A., Odukoya, O. H., & Akinboro, S. A. (2014). LWAs computational platform for e-consultation using mobile devices: Cases from developing nations. *Technology and Health Care*, *22*(4), 561-571. https://doi.org/10.3233/THC-140828

Organisation for Economic Co-operation and Development (OECD) (2009). *Teaching practices, teachers' beliefs and attitudes: Creating effective teaching and learning environments: first results from TALIS*. OECD. https://dx.doi.org/10.1787/9789264068780-6-en

Oyo, B., & Kalema, B. M. (2014). Massive open online courses for Africa by Africa. *The International Review of Research in Open and Distributed Learning*, *15*(6), 1-13. https://doi.org/10.19173/irrodl.v15i6.1889

Pimmer, C., Brysiewicz, P., Linxen, S., Walters, F., Chipps, J., & Gröhbiel, U. (2014). Informal mobile learning in nurse education and practice in a remote areas: A case study from rural South Africa. *Nurse Education Today*, *34*(11), 1398-1404. https://doi.org/10.1016/j.nedt.2014.03.013

Traxler, J. (2009). The current state of mobile learning. In M. Ally (Ed.), *Mobile learning: Transforming the delivery of education and training* (Vol. 1, pp. 9-24). Edmonton, AB: Athabasca University Press.

Trochim, W. M. K. (2006). *The research methods knowledge base* (2nd ed.). Cincinnati, OH: Atomic Dog Publishing. Retrieved from https://doi.org/10.2471/BLT.05.029181

Tsinakos, A., & Ally, M. (2013). *Global mobile learning implementations and trends*. *Academia.Edu*. Retrieved from http://www.academia.edu/download/36240447/global_Mobile_Learning.pdf#page=31%

Urassa, D., Chaya, P., & Pilot, J. (2018). Addressing knowledge gaps among nurses in healthcare in Tanzania: Use of m-learning platforms in Tanzania. *Global Journal of Human Social Science* *18*(1), 54-61.

Witt, R. E., Kebaetse, M. B., Holmes, J. H., Ryan, L. Q., Ketshogileng, D., Antwi, C., ... Nkomazana, O. (2016a). The role of tablets in accessing information throughout undergraduate medical education in Botswana. *International Journal of Medical Informatics*. *88*, 71-77. https://doi.org/10.1016/j.ijmedinf.2016.01.006

World Health Organization. (2011). M-Health: New horizons for health through mobile technologies. *Observatory*, *3*, 66-71. https://doi.org/10.4258/hir.2012.18.3.231

Yunusa, A. A., & Dalhatu, I. I. (2014). Blended learning technique: Rethinking pedagogical approaches in sandwich / B.Ed art-time degree programmes in Nigerian universities. *International Journal of Topical Issues in Education, Maiden Edition*, 58-68. Retrieved from http://oer.udusok.edu.ng:8080/xmlui/handle/123456789/781

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Competency Profile of the Digital and Online Teacher in Future Education

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Abstract

As education progresses in the digital era and in the Fourth Industrial Revolution, learning will be adaptive and individualized to meet the needs of individual learners. This is possible because of emerging technology, artificial intelligence, and the internet of things. This study is making significant contribution to future education by identifying forces that are shaping education and developing a competency profile for the digital teacher of the future. The research conducted focus groups and interviews with education experts from six countries to identify the forces shaping education in the future and the competencies required by the digital teacher to function effectively. The Competency Profile for the Digital Teacher (CPDT) can be used to train and orient the digital teacher of the future.

Keywords: digital teacher, online teacher, teacher competencies, 21st century education, fourth industrial revolution, future education, online learning

Introduction

There are many forces that are placing a sense of urgency on the education system to transform itself for the future, which will drastically change the role of the teacher. Some of these forces include the Fourth Industrial Revolution (Schmidt, 2017; World Economic Forum, 2017), innovative pedagogies (Maldonado-Mahauad, Perez-Sanagustín, Kizilcec, Morales, & Munoz-Gama., 2018; Suárez, Specht, Prinsen, Kalz, & Ternier, 2018), information explosion due to the increasing use of the internet (Reyna, Hanham, & Meier, 2018), lifelong learning (Berry, 2018; Hinzen & Schmitt, 2016), artificial intelligence (Schmidt, 2017), and the move to open education resources (McGreal, 2017; Paskevicius & Hodgkinson-Williams, 2018; Redecker, 2017). This study identified necessary competencies of digital and online teachers who must adapt to the Internet and digital technologies of the future.

Educators need to look into the future to determine what should be done to be relevant and serve society in the future. The education system will be preparing learners for jobs that do not exist today because of emerging technologies, information explosion, and the Fourth Industrial Revolution. The demand for lifelong learning is growing significantly around the world since to get meaningful jobs citizens need to obtain current and relevant education (Kolenick, 2018; Patterson, 2018). As a result, countries are starting to implement digital learning technology to educate their citizens for success in the 21st century. As education moves towards the goal of "education for all' and to help achieve the United Nation's Sustainable Development Goal 4 to provide quality education for all, there will be increasing use of digital technology especially for learners who live in remote locations and for those who cannot physically attend school because of a lack of infrastructure (Gaskell, 2018; UNESCO, 2015). Such a future will require that teachers be trained to use digital technology to provide virtual education to learners in remote areas and for nomadic learners (Ally & Tsinakos, 2014; Dyer, 2016). With technology, the learners, rather than the teachers, are at the center of learning; they develop their knowledge base and create an understanding of the world by being active learners (Anagün, 2018; Guo, 2018; McWilliams, 2016). Accessibility and flexibility of learning opportunities means that learners can decide when and where to learn.

The digital era will call for "digital" teachers who must adapt to education in the future. According to Mitra (2014), education will be self-organizing, and technology will play a major role in the delivery of education and in providing support to learners. Additionally, learning will move toward individualization and learner-centeredness because of artificial intelligence, learning analytics, and the Internet of things (Chai & Kong, 2017; Mitra, 2014; Popenici & Kerr, 2017; Srinivasan, 2017).

Based on the data collected in this study, this paper will present both general and digital competencies that will be required by digital teachers of the future. The competency profile presented in this paper can be used to train or orient future teachers so that they move education into the Fourth Industrial Revolution. This study was guided by two research questions: (1) What are some of the forces shaping the future of education? and (2) What competencies (knowledge and skills) are required by digital teachers of the future?

Literature Review

As technology emerges in the Fourth Industrial Revolution and new pedagogical approaches are developed, the role of the teacher will change to provide quality, flexible education. The literature review that follows focuses on areas of the field that guide this evolution.

Learner-Centered Education

Although learner-centered education is being practiced today (Boling & Beatty, 2010; Bonnici, Maatta, Klose, Julien, & Bajjaly, 2016), emerging technologies will make learning in the future adaptive and more individualized because of the use of smart learning technologies (Gros, 2016; Hwang, 2014). This will allow learners to learn at their peak learning times rather than going to a specific location at a specific time to learn. Some learners' have their peak learning time in the evening while others have theirs in the early morning. The World Innovative Summit in Education (WISE) conducted a survey on *School in 2030* with 645 experts in different sectors from around the world (Qatar Foundation, 2014) in which 83% of the experts reported that they believed learning will be individualized to meet individual learner's need. The majority of experts said that teachers will be a guide for learning rather than a deliverer of information; since learning materials will primarily be in digital format, learners will be able to use the technology to access learning materials, transforming the teacher's role into a facilitator of learning. Based on the results of this survey, the education system should provide learners with the skills to learn independently.

The Role of the Teacher in the Fourth Industrial Revolution

According to the World Economic Forum (2017), the Fourth Industrial Revolution is changing the world because new technologies that combine the physical, digital, and biological worlds are impacting all disciplines, economies, and industries. To cope with these pervasive changes, education, towards the year 2030, must prepare teachers to educate learners to function effectively in the Fourth Industrial Revolution. Training for digital teachers for the future may take place in formal teacher training programs or in professional development undertaken throughout lifelong learning (Chai & Kong, 2017; Kramer & Tamm, 2018). Countries around the world are investing in teacher professional development to ensure that teachers are prepared for the future (Kong, Looi, Chan, & Huang, 2017). Professional development will be increasingly important for teachers in the digital age in order that they may stay abreast of quality and flexible education strategies for more sophisticated learners (Halterbran, 2017; Inverso, Kobrin, & Hashmi, 2017; Patterson, 2018).

The digital teacher must be able to educate students in a virtual environment using emerging digital technologies (Campbell & Cameron, 2016). In courses such as Chemistry and Biology, teachers can use virtual reality technology to allow students to do a virtual walk-through of experiments or body systems (Parong & Mayer, 2018). In a history course, the teacher can use augmented reality technology to give students a virtual experience of historical events or a tour of a history museum (Capuano, Gaeta, Guarino, Miranda, & Tomasiello, 2016). With the increasing use of digital technology and a global movement toward the use of open education resources (OER), learners will satisfy their information needs from digital sources rather than be obliged to rely on a single teacher. The "middle (wo)man" can be easily skipped in the search for information; open education practice (OEP) will become the norm (Cronin, 2017; Ehlers, 2011).

Although in constructivist paradigms and in much adult learning, the role of the teacher has become a facilitator of learning, this trend will become more predominant, and "the guide on the side" will focus on providing help to individual learners in need of assistance. In addition, the teacher of the future must be able to use emerging technologies such as wearable devices to teach students difficult topics, such as in the science areas. One such device is 3-D glasses using augmented reality (AR) where students experience real objects virtually. Yoon, Anderson, Lin, & Elinich, (2017) conducted a study to investigate the effectiveness of AR in teaching science concepts and found that students in the AR group performed better on knowledge tests than students in the non-AR group. Their findings showed that AR enhanced students' ability to visualize details and find hidden information, concluding that digital augmentation had a positive effect on students' content knowledge.

Learners today are the "always-on" generation. Emerging technologies in education, such as those mentioned above, allow learning spaces to exist anywhere and anytime. Teachers and their systems must be prepared to educate the current and upcoming generations of learners who are technology literate and have experience playing digital games and viewing high quality videos. Teachers of the future must learn to be comfortable using educational games and social media as innovative and interactive strategies for teaching (Crompton, Lin, Burke, & Block, 2018; De Troyer, Van Broeckhoven, & Vlieghe, 2017; Yam, Swati, & Jing, 2014). As learning opportunities become more ubiquitous because of mobile and wearable devices, the learning cell model will be useful for organizing and deploying learning resources (Chen, Yu, & Chiang, 2016; Yu, Yang, Cheng, & Wang 2015; Yu, Ally, & Tsinakos, 2018).

In order to prepare learners to function in the 21st century, teachers in the digital age should also be prepared to develop the "whole" learner. Ferrández-Berrueco and Sánchez-Tarazaga (2014) identified four competency areas for teachers that include subject competency, methodological competency, social competency, and personal competency. In a globalized digital era, where technology allows services, production, and processes in organizations to become automated, learners' digital skills must be comprehensive and inclusive (Anagün, 2018; Guo, 2018; McWilliams, 2016).

Education will be self-organizing in a smart learning environment where learners will assume control over their own learning; hence, their needs will be individualized and perhaps more demanding (Gros, 2016; Hwang, 2014; Mitra, 2014). Smart learning environments can be regarded as

> the technology-supported learning environments that make adaptations and provide appropriate support (e.g., guidance, feedback, hints or tools) in the right places and at the right time based on individual learners' needs, which might be determined via analyzing their learning behaviors, performance and the online and real-world contexts in which they are situated. (Hwang, 2014, p. 5).

At the same time, because of the exponential information explosion, information will be updating at a rapid pace, which will require continuous re-learning and updated learning, as well as "smart" education (Gros, 2016; Huang, 2018). As learners interact with smart education systems, the system will be capable of learning about the learner and providing the appropriate intervention (Hwang, 2014). However, a foreseeable barrier to innovation of this type could be the teachers' lack of functioning skills with this new technology (Farias, 2016; Hunt, 2006). Ultimately, the World Economic Forum foresees that teachers will need to adapt to artificial intelligence and robotics in order to successfully make the transition to teach successfully and appropriately in the Fourth Industrial Revolution (World Economic Forum, 2017).

Methodology

Data were collected from 34 experts from six countries (Austria, Canada, China, Greece, Malaysia, and Sweden). The experts were selected based on their expertise using innovative technologies to teach, with experience using emerging technologies and innovative pedagogies such as MOOCs (Massive Open Online Courses), artificial intelligence, augmented reality, virtual reality, online learning, and mobile learning. Most of the experts were involved in training teachers, instructional designers, and instructors to prepare them to implement innovative technologies in their own courses. This qualitative study used focus groups, interviews, and written responses to collect data.. The international input gathered was important for this study since the intention was to develop a competency profile that can be used globally.

Interviews were conducted on a one-to-one basis and lasted between 20 to 30 minutes. The focus groups, which involved small groups of experts, lasted 30 minutes. The written responses were provided on an individual basis; hence, it is not known how long the experts spent to specify the competencies. The experts were asked to think ahead to the year 2030 and suggest competencies that the digital teacher will require to provide quality and flexible education to learners. During the sessions, the researcher documented the competencies provided by participants. The experts also mentioned forces that are impacting the future of education and therefore will affect the skills required by teachers. The competencies listed were then organized into major themes, which formed the major areas for the competency profile. Based on the input from the experts, a draft competency profile was developed and was presented to two expert teachers to validate. The competencies were revised based on the minor suggestions provided by the expert teachers who validated the competencies.

Results

Forces Shaping the Future of Education

The experts mentioned a variety of forces that are shaping the future of education, forces which they feel will impact the skills required by future teachers to provide quality education and support to learners (Figure 1).

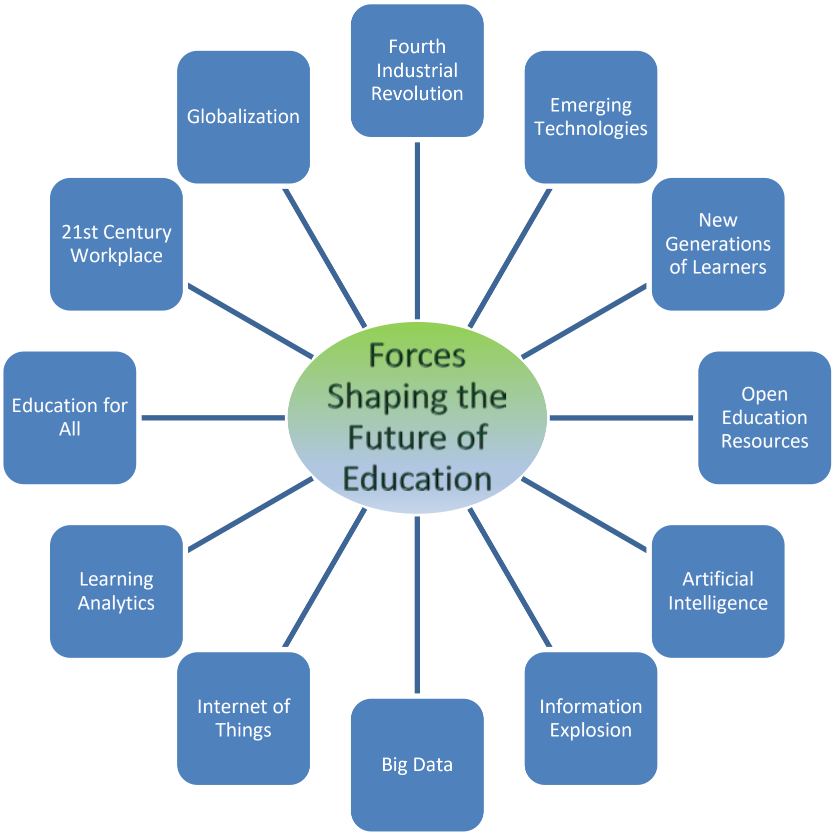

Figure 1. Forces shaping the future of education.

The experts identified nine major themes that indicate the major areas of responsibilities for the digital teacher of the future (Figure 2) and 105 competencies that fall within the major themes. The following sections present the major areas of responsibilities followed by a list of competencies that fall within each major area.

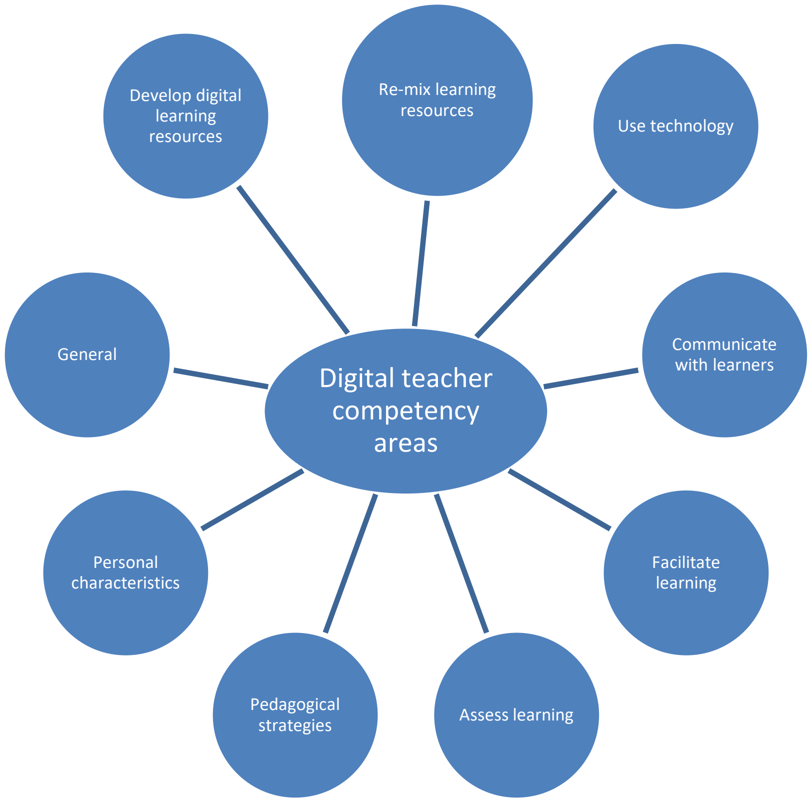

Figure 2. Major areas of responsibilities for the digital teacher of the future.

Competencies Required by Digital Teachers for Future Education

General. The data shows that digital teachers will need to have some general qualities that will allow them to provide quality support virtually to learners. This study identified 12 general competencies for the digital teacher of the future (Figure 3).

A. General	A1. Be comfortable working in a virtual environment.	A2. Provide support of learners regardless of location and time.	A3. Work from anywhere and at any time.	A4. Teach students life skills.
	A5. Keep up with emerging learning technologies to use in education.	A6. Keep current in the content area to facilitate learning.	A7. Encourage students to be good citizens.	A8. Basic knowledge of artificial intelligence.
	A9. State of the art (current) knowledge in the subject area.	A10. Collaborate virtually with other teachers to share information on learners' progress.	A11. Share effective learning practices with other teachers.	A12. Prepare learners to live in harmony with the environment.

Figure 3. Digital teacher general competencies.

Use digital technology. In the digital era, especially in the Fourth Industrial Revolution, the teacher should be digitally literate to use technology to deliver and support education. This study identified 15 competencies for the digital teacher under the area "Use Digital Technology" (Figure 4).

B. Use digital technology	B1. Be digitally literate.	B2. Integrate technology in the curriculum seamlessly.	B3. Be comfortable when using technology.	B4. Use learning analytics to monitor individual learner progress.
	B5. Use assistive technology to provide support to learners with special needs.	B6. Integrate augmented reality, virtual reality, and mixed reality to give learners a real life experience.	B7. Troubleshoot basic technology problems.	B8. Adapt to emerging technologies.
	B9. Use multimedia technologies to deliver learning materials in a variety of formats.	B10. Ability to independently learn how to use new technology and software.	B11. Use technology to provide efficient support to learners.	B12. Have knowledge of the culture and local practice to select the most appropriate technology.
	B13. Explore emerging technologies for learning.	B14. Use features of the technology to enrich the learning process (geo location, capture information, etc.).	B15. Adapt the technology to the needs of the learner.	

Figure 4. Use of digital technology competencies for the digital teacher.

Develop digital learning resources. As an expert in the field, teachers will need to develop digital learning resources for learners to access using technology. This study identified nine competencies in the develop digital learning resources area for the digital teacher (Figure 5).

C. Develop digital learning resources	C1. Have knowledge of the content.	C2. Select the appropriate digital technology to match the content and the learning outcome.	C3. Create high quality digital learning materials.	C4. Develop learning materials to meet specific learner's needs.
	C5. Develop learning materials with limited knowledge of the learner (language, culture, situation).	C6. Identify quality and valid learning materials for learners to access.	C7. Use different strategies for different learning situations.	C8. Use problem-based learning to develop learner's high level knowledge and skills.
	C9. Share learning resources with other teachers.			

Figure 5. Develop digital learning resources compertencies for the digital teacher.

Re-mix learning resources. Because of the availability of open education resources, the teacher will have to select the appropriate learning resources and re-mix the resources to allow learners to achieve the learning outcomes. There are five re-mix learning resources competencies identified in this study (Figure 6).

D. Re-mix digital learning resources	D1. Select appropriate digital learning resources to maximize learning.	D2. Access appropriate open education resources to integrate into the curriculum.	D3. Modify the learning resources to align with the learning outcome.	D4. Re-mix open education resources to meet the needs of individual learners.
	D5. Assess the quality of open education resources.			

Figure 6. Re-mix digital learning resources competencies for the digital teacher.

Communication. An important area of a teachers' responsibilities is communicating with learners using digital technology. The experts in this study identified four competencies under "Communication" (Figure 7).

E. Communication	E1. Communicate at the level of the learner.	E2. Use appropriate non-verbal communication when interacting with learners using two-way video and text.	E3. Model good digital citizenship when using social media to communicate with learners and peers.	E4. Communicate in the language of the learner.

Figure 7. Communication competencies for the digital teacher.

Facilitate learning. The "facilitate learning" area has the largest number of competencies (29; Figure 8), which is an indication that a major role of the digital teacher will be as a facilitator of learning. In the digital era, learners will be learning virtually where there is a physical separation of the digital teacher and the learners.

F. Facilitate Learning	F1. Personalize the learning for individual learners.	F2. Respond to learners' questions in a timely manner.	F3. Ability to change strategies on the fly when supporting the learner to meet the learner needs.	F4. Respect different learner types and adapt to the learner.
	F5. Encourage creativity.	F6. Encourage innovation.	F7 Be a good listener.	F8. Provide appropriate feedback.
	F9. Show enthusiasm about the learning materials.	F10. Model working in the digital age.	F11. Motivate students to learn.	F12. Encourage social interaction between learners.
	F13. Ability to formulate good questions when interacting with learners.	F14. Model good virtual behavior.	F15. Be approachable.	F16. Promote and model digital citizenship and responsibility.

F17. Encourage authentic learning.	F18. Inspire learners.	F19. Create a comfortable learning atmosphere.	F20. Provide feedback to individual learners to meet their individual needs.
F21. Interpret learner dashboard to monitor each learner performance.	F22. Interpret learner's question.	F23. Solve learner's problems.	F24. Provide support to learners who are on the go.
F25. Act as a coach for learners.	F26. Act as a mentor for learners.	F27. Support learners using digital technology.	F28. Be an expert in the content to help learners who will be at different points in the learning process.
F29. Encourage learners to think outside the box.			

Figure 8. Facilitation competencies for the digital teacher.

Pedagogical strategies. The teacher has to use appropriate pedagogical strategies to allow students to achieve the learning outcomes. The "Pedagogical Strategies" area has 12 competencies for the digital teacher (Figure 9).

G. Pedagogical strategies	G1. Use appropriate pedagogical approach to match the technology.	G2. Use appropriate learning theory to develop learning strategies to maximize learning.	G3. Offer choices and multiple options for presenting concepts through resources and support options.	G4. Prescribe learning activities for individual learners.
	G5. Use appropriate collaborative online learning frameworks to encourage interaction between learners and between the teacher and the learner.	G6. Suggest remedial activities to help learners who need them.	G7 Use a variety of learning strategies to develop high level knowledge and skills.	G8. Use interactive strategies such as serious games and simulations to motivate learners.
	G9. Engage learners during the learning process.	G10. Suggest additional learning activities for learners who need them.	G11. Use problem-based learning to encourage high level learning.	G12. Encourage learners to learn independently.

Figure 9. Pedagogical strategies competencies for the digital teacher.

Assess learning. The teacher must provide feedback to learners and assess learner's performance using appropriate assessment strategies. The assessment must be authentic to improve learners' performance and to allow learners to receive academic credit for the lessons or courses they will complete (Conrad & Openo, 2018). The "Assess Learning" area has four competencies for the digital teacher (Figure 10).

H. Assess learning	H1. Select assessment strategies to match the learning outcomes.	H2. Use assessment strategies to measure learners' performance.	H3. Use virtual assessment strategies to assess performance.	H4. Provide feedback to learners.

Figure 10. Assessing learning competencies for the digital teacher.

Personal characteristics. The digital teacher should have personal characteristics to be a good role model, provide quality education, and support to learners. This study identified 15 personal characteristics competencies for the digital teacher (Figure 11).

I. Personal characteristics	I1. Be socially responsible for the use of resources and be environmentally friendly.	I2. Be a good role model for learners.	I3. Work in virtual teams to share information with other teachers.	I4. Accept innovation in the learning system.
	I5. Show enthusiasm virtually.	I6. Be a lifelong learner.	I7 Keep learners' information confidential.	I8. Consider privacy issues and keep learner information.
	I9. Think digitally.	I10. Be open-minded.	I11. Be sensitive to learner's individual differences.	I12. Use good social skills when working virtually.
	I13. Be flexible and adaptable in the modern digital age.	I14. Show empathy by maintaining humanity virtually.	I15. Model good virtual behavior.	

Figure 11. Digital teacher personal characteristics.

Conclusion

Emerging digital technologies in education will continue to transform the delivery of education and the role of the teacher in individualized learning environments. Future education systems will be judged on how well the system prepares learners to function in the 21st century world and in the Fourth Industrial Revolution rather than how many graduates are produced. This research contributes to future education by developing a competency profile to train teachers. There is a gap between how teachers currently instruct and what will be required of teachers in the future (Bezuidenhout, 2018). Hopefully, the competencies presented in this study will help to identify that gap so that relevant teacher training is provided.

The digital teacher 2030 competency profile can be used by educational organizations and governments to develop training programs for the future and be used as a guide to inform "trainers of teachers" so that they can gain the expertise to effectively educate future teachers, as well as model the behaviors that teachers should use (Trust, 2017, 2018).

It is difficult to predict what technology will be available in the year 2030; however, trainers of teachers must stay abreast of emerging technologies. In the future, with artificial intelligence, robotics, and internet of things in the Fourth Industrial Revolution, human teachers may co-teach with robotic teachers. Future research will determine the role of the human teacher in such a relationship. Perhaps, in the near future, *blended* education will refer to the blending of human teachers with robotic teachers to provide quality education for all.

References

Ally, M., & Tsinakos, A. (2014). *Increasing access through mobile learning*. Vancouver, Canada: Commonwealth of Learning.

Anagün, Ş. S. (2018). Teachers' perceptions about the relationship between 21st century skills and managing constructivist learning environments. *International Journal of Instruction*, *11*(4), 825-840. https://doi.org/10.12973/iji.2018.11452a

Berry, B. (2018). *The teachers of 2030: Creating a student-centered profession for the 21st century*. Center for Teaching Quality. Retrieved from https://files.eric.ed.gov/fulltext/ED509721.pdf

Bezuidenhout, A. (2018). Analysing the importance-competence gap of distance educators with the increased utilisation of online learning strategies in a developing world context. *International Review of Research in Open and Distributed Learning*, *19*(3), 264-281. https://doi.org/10.19173/irrodl.v19i3.3585

Boling, E. C., & J. Beatty. (2010). Cognitive apprenticeship in computer-mediated feedback: Creating a classroom environment to increase feedback and learning. *Journal of Educational Computing Research*, *43*(1), 47–65. https://doi.org/10.2190/EC.43.1.d

Bonnici, L.J., Maatta, S.L., Klose, M.K., Julien, H., & Bajjaly, S. (2016). Instructional style and learner-centered approach: A cross-institutional examination of modality preference for online course delivery in a graduate professional program. *Studies in Higher Education*, *41*(8), 1389–1407. http://dx.doi.org/10.1080/03075079.2014.977860

Campbell, C., & Cameron, L. (2016). Scaffolding learning through the use of virtual worlds. In S. Gregory, M. J.W. Lee, B. Dalgarno, & B. Tynan (Eds.), *Learning in virtual worlds: Research and applications* (pp. 241-259). Edmonton, Canada: AU Press. doi:10.15215/aupress/9781771991339.01

Capuano, N., Gaeta, A., Guarino, G., Miranda, S., & Tomasiello, S. (2016). Enhancing augmented reality with cognitive and knowledge perspectives: A case study in museum exhibitions. *Behaviour & Information Technology*, *35*(11), 968–979. https://doi.org/10.1080/0144929X.2016.1208774

Chai, C.S., & Kong, S.C. (2017). Professional learning for 21st century education. *Journal of Computer in Education*, *4*(1), 1-4. DOI 10.1007/s40692-016-0069-y

Chen, M., Yu, S., & Chiang, F. (2016). A dynamic ubiquitous learning resource model with context and its effects on ubiquitous learning. *Interactive Learning Environments*, 1-15. http://dx.doi.org/10.1080/10494820.2016.1143846

Conrad, D., & Openo, J. (2018). *Assessment strategies for online learning: Engagement and authenticity*. Edmonton, Canada: AU Press. doi:10.15215/aupress/9781771992329.01

Crompton, H., Lin, Y., Burke, D., & Block, A. (2018). Mobile digital games as an educational tool in K-12 schools. In S. Yu, M. Ally, & A. Tsinakos (Eds.), *Mobile and ubiquitous learning: An international handbook*, 3-18. Singapore: Springer.

Cronin, C. (2017). Openness and praxis: Exploring the use of open educational practices in higher education. *International Review of Research in Open and Distributed Learning*, *18*(5), 15-34. https://doi.org/10.19173/irrodl.v18i5.3096

De Troyer, Q., Van Broeckhoven, F., & Vlieghe, J (2017). Linking serious game narratives with pedagogical theories and pedagogical design strategies. *Journal of Computing in Higher Education*, *29*, 549–573. DOI 10.1007/s12528-017-9142-4

Dyer, C. (2016). Evolving approaches to educating children from nomadic communities. *Prospects*, *46*, 39–54. DOI 10.1007/s11125-016-9381-6

Ehlers, U. D. (2011). Extending the territory: From open educational resources to open educational practices. *Journal of Open, Flexible and Distance Learning*, *15*(2). Retrieved from http://www.editlib.org/p/147891/

Farias, G. (2016). *Large-scale deployment of tablet computers in Brazil: An implementation model for school districts* (Unpublished Doctoral Dissertation). Athabasca University, Athabasca, Alberta.

Ferrández-Berrueco, R., & Sánchez-Tarazaga, L. (2014). Teaching competences in Secondary Education. Analysis of teachers' profiles. *RELIEVE*, *20*(1), 1-20. DOI: 10.7203/relieve.20.1.3786

Gaskell, A. (2018). Meeting sustainable development goal 4: Some key contributions. *Journal of Learning for Development*, *5*(1), 1-4. Retrieved from http://www.jl4d.org/index.php/ejl4d/article/view/287/295

Gros, B. (2016). The design of smart educational environments. *Smart Learning Environments*, *3*(15), 2-11. DOI 10.1186/s40561-016-0039-x

Guo, H. (2018). Application of a computer-assisted instruction system based on constructivism. *International Journal of Emerging Technology in Learning*, *13*(4), 33-44. https://doi.org/10.3991/ijet.v13i04.8468

Halterbran, V.R. (2017). Lessons in learning. *Adult Learning*, *28*(1), 12-19. https://doi.org/10.1177/1045159516643942Lifelong

Hinzen, H., & Schmitt, S. (2016). *Agenda 2030 – Education and lifelong learning in the sustainable development goals*. Bonn, Germany: DVV International. Retrieved from https://www.dvv-international.de/fileadmin/files/Inhalte_Bilder_und_Dokumente/Materialien/IPE/IPE_75_EN_web.pdf

Huang, R. (2018, March). Mainstreaming digital skills to embrace the digital era. *Paper presented at the UNESCO Mobile Learning Week*, Paris.

Hwang, G. (2014). Definition, framework and research issues of smart learning environments - a context-aware ubiquitous learning perspective. *Smart Learning Environments*, *1*(4), 1-14. doi:10.1186/s40561-014-0004-5

Hunt, N.P. (2006). Using technology to prepare teachers for the twenty-first century. *Asia-Pacific Journal of Teacher Education*, *25*(3), 345-350. DOI: 10.1080/1359866970250309

Inverso, D.C., Kobrin, J., & Hashmi, S. (2017). Leveraging technology in adult education. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education*, *6*(2), 55-58.

Kolenick, P. (2018). Adult education in the post-secondary context: Sustainability in the 21st century. *Alberta Journal of Educational Research*, *64*(2), 208-213.

Kong, S., Looi, C.K., Chan, T.W., & Huang, R. (2017). Teacher development in Singapore, Hong Kong, Taiwan, and Beijing for e-learning in school education. *Journal of Computer in Education*, *4*(1), 5-25. DOI: 10.1007/s40692-016-0062-5

Kramer, A., & Tamm, M. (2018). Does learning trigger learning throughout adulthood? Evidence from training participation of the employed population. *Economics of Education Review*, *62*, 82-90. https://doi.org/10.1016/j.econedurev.2017.11.004

McGreal, R. (2017). Special Report on the role of open educational resources in supporting the sustainable development goal 4: Quality education challenges and opportunities. *International Review of Research in Open and Distributed Learning*, *18*(7), 292-305. https://doi.org/10.19173/irrodl.v18i7.3541

Maldonado-Mahauad, J., Perez-Sanagustín, M., Kizilcec, R.F., Morales, N., & Munoz-Gama, J. (2018). Mining theory-based patterns from big data: Identifying self-regulated learning strategies in Massive Open Online Courses. *Computers in Human Behavior*, *80*, 179-196. https://doi.org/10.1016/j.chb.2017.11.011

McWilliams, S.A. (2016). Cultivating constructivism: Inspiring intuition and promoting process and pragmatism. *Journal of Constructivist Psychology*, *29*(1), 1–29. https://doi.org/10.1080/10720537.2014.980871

Mitra, S. (2014). The future of schooling: Children and learning at the edge of chaos. *Prospects 44*, 547–558. DOI 10.1007/s11125-014-9327-9

Parong, J. & Mayer, R.E. (2018). Learning science in immersive virtual reality. *Journal of Educational Psychology*, *110*(6), 785-797. http://dx.doi.org/10.1037/edu0000241

Paskevicius, M., & Hodgkinson-Williams, C. (2018). Student perceptions of the creation and reuse of digital educational resources in a community development-oriented organisation. *Journal of Learning for Development*, *5*(1), 22-39. Retrieved from http://www.jl4d.org/index.php/ejl4d/article/view/253/283

Patterson, M.B. (2018). The forgotten 90%: Adult nonparticipation in education. *Adult Education Quarterly*, *68*(1), 41 –62. DOI: 10.1177/0741713617731810

Popenici, S.D. & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, *12*(22), 1-13. DOI 10.1186/s41039-017-0062-8

Qatar Foundation. (2014). *2014 WISE survey: School in 2030*. Retrieved from https://www.wise-qatar.org/sites/default/files/wise-survey-school-in-2030.pdf

Redecker, C. (2017). *European framework for the digital competence of educators*. Luxembourg: Publications Office of the European Union.

Reyna, J., Hanham, J., & Meier, P. (2018). The Internet explosion, digital media principles and implications to communicate effectively in the digital space. *E-Learning and Digital Media*, *15*(1), 36-52. DOI 10.1177/2042753018754361

Schmidt, V.H. (2017). Disquieting uncertainty: Three glimpses into the future. *European Journal of Futures Research*, *5*(6), 1-10. DOI 10.1007/s40309-017-0113-9

Srinivasan, S. (2017). The future of mobile learning. *Media Development*, *1*, 16-19.

Suárez, A., Specht, M., Prinsen, F., Kalz, M., & Ternier, S. (2018). A review of the types of mobile activities in mobile inquiry-based learning. *Computers and Education*, *118*, 38-55. https://doi.org/10.1016/j.compedu.2017.11.004

Trust, T. (2017). Preparing future teachers to redefine learning with technology. *Journal of Digital Learning in Teacher Education*, *33*(2), 44-45. DOI: 10.1080/21532974.2017.1281654

Trust, T. (2018). Why do we need technology in education? *Journal of Digital Learning in Teacher Education*, *34*(2), 54-55, DOI: 10.1080/21532974.2018.1442073

UNESCO. (2015). *Incheon declaration. Education 2030: Towards inclusive and equitable quality education and lifelong learning for all*. Retrieved from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/ED/pdf/FFA_Complet_Web-ENG.pdf

World Economic Forum. (2017, January). *Realizing human potential in the fourth industrial revolution: An agenda for leaders to shape the future of education, gender and work* (White paper). Retrieved from http://www3.weforum.org/docs/WEF_EGW_Whitepaper.pdf

Yam, S. C., Swati, M., & Jing, C.O. (2014). Professional development for scaling pedagogical innovation in the context of game-based learning: Teacher identity as cornerstone in "shifting" practice, *Asia-Pacific Journal of Teacher Education*, *43*(5), 423-437, DOI: 10.1080/1359866X.2014.962484

Yoon, S., Anderson, E., Lin, J., & Elinich, K. (2017). How augmented reality enables conceptual understanding of challenging science content. *Educational Technology & Society*, *20*(1), 156–168. Retrieved from https://www.j-ets.net/ETS/journals/20_1/14.pdf

Yu, S., Ally, M. & Tsinakos, A. (2018). *Mobile and ubiquitous learning: An international handbook*. Singapore: Springer.

Yu, S., Yang, X., Cheng, G., & Wang, M. (2015). From learning object to learning cell: A resource organization model for ubiquitous learning. *Educational Technology & Society*, *18*(2), 206–224. Retrieved from https://www.j-ets.net/ETS/journals/18_2/16.pdf