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Editorial



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This last issue of IRRODL for 2017 leads off with three articles on mobile learning, which is becoming increasingly relevant, if not essential, for e-learning in both developed and developing countries. According to the International Telecommunications Union, mobile-broadband subscriptions have grown annually in the last five years to reach approximately 4.3 billion people, out of a world population of 7.6 billion. Moreover, mobile subscription prices have decreased in the past three years by more than 50%, resulting in an increase in the importance and applicability of mobile learning, or M-learning, becoming more and more obvious to educators. The four lead articles drill down from a broad perspective, to a country context, to two specific M-learning implementations. These are followed by four articles relating to different aspects of open learning, including the general meaning of open, faculty perceptions, OER experience, and MOOCs. The next three articles on teacher and medical professional education are concerned with digital tools and interactions. The remaining articles concern a study on content effectiveness and inclusiveness. In the final research notes section, we include my report to UNESCO on OER in support of UNESCO's *Strategic Development Goal 4: Education for All*.

Kroll and **Duart** provide us with an excellent report on the trends in M-learning through a systematic review of articles. The report focuses on the themes, methods, settings, and technologies found in the research on M-learning in higher education. One finding of special importance is the increasing research on the use of a wide variety of different mobile devices. This is significant because commercial educational content comes with digital locks that do not allow for switching from one device to another, or even one application to another. On the other hand, Open Educational Resources (OER) provide teachers and learners with the flexibility to switch devices as needed.

Aluko gives us an African perspective on implementing M-learning using the UNESCO guidelines to construct suitable policies using recognized standards for mobile broadband implementations. Specifically, she uses a qualitative approach with which to examine the relevance of M-learning in the South African context.

This is followed by two articles from Turkey on the use the mobile application *WhatsApp*. **Avki** and **Adiguzel** present a mobile-blended model for collaborative learning using a project-based learning approach, with the aim of providing optimal opportunities for English language learners to engage in speaking English. Their results showed positive increases in oral communications using colloquial English as well as in written messaging. On the other hand, Cetinkaya's study focused on student perceptions and success, concluding that *WhatsApp* is more useful as a supportive technology.

Four papers on openness are introduced by **Rolfe** who starts with an investigation into what “open” means through surveying faculty and staff at one UK university. Their interviews revealed that openness could be associated with pedagogy and practice, learner benefits, accessibility and access, institutional structures, as well as values and culture.

Panda and **Santosh** explore the adoption of openness as a “core value” and as part of the institutional strategy by faculty at the Indira Gandhi National Open University in India (IGNOU) and their attitude towards sharing of resources in academic institutions. Their research suggests that sharing free resources is valued; however, they found that there was a lack of understanding in intellectual property rights, copyright, and OER. They close with a call for more training and for institutional policies supporting OER.

Following this faculty study, students' undergraduate experience with OER is examined by **Afolabi**. The research suggests that a grasp of the learners' skills and competencies is important in designing an OER intervention strategy. They also found that a positive opinion on OER was correlated with higher achievement scores.

Ikahihifo, Spring, Rosecrans, and **Watson** follow with an assessment of the savings for students due to OER implementation at an American community college. In this case, the investigators asked students how they used the money that was saved. They reported that they used the savings to pay off tuition or purchase content in other courses. Others used funds to take additional courses or simply for day-to-day expenses.

The Spanish National University of Distance Education (UNED) is the focus of **Gil-Jaurena, Callejo-Gallego,** and **Agudo's** evaluation of a MOOC implementation. They included demographics noting that the “average” student was a 37-year-old employed female with a university degree. As has been the experience of many MOOC implementations, completion rates were low and this could be correlated with the lack of support, to which students gave a low rating.

Professional education is the subject of the next four articles, beginning with **Luo, Murray,** and **Crompton's** piece on intervention with pre-service teachers. Using an authentic learning framework, their test results suggest that web-based tools and increased comfort levels were beneficial for teachers who designed their own classes.

On the other hand, **Krejns, Vermuelen, Buuren,** and **Acker** research focused on the mediating role of attitude, perceived norm, and perceived behavioural control of perceived success on the behavioural intention of teachers using digital content and applications. They conclude that behavioural intention was related to perceived success, with the implication that teachers need to experience success in using digital learning materials in the early stages, either through their training or in other ways.

The **Forbes** article addresses the ethics of social media use and professional online presence for teacher educators. They suggest that there is a need for differential scaffolding dependent on the learners' comfort with the use of social media. They also provide some practical advice on integrating coursework into online social environments.

Teras and **Tarcoglu** complete the professional development section using authentic e-learning principles in a program for vaccine management. Their findings suggest that learning was facilitated more in a “dynamic web of interactions” rather than by simply covering content, which plays only a supporting role.

Learning interaction in a medical environment is also the focus of **Thomas, Turkay, and Parker's** article concerning student engagement. Focusing on feedback from assessments, they concluded that such immediate feedback could help to mitigate the negative effects of assessment and help reduce the rate of student attrition.

Fanguy, Costley, and Baldwin investigate the effectiveness of the summaries in lecture videos for a flipped class course. While the provision of lecture summaries is shown to significantly improve the performance of students who access them, the introduction of guest lecturers resulted in students losing concentration and missing out on the benefits provided by the summaries.

Inclusiveness issues are addressed by **Lago and Acedo**, who study the inequalities of access for deaf and hard-of-hearing students. Their analysis of more than 400 participants suggest a significant relationship between participation in online courses and the following: level of education, knowledge of sign language, and number of members in the household.

This issue, the last of 2017, concludes our offerings for the year. It has been a very successful and productive year for IRRODL and we thank you for your contributions, support, and readership. We wish you all peace, health, and happiness in 2018.



November – 2017

Research Trends in Mobile Learning in Higher Education: A Systematic Review of Articles (2011 – 2015)



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Abstract

The potential and use of mobile devices in higher education has been a key issue for educational research and practice since the widespread adoption of these devices. Due to the evolving nature and affordances of mobile technologies, it is an area that requires ongoing investigation. This study aims to identify emerging trends in mobile learning research in higher education in order to provide insights for researchers and educators around research topics and issues for further exploration. This study analysed the research themes, methods, settings, and technologies in mobile learning research in higher education from 2011 to 2015. A total of 233 refereed articles were selected and analysed from peer reviewed journals. The results were compared to three previous literature review-based research studies focused between 2001 and 2010 to identify similarities and differences. Key findings indicated that: (a) mobile learning in higher education is a growing field as evidenced by the increasing variety of research topics, methods, and researchers; (b) the most common research topic continues to be about enabling m-learning applications and systems; and (c) mobile phones continue to be the most widely used devices in mobile learning studies, however, more and more studies work across different devices, rather than focusing on specific devices.

Keywords: mobile learning, research trends, research methods, pedagogical issues, higher education

Introduction

Many higher education institutions are implementing mobile learning to provide flexibility in learning. It is expected that this will continue to be a growing trend with the proliferation of wireless devices and technologies. It is expected that the next generation of mobile learning will be ubiquitous and learners themselves will be more mobile and able to learn using multiple devices (Ally & Prieto-Blázquez, 2014). Although there are a number of interpretations of what is meant by mobile learning, this study makes

use of the definition by O'Malley et al. (2005) as “any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies.” (p. 7).

Mobile devices tend to drive new research opportunities in mobile learning because of the rate of changes in technologies. In addition to devices, communication technologies have also changed, shifting the focus of research (Parsons, 2014). For example, social media and messaging “apps” are commonplace. The development and usage patterns of mobile technologies in education change quickly. This means that regular analysis is required of “trends in mobile device types and functionality, along with learner types and the use of mobile devices in various disciplines and courses” (Wu et al., 2012, p. 818). The research purposes and methods used in studies are important because they influence how research results are shared, interpreted and used (Wingkvist & Ericsson, 2011). Review studies can help to identify progress in the field and offer guidelines for the design of future research (Frohberg, Göth, & Schwabe, 2009). Understanding the trends in research studies can also help higher education policy makers in making decisions regarding technology and teaching and learning (Wu et al., 2012).

This paper provides a systematic review of mobile learning research in higher education from 2011 to 2015. It begins with an analysis of previous review studies in order to provide the basis of comparison with similar studies. The research purpose and questions are then described. The next section discusses the methodology used to conduct the review study. This is followed by the presentation of the results of the study, with a comparison to three previous studies. The final section provides a discussion of the findings of the review study.

Previous Studies

A number of review studies have been conducted in recent years in an attempt to explore and provide insights into the growing body of knowledge in mobile learning. One of the first reviews in mobile learning provided an activity-focused perspective of case studies in the use of mobile technologies for education (Naismith, Lonsdale, Vavoula, & Sharples, 2004). Cheung and Hew (2009) conducted a review of research methodologies used in mobile learning in school and higher education settings. They reviewed 44 articles published until the end of 2008 and found that descriptive research was the most dominant research method and questionnaires were the most used data collection method. Frohberg, Göth, and Schwabe (2009) conducted a review of 109 mobile learning projects to evaluate and categorise them against a mobile learning task model. Hwang and Tsai (2011) conducted a study of research trends in mobile and ubiquitous learning by reviewing 154 articles from six major technology-enhanced learning journals from 2001 to 2010. They found that the number of studies increased significantly over the period. They also found that higher education students were the most frequent learning populations and that most studies did not focus on a specific learning domain. Hung and Zhang (2012) examined mobile learning trends between 2003 and 2008 by using text-mining techniques to conduct a meta-trend analysis of 119 articles. They similarly found that studies in mobile learning increased rapidly over that period. They also found that many studies focused on the effectiveness of mobile learning but there was increasing focus on evaluation and systems development. Wu et al. (2012) recognised the value of these two previous studies, but felt further examination was required “from the standpoint of research purposes, methodologies, and outcomes” (p. 817). The authors used a meta-analysis approach to

systematically review 164 mobile learning studies published between 2003 and 2010. They also found most research purposes focussed on effectiveness and system design, but also found that surveys and experimental methods were the most used research methods and that the research outcomes in studies were significantly positive.

Systematic reviews have also been conducted on conference proceedings. Wingkvist and Ericsson (2011) surveyed 114 papers presented at the World Conference on Mobile Learning (mLearn) conferences in 2005, 2007, and 2008. The focus of the review was on research purposes and research methods. They found that research methods were evenly distributed, with the exception of basic research (development of new theories). In terms of research purpose, the majority of papers were descriptive research, followed by developmental and understanding research. The lack of evaluative research papers was found to be a problem (Wingkvist & Ericsson, 2011).

A number of review studies have also been conducted to investigate a particular aspect or theme related to mobile learning. Wong and Looi (2011) conducted a review of mobile-assisted seamless learning related literature between 2006 and 2011. Baran (2014) studied the literature to “fill the gap” on mobile learning research in teacher education programmes. Song (2014) investigated methodological issues in Mobile Computer-Supported Collaborative Learning (mCSCL) research between 2000 and 2014. Liu et al. (2014) reviewed 63 articles in K-12 education between 2007 and 2012. Hsu and Ching (2015) reviewed 17 articles to categorise the models and frameworks developed specifically for mobile learning. Alrasheedi and Capretz (2015) reviewed 19 articles to determine critical success factors affecting mobile learning.

Parsons (2014) noted the number of previous reviews, yet highlighted that most reviews tended to focus on a specific subset of the literature or a particular aspect of mobile learning. The purpose of his study was to “provide a full-landscape view of the field of mobile learning” up to and including 2013 (p. 2). Findings were presented in two forms. A timeline was used to highlight the evolution of mobile learning through a series of significant “firsts.” Secondly, a mind map was used to summarise the key concerns in the areas of research, technology, content, learning, and learner (Parsons, 2014).

Research Problem

The number of literature review-based studies and the results of these studies indicate a research field that is growing and changing. Due to developments in technology, it is worth considering how the field of mobile learning research is changing and how these studies are applied in higher education specifically. Although several review studies (Hwang & Tsai, 2011; Wu et al., 2012) have found that the majority of mobile learning studies take place within higher education, very few mobile learning review studies have focussed solely on this sector. This study aims to analyse the research topics, methods, settings, and technologies used in mobile learning research in higher education, published from January 2011 to December 2015. The research questions are:

1. What research methods have been used in mobile learning articles published from 2011 to 2015?
2. What are the research trends in terms of purposes, themes, and technologies?

3. How do the findings relate to previous mobile learning reviews from 2001 to 2010?

Methodology

A systematic review provides a summary of the research literature, either quantitative or qualitative, that uses explicit, replicable methods to identify and select relevant studies; and uses objective and replicable techniques to analyse and summarise those studies (Cooper, 2010, as cited in Bernard, Borokhovski, & Tamim, 2014). In order to ensure a systematic review process, this study followed the seven steps suggested by Cooper (2010, as cited in Bernard et al., 2014) for conducting a systematic review or meta-analysis:

1. Formulate the research problem.
2. Search the literature.
3. Gather information from studies.
4. Evaluate the quality of studies.
5. Analyse and integrate the outcomes of research.
6. Interpret the evidence.
7. Present the results.

These stages are neither mutually exclusive nor entirely distinct; rather, they should be viewed as key steps in a continuous and iterative process (Cooper, 2010, as cited in Bernard et al., 2014). The first step in conducting a systematic review is to formulate the research problem, which has been specified in the section above.

Literature Search

The second step in a systematic review is to search the literature. A limitation may exist in this study, referred to as publication bias (Bernard et al., 2014), as this study has not surveyed the “grey literature” such as conference proceedings, technical reports, dissertations, and book chapters. However, the search was limited to peer reviewed journal articles in order for better comparison between sources and aligns with the search strategies by Hwang and Tsai (2011), Wu et al. (2012), Baran (2014), and Bozkurt et al. (2015). Based on these studies, two databases were selected to ensure comprehensive data collection: Scopus and ISI Web of Science. The starting point involved searching for a combination and variation of the keywords “mobile learning” or “m-learning” and reviewing the results against the following inclusion criteria:

- Must involve mobile learning as a primary condition,
- Must focus specifically on learning at the higher education level,
- Must be published in a peer reviewed journal between January 2011 and December 2015,
- Must be written in English, and

- The full-text of the article must be publically available or available through the researchers' institutional library subscriptions.

The first database searched was Scopus. A search of the keywords “mobile learning,” “m-learning,” or “mlearning” in articles published between 2011 and 2015 resulted in 1024 results. The results were filtered to remove non-journal sources (955 results remained) and non-English texts (937 results remained). The researchers then discarded 373 results because they did not have access to the full text. The remaining 564 results were assessed against the criteria that the primary focus of the article was mobile learning and within higher education. A total of 348 articles did not meet these criteria, leaving 216 articles to be included in this study.

The second database searched was the ISI Web of Science (SCI/SSCI). A search of the keywords “mobile learning,” “m-learning,” or “mlearning” in articles published between 2011 and 2015 resulted in 1703 results. The results were filtered to remove non-journal sources (698 results remained) and non-English texts (578 results remained). The researchers then discarded 254 results because they did not have access to the full text. The remaining 324 results were assessed against the criteria that the primary focus of the article was mobile learning and within higher education. One hundred and sixty-nine articles did not meet these criteria, leaving 155 articles to be included in this study. These were compared to the results of the previous database search, and 138 duplicates were excluded and 17 results were added, resulting in a total of 233 articles to be studied.

Information Gathering

The third and fourth steps in conducting a review are to gather the information from studies and evaluate the quality of studies. The 233 articles were collected and organised with the bibliographic data including article title, authors, journal, abstract, keywords, and publication year. Eleven additional categories related to the articles were coded, based on the studies of Hwang and Tsai (2011), Wu et al. (2012), Baran (2014), and Bozkurt et al. (2015). The categories were: (a) research purpose, (b) research theme, (c) conceptual and theoretical background, (d) research method, (e) research design, (f) data collection method, (g) target population, (h) learning domain/discipline, (i) learning setting, (j) type of device, and (k) country. Two independent researchers then independently confirmed the coding for the first six categories. Disagreements between the two coders were resolved through discussion and further review of the disputed studies by the principal researchers. This review study targeted peer-reviewed journal articles, which helps to ensure the relative rigour and quality of studies under review (Hsu & Ching, 2015). The spreadsheet matrix with the 233 categorised articles can be accessed [online](#).

Research Analysis

The fifth step is to analyse and integrate the outcomes of research. This study made use of content analysis to analyse the data. Content analysis is a method of analysing documents and enables the researcher to test theoretical issues to enhance understanding of the data (Elo & Kyngäs, 2008). Content analysis can use a mix of quantitative and qualitative methods so that a combination of bibliometric and categorical data can be used to reveal trends (Hung & Zhang, 2012). In order to answer our third research question, the results were then compared to the results of this study with three previous literature review studies (Hung & Zhang, 2012; Hwang & Tsai, 2011; Wu et al., 2012). It must be noted that a direct comparison cannot be performed with each aspect of the studies due to differences in the

approaches, timing, and methods used in this study, but that a useful comparison may still be drawn between these studies.

Steps 6 and 7 of the systematic content review process are to interpret the evidence and present the results. The next section of the paper presents the outcomes of this process. Two hundred and thirty-three articles on mobile learning in higher education published from 2011 to 2015 were included in this sample: for 2011 – 22 articles; for 2012 – 38 articles; for 2013 – 45 articles; for 2014 – 68 articles; and for 2015 – 60 articles. The frequency of papers is apparent in the sample increase for each year under study, except for the last.

Journals

These articles were published in 88 different journals. Table 1 shows the frequency of articles from journals that have three or more articles in this study. Those journals that are open access are denoted with an OA in brackets after the journal name.

Table 1

Distribution of Journals With Three or More Articles in This Study

Rank	Journals	Frequency
1	Computers & Education	19
2	The International Review of Research in Open and Distributed Learning (OA)	18
3	Educational Technology & Society (OA)	13
3	International Journal of Interactive Mobile Technologies (OA)	13
5	Computers in Human Behavior	12
5	Turkish Online Journal of Educational Technology (OA)	12
7	British Journal of Educational Technology	11
7	Journal of Universal Computer Science (OA)	11
9	The Turkish Online Journal of Distance Education (OA)	7
10	Australasian Journal of Educational Technology (OA)	5
10	Electronic Journal of e-Learning (OA)	5
10	IEEE Transactions on Learning Technologies	5
13	International Journal of Mobile and Blended Learning	4
13	Research in Learning Technology (OA)	4
15	Journal of Asynchronous Learning Networks	3
15	Nurse Education Today	3
15	Language Learning and Technology (OA)	3
15	The International Journal of Educational Technology in Higher Education (OA)	3

Countries

This study represented a wide range of developed and developing countries, for a total of 45 countries. Country categorisation was based on the country where the research was conducted, rather than the researcher's affiliation. The countries with the most number of studies represented were United States (26), United Kingdom (25), Taiwan (21), Spain (16), and Turkey (16). In terms of comparison with studies from 2001-2010, these findings closely align to the findings of Hwang and Tsai (2011). In their study, they found that the three countries that contributed the most number of studies were the United States, Taiwan, and the United Kingdom, which is the same in this study. Hung and Zhang (2012) also found the top two contributors to be Taiwan and the United States, although South Korea was third in

their study. As an indication of the expansion of the field of mobile learning, the articles in the study by Hwang and Tsai (2011) represented studies conducted in 25 countries, while in this study, 45 countries were represented.

Results

Research Purposes

Each article was categorised according to its research purpose, adapted from the classification presented by Wu et al. (2012). The original four purposes were: (1) Evaluate Effectiveness, (2) Design a Mobile System, (3) Investigate the Affective Domain, or (4) Evaluate the Influence of Learner Characteristics. A similar classification was provided by Hsu and Ching (2015). Two additional categories were added by the researchers for this study: (5) Develop Theory and (6) Explore Potential, in order to better represent all possible purposes. These categories were then defined as:

- Evaluate the effects: investigates whether mobile devices can improve or enhance student learning.
- Explore the potential: explores how to use a new tool or how a new technology could be used for learning (usually a small pilot or exploratory study).
- Investigate the affective domain: investigates the affective domain includes factors such as student motivation, beliefs, attitudes, perceptions, and values.
- Design a system: designs frameworks or systems where the emphasis is on the development and presentation of solutions.
- Develop theory: create or promote new pedagogical approaches, models, theories, or frameworks of mobile learning.
- Influence of learner characteristics in the learning process: examines the influence of learner characteristics such as age, gender, ability, experience, learning style, and culture.

As shown in Figure 1, the most common research purpose was found to be to evaluating effectiveness (24%), followed by designing a mobile system (23%), and investigating the affective domain (19%). In terms of comparison with 2001-2010, these findings are similar to those of Wu et al. (2012) in that evaluating effectiveness was the most common method, followed by designing a mobile system. However, studies investigating the affective domain, previously a very small research purpose in terms of the number of studies, have become a greater point of focus.

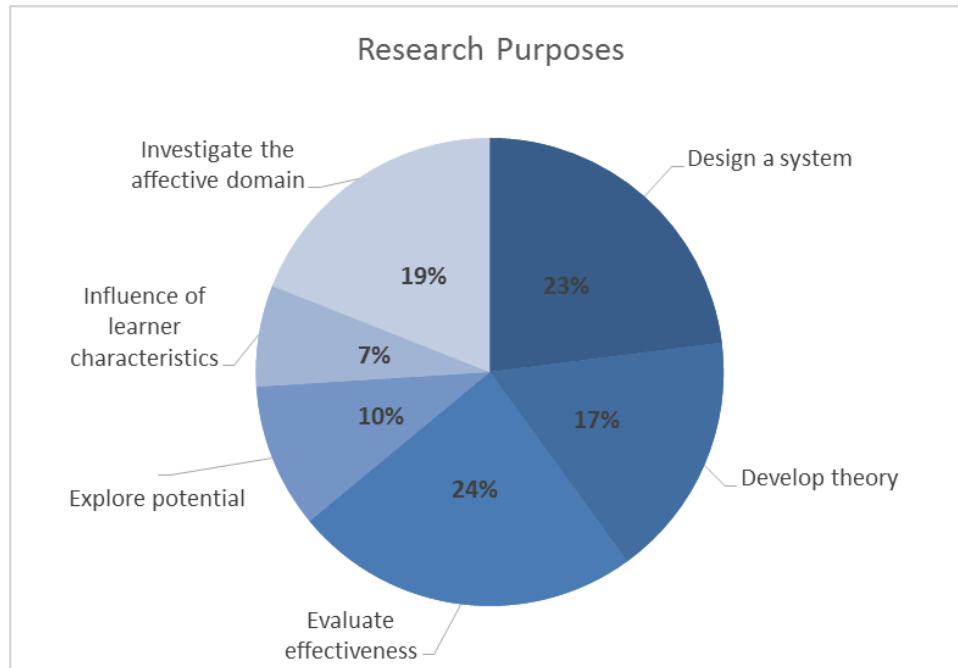


Figure 1. Distribution of studies by research purpose.

Themes

It is difficult to find a common list of themes within mobile learning as the categorisation of mobile learning research depends on the focus of the interests of the researchers (Parsons, 2014). For example, researchers such as Parsons (2014) and Hsu, Ching, & Snelson (2014) have provided different categorisations. In this study, the researchers decided to adapt the themes proposed by the annual *International Conference on Mobile Learning Conference* themes (<http://mlearning-conf.org/>). Figure 2 shows the distribution of research themes in studies from 2011-2015. Although several articles contained overlapping themes, each article was categorised into one major theme for the purpose of this review. Studies covered a wide range of themes within mobile learning in higher education. The most common research theme focused on enabling m-Learning applications and systems (23%), followed by socio-cultural context and implications of m-Learning (13%), and tools and technologies for m-Learning (12%). No comparison can be done with the research studies from 2001-2010 as the research themes as categorised in this study were not within the scope of the studies of Hwang and Tsai (2011), Hung and Zhang (2012), and Wu et al. (2012).

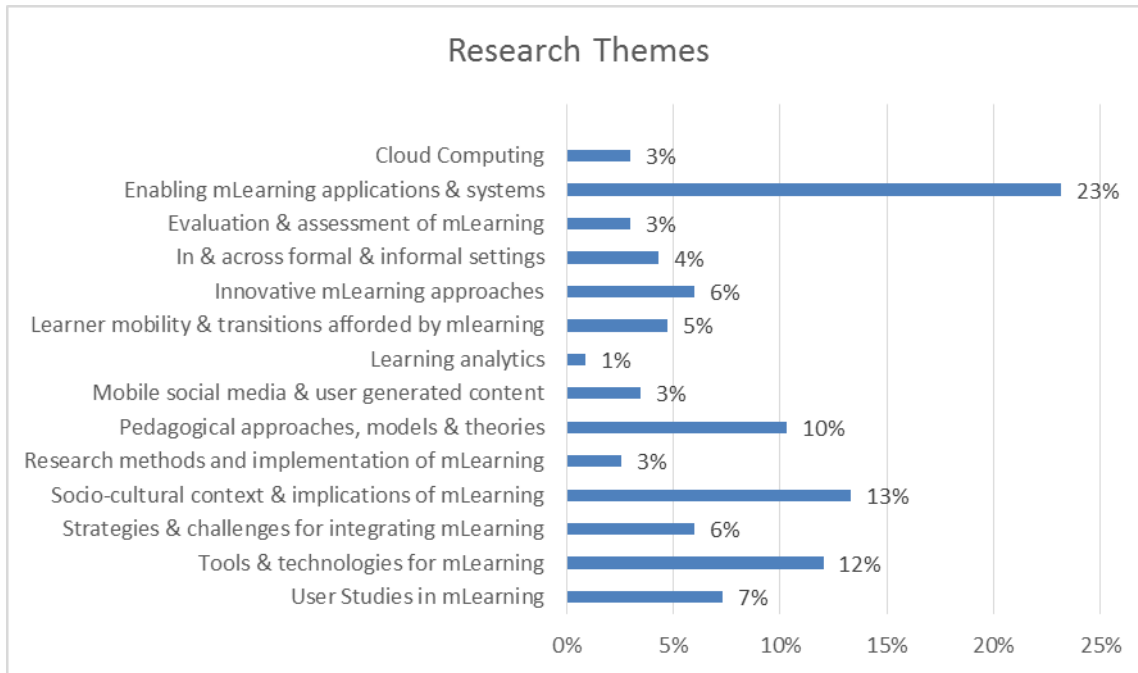


Figure 2. Distribution of studies by research theme.

Researchers continue to investigate a wide variety of research themes or topics. The most common research theme for mobile learning in higher education is the wide variety of applications and systems that are used to enable learning. Existing systems such as text messaging can be used to communicate with or support students (Lim, Fadzil, & Mansor, 2011) or custom applications can be designed for specific subjects (Wu, 2015). The next most common theme is the exploration and use of new tools and technologies for mobile learning. These include specific devices such as smartphones (Gikas & Grant, 2013), tablets (Churchill & Wang, 2014; Engin & Donanci, 2015) and other devices. Researchers are also interested in the social and cultural contexts that surround mobile learning (Arpaci, 2015; Viberg & Gronlund, 2013). Educators are exploring how to use social media such as Twitter (Hsu & Ching, 2012) for learning. Researchers are also developing pedagogical approaches or theories for mobile learning (Dennen & Hao, 2014; Park, 2011). Other researchers have provided strategies for integrating mobile learning and overcoming challenges to mobile learning implementation (Brown & Mbat, 2015; Cochrane, 2014). A few studies have also examined differences in learners and faculty by studying users within mobile learning (Mac Callum, Jeffrey, & Kinshuk, 2013; Lin, Zimmer, & Lee, 2013). Educators are also interested in learning within classes and out of classes. In-class systems may include student response systems (Calma, Webster, Petry, & Pesina, 2014), while researchers are also interested in informal learning outside of classrooms (Reychav, Kobayashi, & Dunaway, 2015). Innovative learning approaches include a variety of different approaches. Studies have used context-aware mobile learning services to personalise learning (Lu, Chang, Kinshuk, Huang, & Ching-Wen, 2014; Wu, Hwang, Su, & Huang, 2012) or made use of mobile augmented reality (Fonseca, Martí, Redondo, Navarro, & Sánchez, 2014). The use of gamification has been used to promote motivation (Bartel & Hagel, 2014). Learner mobility studies have focused on learners using devices for collaborative learning in the field (Redondo, Fonseca, Sánchez, & Navarro, 2014). Another area of interest for educators and researchers is the use of assessment and evaluation. For example, integrating the use of mobile quizzes into learning processes (Bogdanović, Barać, Jovanić, Popović, & Radenković, 2014). Researchers have focused on integrating cloud computing into mobile learning (Wang, Chen, & Khan, 2014). Researchers have also investigated how mobile learning is researched and implemented, through review studies (Baran, 2014). With

increasing amounts of data available, educators are interested in using learning analytics to understand and optimise learning processes and environments (Tabuenca, Kalz, Drachsler, & Specht, 2015).

Theoretical and Conceptual Backgrounds

Every research study should have clear theoretical or conceptual backgrounds (Bozkurt et al., 2015). In classifying the theoretical and conceptual backgrounds specified in research articles, insights may be provided regarding the kinds of topics and how researchers are approaching them in mobile learning in higher education. Where stated, the theories and or concepts stated in the articles were included in the categorisation, adapted from the classification by Bozkurt et al. (2015). Table 2 lists the most frequently stated theories or underlying concepts. In several articles, multiple theoretical or conceptual backgrounds were used together; however, Table 2 only highlights the frequency of the theoretical or conceptual backgrounds in the population.

The most frequently stated theoretical or conceptual backgrounds model how users come to accept and use a new technology (Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Diffusion of Innovation). A strong emphasis can be seen on collaboration within a community (Collaborative Learning, Communities of Practice). Another trend can be seen to be moving to a learner-oriented paradigm focussing on student experiences in a social world (Activity Theory, Social Constructivism, Constructivism) and authentic learning experiences (Authentic Learning). With the affordances of mobile technologies leading to educators redesigning their curricula or modes of provision, instructional design theories are also important (Cognitive Load Theory, Instructional Design).

Table 2

Distribution of Most Common Theoretical or Conceptual Backgrounds

Rank	Theoretical / Conceptual background	Frequency
1	Technology Acceptance Model (TAM)	23
2	Unified Theory of Acceptance and Use of Technology (UTAUT)	9
3	Collaborative Learning	6
4	Activity Theory / Systems	5
4	Cognitive Load Theory	5
4	Diffusion of Innovation	5
4	Self-regulated / Self-managed Learning	5
8	Authentic Learning	4
8	Communities of Practice	4
8	Learning Styles	4
8	Scaffolded Learning	4
8	Social Constructivism	4
8	Socio-cultural Theory	4
8	Technological Pedagogical And Content Knowledge (TPACK)	4
15	Adaptive Learning	3
15	Constructivism	3
15	Cultural Dimensions	3
15	Instructional Design	3
15	Substitution Augmentation Modification Redefinition (SAMR)	3

No comparison can be done with the research studies from 2001-2010 as the theoretical and conceptual background was not a specific focus of the studies of Hwang and Tsai (2011), Hung and Zhang (2012), and Wu et al. (2012).

Research Designs

A mobile learning study generally employs a quantitative, qualitative, or mixed research method like other educational fields (Bozkurt et al., 2015). In this review, researchers in mobile learning in higher education mostly conducted qualitative research (46%) or quantitative research (43%), with fewer studies employing mixed methods (11%). No comparison can be done with the research studies from 2001-2010 as the research method was not a specific focus of the studies of Hwang and Tsai (2011), Hung and Zhang (2012), and Wu et al. (2012).

In addition to the research method, the research design can also be explored within each of the methods. The methods used to categorise the research were adapted from Bozkurt et al. (2015) and Creswell (2009). Table 3 indicates that the most commonly used research designs for quantitative studies were descriptive surveys (17%), followed by correlational studies (13%), and experiments (12%). Table 3 also indicates that the most commonly used research design for qualitative studies was design-based research (18%), followed by case studies (17%), and action research (3%). For mixed methods, the most common research designs used were sequential explanatory (7%), concurrent triangulation (3%), and sequential exploratory (1%).

Table 3

Distribution of Studies by Research Design

Quantitative (43%)		Qualitative (47%)		Mixed (11%)	
Case Study	1%	Action Research	3%	Concurrent Triangulation	3%
Correlational	13%	Case Study	17%	Sequential Explanatory	7%
Experiment	12%	Content Analysis	3%	Sequential Exploratory	1%
Survey	17%	Design-based	18%		
		Grounded Theory	1%		
		Meta-synthesis	2%		

In terms of comparison with 2001-2010, the quantitative method findings closely align to the findings of Wu et al. (2012). They found the most common methods for quantitative studies to be experiments and descriptive research. However, the qualitative methods are different in that Wu et al. (2012) did not find case studies, action research, nor other qualitative methods to be widely used. A caution must be noted though that Wu et al. (2012) presented their results with a different classification and integrated the presentation of results for both research methods and data collection methods.

Data Collection

Data collection methods were also investigated in this study. Methods were coded into seven categories, adapted from Song (2014) and Cheung and Hew (2009). Table 4 shows that the most common method used was a survey (47%) followed by interviews/focus groups (18%) and assessments (13%). Studies utilised between one and five data collection methods, with 57% of studies utilising one method and 28%

of studies utilising two methods. Twelve percent of studies utilised three methods, while 3% utilised four methods.

Table 4

Distribution of Studies by Data Collection Method

Method	Instruments or techniques	Frequency
Assessment	Tests or quizzes	13%
Document Review	Examination of documents	5%
Interviews/Focus Groups	Discussions between researchers, staff, or students	18%
Observation	Visual examination and documenting actions and utterances of participants, either directly or via recording	3%
Process Data	Estimates of time, frequency and sequence as well as tracing data and learning analytics obtained from systems and devices	6%
Product Data	All outputs produced by participant activities such as course assignments	7%
Survey	Questionnaires, surveys, and scales	47%

In comparison with studies from 2001-2010, the collection method findings do align somewhat to the findings of Wu et al. (2012) in that surveys continue to be the most common format of collecting data. However, the current study results seem to indicate that a wider range of data collection methods were used (2011-2015) than previously.

Population Groups

It was found that the vast majority of studies were aimed at students (78%). A few studies focused on faculty (10%) or a combination of both faculty and students (12%). Of the studies that focused on students, 75 studies distinguished between undergraduate and postgraduate levels of students. Of these studies, 81% studies focussed on undergraduates and 19% focused on postgraduate students. As both faculty and student adoption play a part in the success of mobile learning initiatives, it is recommended that more studies in the future look to investigate the implications for both faculty and students. A major difference between this study and previous studies by Hwang and Tsai (2011) and Wu et al. (2012) is that this study only focused on the higher education sector. However, both Hwang and Tsai (2011) and Wu et al. (2012) similarly found that the majority of mobile learning studies across all sectors focused on higher education students.

Academic Disciplines

Wu et al. (2012) define an academic discipline as a branch of knowledge that is taught or researched at the higher education level. This study follows the discipline taxonomy used by Wu et al. (2012) who adopted it from the taxonomy developed by Becher (1994), Wanner, Lewis, and Gregorio (1981), and others. This taxonomy identifies five major categories of academic discipline: humanities, social sciences, natural sciences, formal sciences, and professions and applied sciences. Academic subjects listed in the *Classification of Instructional Programs* (CIP) (Institute of Education Sciences, 2010) can be classified within these disciplines. These disciplines and subjects are listed in Table 5. A third (33%) of mobile learning studies in higher education are across disciplines (generic) or not discipline-specific. If the remaining studies are classified according the above taxonomy, the most frequent are professions and applied sciences (34%), followed by humanities (16%), formal sciences (11%), social sciences (3%),

and natural sciences (3%). In terms of individual sub-disciplines, languages and linguistics was the most common focus (35 studies), followed by education (28 studies), computer science (26 studies), and health sciences (26 studies).

Table 5

Distribution of Disciplines and Sub-disciplines

Discipline	Subject	Number of studies
1. Humanities (16%)	1.1 History	0
	1.2 Languages and Linguistics	35
	1.3 Literature	0
	1.4 Performing Arts	0
	1.5 Philosophy	0
	1.6 Religion	1
	1.7 Visual Arts	3
2. Social Sciences (3%)	2.1 Anthropology	0
	2.2 Archaeology	0
	2.3 Area Studies	0
	2.4 Cultural & Ethnic Studies	1
	2.5 Economics	0
	2.6 Gender & Sexuality Studies	0
	2.7 Geography	3
	2.8 Political Science	0
	2.9 Psychology	2
	2.10 Sociology	2
3. Natural Sciences (3%)	3.1 Space Sciences	1
	3.2 Earth Sciences	2
	3.3 Life Sciences	1
	3.4 Chemistry	2
	3.5 Physics	0
4. Formal Sciences (11%)	4.1 Computer Science	26
	4.2 Logic	0
	4.3 Mathematics	2
	4.4 Statistics	0
	4.5 Systems Science	0
5. Professions / Applied Sciences (34%)	5.1 Agriculture	0
	5.2 Architecture & Design	5
	5.3 Business	12
	5.4 Divinity	0
	5.5 Education	28
	5.6 Engineering	8
	5.7 Environmental Studies and Forestry	1
	5.8 Family and Consumer Science	0
	5.9 Health Sciences	26
	5.10 Human Physical Performance and Recreation	0
	5.11 Journalism, Media Studies and Communication	1
	5.12 Law	0
	5.13 Library and Museum Studies	2
	5.14 Military Science	0
5.15 Public Administration	0	
5.16 Social Work	0	
5.17 Transportation	0	
Generic (Across Disciplines) (30%)	Generic (Across Disciplines)	81

In terms of comparison with studies from 2001-2010, these findings closely align to the studies by Hwang and Tsai (2011) and Wu et al. (2012). Wu et al. (2012) found that the most common disciplines to be professions and applied sciences (29%), humanities (20%), and formal sciences (16%). Similar to findings by Hwang and Tsai (2011), a significant proportion of studies do not focus on a specific discipline, but are generic or across disciplines. Thus, it can be seen that mobile learning continues to be applied across most disciplines and that researchers from different disciplines can collaborate. In terms of sub-disciplines or subjects, the present study has similar findings that languages and linguistics, computer science, and health sciences are well represented. Language and health science educators seem to be more eager to adopt the affordances of mobile learning, where practical benefits can be seen for students. Mobile-assisted language learning (MALL) is a particularly growing area (Viberg & Gronlund, 2013; Wu, 2015). The present study shows that the education discipline has become more of a focus for researchers. It is theorised that educators in computer science and education may be more prone to take advantage of technological innovations in learning. Nonetheless, more studies are required that show how mobile learning is adopted in other academic subjects. For future research at a category level, it is recommended that more research studies be conducted in the natural and social sciences.

Research Settings

Figure 3 shows the distribution of research settings. The categories of research settings were adapted from Song (2014) and Zheng, Huang, & Yu (2014). Most often, research was carried out in both in class and out of class settings (33%), followed by research carried out in class settings (16%) and research conducted across settings (15%). Research also took place in field settings, out of class settings, and in distance settings. More studies are needed in the future that focus on learner mobility and transitions across different settings.

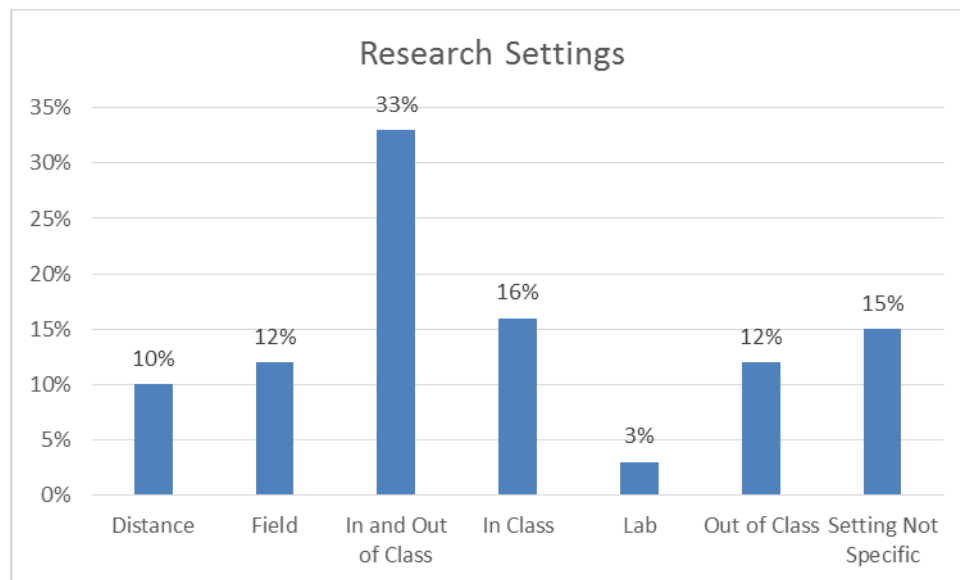


Figure 3. Distribution of studies by research setting.

No comparison can be done with the research studies from 2001-2010 as research settings were not a specific focus of the studies of Hwang and Tsai (2011), Hung and Zhang (2012), and Wu et al. (2012).

Devices

Figure 4 shows the distribution of mobile devices used in the studies from 2011 to 2015. As indicated, the majority of studies (107) studied non-specific / generic mobile devices or learning across mobile devices. This may indicate that as technology changes so quickly, it may be best not to invest in a specific device as mobile learning can take place across a multitude of devices. This result may also be indicative of the growing realisation of Bring-Your-Own-Device (BYOD) (Cochrane, Antonczak, Keegan, & Narayan, 2014; Traxler, 2016). If one looks at the specific device trends, it is clear that mobile phones (including smartphones) are the most frequently used devices in studies (73). It must be noted that 38 of the 73 studies using mobile phones specified the use of smartphones in particular. Tablets are also very frequently used in studies (33). For those studies that reported the specific brand of tablet, the Apple iPad was the overwhelmingly most used tablet brand.

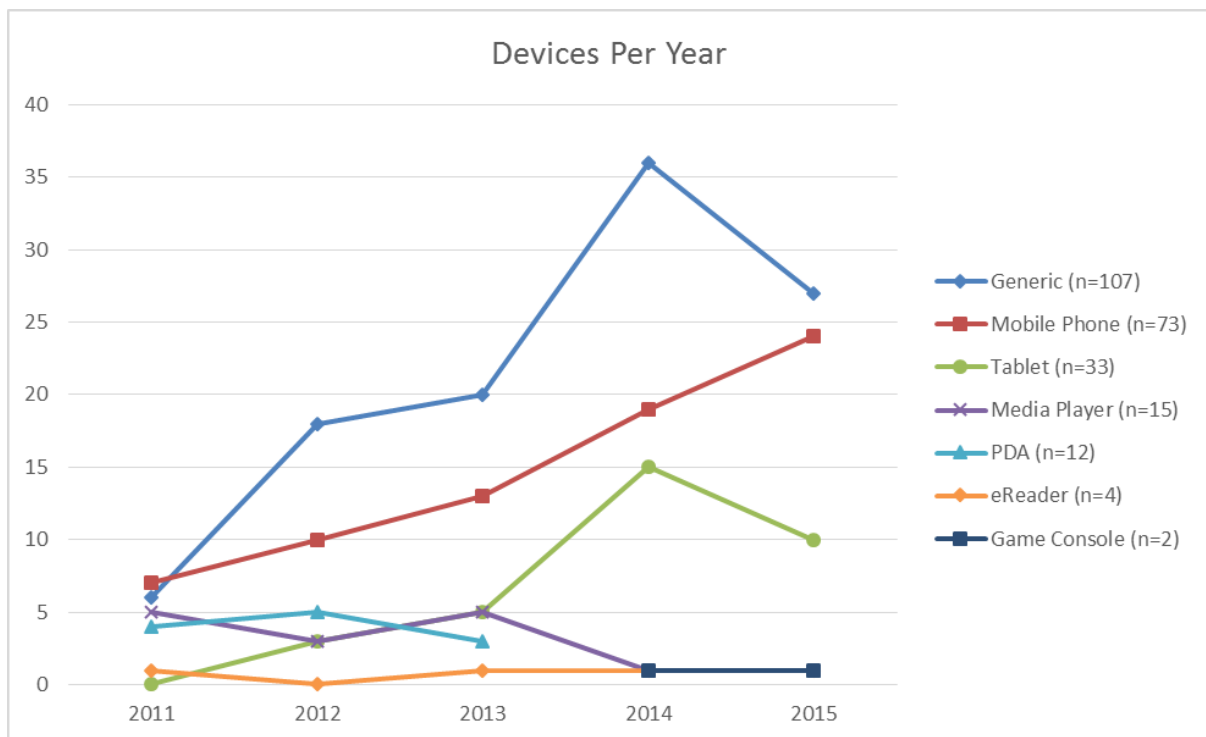


Figure 4. Distribution of devices by year.

In terms of comparison with studies from 2001-2010, the results demonstrate the changes in available technologies since the study conducted by Wu et al. (2012). However, mobile phones are still the most common devices used in studies. An increasing number of studies have focused on the use and affordances of smartphones (for example, the use of specific apps) rather than basic phones and features (for example, text messaging). Changes in available devices and emerging technologies influence the studies that are conducted. For example, previous studies made significant mention of PDA devices, whereas in the more recent studies from 2011-2013, these are seldom mentioned, and not mentioned at all in 2014-2015 studies. Tablet devices, particularly the Apple iPad, launched in 2010, have become much more prevalent.

Discussion

The results of this study reveal research trends and issues in mobile learning in higher education. Mobile learning continues to be a growing area of research in higher education as evidenced by the number of academic articles published between 2011 and 2015 and the number of countries where this research was conducted. Forty-five countries were represented in this study. The results of this study have several implications for future research in mobile learning in higher education.

Need for Expansion of Focus of Research Themes

The most common research purpose was found to be evaluating the effectiveness of mobile learning (24%), followed by the design of a mobile system for learning (23%). This study found that the three most common research themes together (mobile applications and systems; socio-cultural contexts; and tools and technologies) account for almost half of the mobile learning studies in higher education (48%). Figure 5 shows the research themes according to research purpose. This figure shows that there are several themes that are underrepresented in current studies. Consideration of those themes that have fewer studies should lead to researcher reflection and more studies in those areas to lead to a more complete understanding of the field. As a growing research field, the themes within mobile learning in higher education will change over time. However, several themes merit specific attention. More research and practice is required in themes related to innovative approaches (such as context-awareness services, augmented reality, and gamification). Additionally, studies that focus on learner mobility and transitions across different settings are areas where more research is needed. Finally, the use of newer technologies such as cloud computing and learning analytics may become greater themes of focus for researchers.

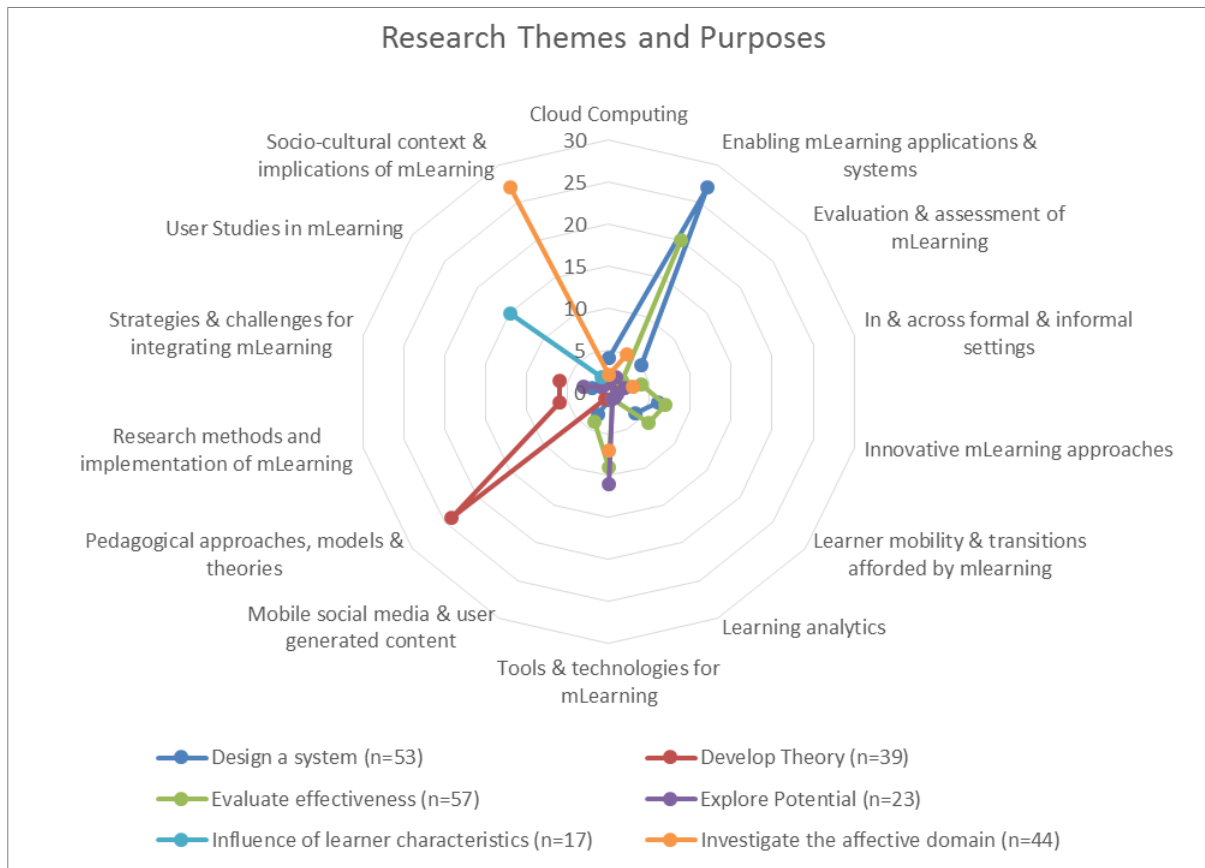


Figure 5. Research themes and purposes radar chart.

Promotion of Variety in Research Design

In terms of research methodology, both qualitative (46%) and quantitative (43%) approaches were used most often, with the remainder of studies utilizing a mixed methods approach. A variety of research designs were employed by researchers; the most common data collection methods were surveys (47%), interviews/focus groups (18%), and assessments (13%). These findings align closely with studies from 2001-2010, but it appears that a wider variety of methods are increasingly being utilised. For future studies, it is recommended that authors are clear in describing the methodology used in their studies and include the theoretical/conceptual background, research design, data collection methods, data analysis approach, population groups, academic discipline, and research setting. Due to the various research topics and approaches in this expanding research field, there is a need for a wide range of research designs. However, the authors would like to point out that more studies in the future should look to make use of mixed methods research approaches. These approaches can combine the strengths of quantitative and qualitative methodologies. It is further recommended that more longitudinal studies are required, as well as studies across more than one individual course in order to understand the long-term effects and impact of mobile learning initiatives. This will also assist with understanding issues around sustainability and scale. Fewer studies are required that compare the mode of teaching and learning (mobile learning or e-learning). This is because of the many variable conditions within a mode of teaching and learning. Researcher attempts to keep all other conditions the same, can lead to a suppression of the conditions that may flourish in a particular mode (Bates & Sangra, 2011).

Growth of Bring-Your-Own-Device (BYOD) and Multiple Devices

A key finding from the study was that a significant proportion of studies did not focus on a specific device for learning, and instead focused on a generic device or on multiple devices. For studies where a device was specified, mobile phones (including smartphones) were the devices most commonly used in studies, followed by tablets. Increasingly, educators and researchers cannot rely on funding for studies where students or staff are provided with specific devices for learning. Further studies are required that look at the personal devices that students have access to and how they access content and university services from these devices. However, BYOD goes beyond access to devices as students are no longer limited to institutional systems, but increasingly have their own internet access and make use of their own services. Devices are important, but the associated systems and networks are equally significant (Traxler, 2016). Access and use of these devices by a majority of students presents challenges and opportunities for the support and provision of learning (Traxler, 2010). Further research is required in how BYOD strategies are incorporated into university teaching and learning and the provision of associated academic and technological support. For the successful integration of mobile learning, faculty need to critically assess the use of mobile devices for learning and design specific learning experiences that take advantage of the affordances of mobile devices. Otherwise, mobile learning may continue to be restricted to viewing a mobile version of an institutional learning management system. Very often, students have access to more than one personal device. Students may use of multiple devices and these devices can change over time. New technologies arrive all the time, enabling faculty and students to explore new ways to learn with these tools (Parsons, 2014). For example, future studies may focus on the impact of wearable technologies in learning.

Focus on Sustainability and Mainstreaming of Mobile Learning

Increasingly, advanced mobile technologies have become integrated into society, but despite the potential, have not yet been “fully and formally integrated into higher education” (Traxler, 2016, “Looking backward”, para. 3). Many innovative research projects in mobile learning in the last 15 years did not extend beyond pilot projects to become embedded or mainstreamed in education, in part because of financial and cultural barriers (Traxler, 2016). Further research into how mobile learning studies can be scaled up or embedded into higher education institutions would be useful. It is expected that in the next 10 years, mobile technologies will continue to become more popular, personal, and social. This means that mobile and connected learners can potentially change the nature of teaching and learning. With the aid of mobile technologies, students can easily “generate, store, share, discuss and consume images, ideas, information and opinions, can access the cloud, and the services it provides, and can access each other” (Traxler, 2016, “Looking forward,” para. 8). Often this takes place outside of institutional systems and applications. This has profound implications for how faculty design courses and facilitate learning.

Conclusion

Similar to previous review studies, this research aims to provide analysis and guidance for the selection of research topics and methods within mobile learning (Hung & Zhang, 2012). Systematic reviews can generate suggestions and insightful implications for researchers and educators aiming to provide meaningful mobile learning experiences and environments (Hsu & Ching, 2015). The reviews of Hwang and Tsai (2011), Hung and Zhang (2012), and Wu et al. (2012) applied to research studies from 2001 until 2010. This study examined articles from 2011 to 2015 as follow up research to consider the

similarities and differences in an expanding field. This research focused solely on the higher education context. Following a search of three academic databases, 233 peer-reviewed articles were selected and organised for review. The researchers used content analysis to analyse the data around categories related to research purpose, theme, method, target population, setting, device, and others. In comparison with previous reviews, similarities were found with regard to research purposes and research methods used.

Key findings indicate that researchers conduct studies in mobile learning in higher education for a variety of reasons, but that evaluating the effectiveness is the most common purpose. Similarly, a variety of themes within mobile learning are explored, but the most common topic focuses on enabling applications and systems. An increasing number of studies have focused on the use and affordances of smartphones (for example, the use of specific apps) rather than basic phones and features (for example, text messaging). Newer research topics relate to mobile learning and social networking, games and augmented reality. Research methods are split between quantitative and qualitative methods. Data collection continues to focus primarily on surveys, but a wider variety of methods is being utilised. A significant proportion of studies do not focus on a specific mobile device, but across devices in mobile learning. The research shows the increasing trend of BYOD. Mobile phones are still the most common devices used in mobile learning studies (including smartphones), but tablets are increasingly popular. A significant change is occurring through BYOD, where learning with multiple personal devices is possible.

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Applying UNESCO Guidelines on Mobile Learning in the South African Context: Creating an Enabling Environment through Policy



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Abstract

Mobile broadband penetration is growing rapidly in Africa, and it offers vast opportunities for mobile learning. Together with its possibilities is the danger of overlooking standards related to its use. The United Nations Educational, Scientific and Cultural Organisation (UNESCO) has initiated work in this area focusing on African and Middle East (AME) countries. Countries are required to develop their own mobile learning policies. Examining information and communication technology (ICT) in the South African education environment, a qualitative approach is adopted using a literature review to assess the relevance and applicability of mobile learning in the broader education environment. A thematic analysis is used to identify themes from UNESCO's guidelines, which are compared to the South African environment. Tracing the use of technology by an open distance learning (ODL) provider, an adapted framework was developed for mobile learning. This article argues the need to create an environment that enables sustainable mobile learning provision through policy development.

Keywords: ODL, ICT, mobile learning, mobile technology, capacity building, policy

Introduction

Literature shows that mobile technology has opened up a world of opportunities for education, especially in Africa (Keegan, 2005; Traxler, 2013). Mobile learning involves the use of mobile technology, either alone or in combination with other information and communication technologies (ICTs) to enable learning anywhere, anytime (Kraut, 2013). South African mobile broadband

penetration is reported to show the fastest growth on the continent (ITWeb Networking, 2014). Nonetheless, amid the hype about its possibilities for learning, there is a danger of over-emphasising these possibilities at the expense of quality assurance standards. Presently, the potential of mobile broadband does not necessarily appear to relate to “quality” or “policy.” Scholars have often warned of the need to be cautious when adopting technologies for education (Bates, 1997; Venkatesh & Bala, 2008; Smith & Winthrop, 2012). This risk necessitates the need for policy statements at both governmental and institutional levels.

UNESCO has initiated work in this area by providing guidelines on the use of mobile technology for learning (Kraut, 2013). The main purpose of these guidelines, which were the outcome of a UNESCO-Nokia partnership focusing on African and Middle East (AME) countries, is to help countries develop their own approaches to mobile learning (UNESCO, 2011). Although the guidelines are now in the public domain, the onus rests on each country to take the initiative to adapt these guidelines to its own context. Given the ubiquity of mobile technology, it appears that countries would generally have no choice but to take this step. South Africa could be said to be one of the more “advanced” countries in Africa in terms of the availability of mobile phones and bandwidth, even though it is not without its challenges. Although the country has publicly acknowledged the place of open and distance learning (ODL) in mending its education system, it has only recently enacted a policy on ODL – a delivery mode that adopts the use of technology (DHET, 2014). Towards the realisation of such a policy, this article seeks to answer the following questions:

1. What is the policy environment in South Africa regarding the use of mobile technology by ODL institutions?
2. To what extent does this relate to UNESCO’s guidelines on the use of the technology?
3. How can ODL institutions (irrespective of their contexts) gauge their readiness to use mobile technology for academic purposes?

Citing the case of South Africa, this article aims to create awareness that will stimulate debate on the need to develop a policy on mobile learning in each local context based on UNESCO’s guidelines.

Mobile Technology: Changing the Face of Learning in South Africa

Globally, it has been predicted that some of the key factors that will drive the expansion of mobile learning include technological advances that make mobile phones more accessible, affordable, and functional, leading to the disappearance of challenges with smaller screen size limitations and the improvement of energy sources and power capacity (Kraut, 2013). Other factors include decreasing societal resistance to using mobile phones in formal education, increasing numbers of successful mobile learning projects that can serve as exemplars for large-scale initiatives, greater pressure on educational institutions to provide high-quality education at low cost to larger numbers of students, the rise of online education and distance learning, and the cultivation of new procurement and distribution channels for digital learning resources.

Due to the rapid growth of mobile technology in Africa, mobile penetration increased from 53% in 2012 (mobiThinking, 2015) to 75% in 2014 (Mwenje, 2014). This has been predicted to reach 79% by 2020, while it is asserted that some African countries have already reached saturation point. This means that every citizen has access to technology (Frost & Sullivan, 2014). South Africa is one of the few countries in Africa with widespread access to technology (Laaser, 2006), but it is not exempted from the challenges of the digital divide: the many remote communities that remain without coverage (Gillwald, Moyo, & Stork, 2012). Scholars have called for caution in inferring vigorous future growth for mobile communications due to demographic and related economic aspects (Balancing-act Africa, 2017).

In South Africa, while not all schools have the capacity to integrate ICTs into classrooms, a growing range of mobile offerings, including applications (apps) and curriculum-supporting websites, is changing the way students interact with learning material (Ngubeni, 2014). In Africa, far from being a theoretical possibility, mobile learning is a current reality (Kraut, 2013). However, scholars have cautioned that ICTs have no intrinsic benefits per se, but are most usefully understood when they are interwoven into practices that exist in specific contexts and for particular purposes (Vosloo, 2013; Kirkwood & Price, 2006). Nonetheless, the unique benefits of mobile learning include its ability to facilitate personalised learning anytime, anywhere, build new communities of learners, and assist learners with disabilities (Kraut, 2013). Mobile technologies have replaced different tools on which people can learn, such as desktop computers, daily newspapers, DVDs, college backpacks, and pocket foreign language dictionaries (Mims, 2012; Qualman, 2016), some of which are not even available to students in rural communities.

In Africa, the use of ICTs in pedagogy is undermined by the misalignment between either enacted or espoused policy (where it exists) on the one hand, and infrastructure, insufficient human resources, poor connectivity, and a lack of access on the other (Tamukong, 2007; Muwanga, 2009). This article focuses on the need to create an environment for sustainable mobile learning provision through policy development.

A policy is an official, formalised plan or course of action that serves to guide and determine decisions, actions, and good practice. Although many African countries appear to have ICT policies, there is a general and marked absence of policies dedicated to mobile learning (Tamukong, 2007). Scholars have attributed this absence to the ignorance of policy makers regarding the capabilities of mobile technologies, negative perceptions that some have about mobile learning, limited examples of sustainable and scalable projects, and issues related to digital access rights, including censorship and privacy concerns (Kraut, 2013). Due to its interwoven nature, capacity building has been identified as a useful method to confront the many challenges involved in ICT usage in Africa (Tamukong, 2007). One way to create an enabling environment at the organisational level is to develop policies that allow organisations to operate optimally and deliver on their mandates (UNDP, 2009).

Research Design and Data Analysis

This study adopted the qualitative research design, in which literature and ICT-related documents were analysed. UNESCO's policy suggestions were juxtaposed with identified documents in South

Africa. The goal was to analyse the documents thematically. Thematic analysis is a qualitative method to identify, analyse, and report patterns within data, which do not need to be tied to any pre-existing theoretical framework (Braun & Clarke, 2006). This article is based on the inductive “bottom up” thematic analysis approach, in which identified themes are linked to the data (Patton, 1990; Frith & Gleeson, 2004; Braun & Clarke, 2006) and not to any pre-existing coding frame (Braun & Clarke, 2006). Thus, the themes have only been identified at the semantic level, in which the researcher is only interested in surface meaning (Braun & Clarke, 2006; Boyatzis, 1998). This enabled a description, comparison, and explanation of the findings (Ryan & Bernard, 2003).

The study made use of the six phases suggested by Braun and Clarke (2006):

- Phase 1:** Familiarising oneself with the data through repeated reading: This involves immersing oneself in the data by repeatedly reading it in an active way to become familiar with meanings and patterns. This process involves taking notes and marking ideas for coding.
- Phase 2:** Generalising initial codes: This involves generating initial codes from the data based on the identified meanings and patterns identified in Phase 1. In this case, the coding was done manually as the researcher did not peruse too many documents.
- Phase 3:** Searching for themes by sorting codes into potential themes: This involves re-focusing the analysis at the broader level of themes rather than codes. In this phase, the different codes are sorted into potential themes. This enabled the researcher to identify the relationship between codes and themes.
- Phase 4:** Reviewing the themes for refinement: In this phase, the researcher was able to consolidate some themes to avoid repetition. This phase also enabled her to consider the validity of individual themes in relation to the data set.
- Phase 5:** Defining and naming themes: This involves further refining the themes, which enables one to identify the essence of each theme given the overall picture.
- Phase 6:** Producing a report: This involves documenting the findings of the research, which are written in such a way as to go beyond a mere description of the data. The argument is stated in relation to the research questions.

Research Findings

The research findings have been divided between the identified documents in the ICT policy environment and mobile learning in South Africa, and the identified themes in UNESCO’s Policy Guidelines for Mobile Learning (Kraut, 2013). The application of these findings to the research questions is then discussed.

Identified Documents in the ICT Policy Environment and Mobile Learning in South Africa

Research shows that almost all African countries have ICT policies in place (Farrell & Isaacs, 2007; IST-Africa, 2012; Kraut, 2013) and giant strides are being made. In South Africa, the current policy framework for ICT in education has been evolving since 1996. It is embedded within government's broader economic, social, and development strategy (Isaacs, 2007). Three documents in particular relate to the policy environment in terms of mobile learning in South Africa:

- **National Association of Distance Education Organisations of South Africa (NADEOSA) quality criteria (Welch & Reed, 2005):** This document was initially developed in the course of research undertaken for the Department of Education (DoE). The quality criteria have since been revised through a stakeholder process involving the distance education community. The criteria include policy and planning, learners, programme development, course design, course materials, assessment, learner support, human resource strategy, management and administration, collaborative relationships, quality assurance, information dissemination, and results.
- **Policy for the Provision of Distance Education in South African Universities in the Context of an Integrated Post-school System (DHET, 2014):** Although South Africa has been involved in distance education for over a century, it has only recently launched its policy on the model. An important factor to have influenced the policy is the ubiquitous penetration and affordability of ICT across the country. One of the key provisions of the policy statement is the creation of an enabling environment for the appropriate integration of ICT to enhance distance education provision in both public and private universities, as well as other post-schooling institutions.
- **Distance Higher Education Programmes in a Digital Era: Good Practice Guide (Council on Higher Education [CHE], 2014):** This guide was developed through a consultative process by the South African Institute for Distance Education. It provides good practice guidelines, examples and indicators for the development and evaluation of distance education programmes, including those supported by digital technologies. Some of its key components include the consideration of the impact of technology, the evaluation of distance education provision in a digital era, and lines of enquiry to guide programme developers and evaluators.

Of the three documents mentioned above, only the second is an enacted policy that has gone through a proper legislative process. The other two are espoused policies that show stakeholders' recognition of the affordability that mobile technology could bring to education.

Identified Themes in UNESCO's Policy Guidelines for Mobile Learning

The policy guidelines on mobile learning emanated from UNESCO's attempt to discuss the opportunity for a set of policy guidelines that could help countries develop their own approaches to mobile learning (UNESCO, 2011). The guidelines illuminate ways in which mobile technologies can be used to support the United Nations' "Education for All" goals, while responding to the challenges of particular educational contexts, supplementing and enriching formal schooling, and making learning more accessible, equitable, personalised, and flexible for students everywhere (Isaacs, 2012).

The following 10 policy guidelines are discussed in the document:

1. Create or update policies related to mobile learning.
2. Train teachers to advance learning through mobile technologies.
3. Provide support and training to teachers through mobile technologies.
4. Create and optimise educational content for use on mobile devices.
5. Ensure gender equality for mobile students.
6. Expand and improve connectivity options while ensuring equity.
7. Develop strategies to provide equal access for all.
8. Promote the safe, responsible and healthy use of mobile technologies.
9. Use mobile technology to improve communication and education management.
10. Raise awareness of mobile learning through advocacy, leadership, and dialogue.

Based on the six phases of thematic analysis identified by Braun and Clarke (2006), 10 themes have been identified from UNESCO's guidelines (see Figure 1).

- 
- ❖ *Policy updates/creation*
 - ❖ *Training teachers*
 - ❖ *Teacher support*
 - ❖ *Developing educational content*
 - ❖ *Gender equality*
 - ❖ *Improving connectivity*
 - ❖ *Equal access*
 - ❖ *Safe and responsible use*
 - ❖ *Improved communication and education management*
 - ❖ *Awareness through advocacy, leadership and dialogue*

Figure 1. The 10 themes identified from UNESCO's guidelines, based on the six phases of thematic analysis identified by Braun and Clarke (2006).

The essence of this research is to identify similarities between UNESCO's guidelines and the South African context, to identify gaps and to make recommendations. This enabled the researcher to

rigorously apply the themes to make her assumptions congruent with the way she has conceptualised the subject matter (Reicher & Taylor, 2005; Braun & Clarke, 2006).

Discussion

Assessing the South African Mobile Technology-in-Education Environment

The themes from UNESCO's policy guidelines for mobile learning have been used to assess South Africa's mobile technology-in-education environment. Due to their interrelatedness, overlapping themes have been combined to avoid unnecessary repetition. This is in line with the Phase 4 of the process described by Braun and Clarke (2006).

Policy updates and awareness through advocacy, leadership, and dialogue. Two of UNESCO's policy guidelines relate to the theme of policy updates and awareness through advocacy, leadership and dialogue. These are the guidelines: *create or update policies related to mobile learning* and *raise awareness of mobile learning through advocacy, leadership and dialogue* (see Figure 1).

Although mobile technology holds significant potential for resolving AME countries' educational challenges, mobile learning has to be supported by political will and leadership (Isaacs, 2012). The three documents that were compared to UNESCO's policy guidelines provide evidence of South Africa's ongoing effort to update its ICT policies, provide leadership, and create awareness of the importance of technology and its relevance to education. Even though there is not yet a fully dedicated policy on mobile learning in the country, government seems to be aware of the affordability that mobile technology could bring to ODL. Furthermore, there is ample evidence that all the policy and policy-related documents have been developed through dialogue and consultation. There is also evidence that these efforts have filtered down to institutions of higher learning, since most of these institutions have developed policies on the use of ICTs to enhance student learning. However, the findings reveal that the first two documents—*NADEOSA's Quality Criteria* and the *Policy for the Provision of Distance Education in South African Universities* (DHET, 2014)—merely allude to the potential use of technology for learning; *Good Practice Guide of the Council on Higher Education (CHE)* provides only a general guide on the use of ICTs. The country therefore does not appear to have a dedicated policy on mobile learning. This fact supports findings from literature that there is a policy vacuum regarding the use of the technology in AME countries (Keating & Williams, 2006; (Isaacs, 2012).

Training and supporting teachers. Another two of UNESCO's policy guidelines—train teachers to advance learning through mobile technologies and provide support and training to teachers through mobile technologies—relate specifically to the training and support of teachers (see Figure 1).

Teachers are crucial to any expected success with mobile learning. However, without proper training and support, teachers are in danger of using ICTs to merely transmit subject content, rather than to truly take advantage of these technologies to enhance learning (Ndlovu & Lawrence, 2012). This occurs because many teachers grew up in environments with limited electronic technology, and thus

find the adaptation necessary for working with ICTs more difficult than their learners do. Hence, there is a need for extensive staff development and support (DoE, 2004).

Initiatives in collaboration with government involve organisations such as the Meraka Institute, Microsoft, and Vodacom. The *Vodacom Mobile Education Programme* focuses especially on Mathematics and Physical Science (Brand South Africa, 2011). The training focuses on ICT literacy, as well as the effective use and integration of digital content in the classroom. To support this training, educators are provided with the necessary ICT infrastructure and tools. Although research-based evidence that mobile phones can enhance and support teachers' professional development and ODL is sparse in AME countries, a range of projects has shown that Short Message Service (SMS) technology can facilitate communication with student teachers in remote areas. It has also shown that technology can serve as a curriculum delivery platform, support education management and information systems, and enable peer support, teacher training and continuing teacher professional development (UNESCO, 2012a). At the higher education level, institutions are continually making efforts to train and update the ICT skills of staff and students.

Creating and optimising educational content. A further one of UNESCO's policy guidelines relates to the need to create and optimise educational content. This is the guideline: *create and optimise educational content for use on mobile devices* (see Figure 1).

Research shows that South Africa is the leading innovator in Africa in terms of social networking, microblogging, and content creation (UNICEF, 2012). South African researchers are extensively involved in UNESCO's work in mobile learning (UNESCO, 2011). The government—in partnership with the relevant companies—has been involved in the content development of interactive workbooks (Mnisi, 2015). In 2013, for example, Future Mobile Technology launched a tablet pre-loaded with South Africa's Mathematics and Physical Science curricula for grades 10 to 12 (Future Mobile Technology, 2013). The country has also made giant strides in the development of home-grown instant messaging services, such as MXit.

Examples of successful educational projects on MXit are Dr Math, a project that helps school learners with their Mathematics homework via their cell phones (Butgereit, 2007), and Yoza, a research project that has evolved into an online library of mobile novels and short stories ((Isaacs, 2012). Other examples from the continent are the BridgeIT initiative in Tanzania and the Dunia Moja project in South Africa, Tanzania, and Uganda, in partnership with Stanford University in the USA (Trucano, 2009). Some instructional design guidelines based on a solid theoretical framework for mobile learning exist (Traxler, 2009; Isaacs, 2012; Park, 2014). Nevertheless, scholars indicate that more academic research is needed on the app (Chigona & Chigona, 2008; Makoe, 2010; Mayisela, 2013). More research is also necessary to categorise the numerous examples of mobile learning in the context of distance education.

Equal access and gender equality. Another two of UNESCO's policy guidelines—*ensure gender equality for mobile students* and *develop strategies to provide equal access for all*—relate specifically to the need for equal access and gender equality in the adoption of mobile learning (see Figure 3).

Even though some landmarks have been achieved, a lot still needs to be done with regard to gender equality in terms of mobile technology. According to a recent study by the Global System Mobile Association (2015), over 1.7 billion females do not own mobile phones. Cost remains the greatest barrier. This is because women from such backgrounds typically have less financial independence than men. The challenge is not only limited to the cost of the handset, but also the use and maintenance of handsets or related equipment (Isaacs, 2012).

Earlier in one of its studies, Isaacs (2012) gave other possible reasons as a combination of unequal distribution of income, restrictive social taboos, and higher illiteracy rates among women. However, in South Africa, the reverse is the case as female mobile subscribers tend to outnumber males (Gillwald et al., 2012). Nonetheless, South Africa is not without its challenges as most subscribers are located in urban areas. Some efforts are being made to address the issue of connectivity through diverse governmental and non-governmental projects.

Improved communication and education management. Another two of UNESCO's policy guidelines—expand and improve connectivity options while ensuring equity and use mobile technology to improve communication and education management—*relate specifically to the need for improved communication and education management (see Figure 3).*

The availability of more bandwidth has led to improved communication and education management in the country. ICTs have the capacity to automate processes and save time, which frees managers to focus on instructional leadership (DoE, 2004). Many mobile apps for better classroom management are available (Educational Technology and Mobile Learning, 2015). Many ODL providers are also using mobile technology extensively for administrative and management purposes (CHE, 2014; Aluko & Hendrikz, 2012).

Safe and responsible use. A further one of UNESCO's policy guidelines relates to the safe and responsible use of mobile technologies for learning. This is the guideline: *promote the safe, responsible and healthy use of mobile technologies (see Figure 3).*

Concerns regarding safety and the responsible use of ICTs are widespread and serious. This is because of the dangers to which users, especially children, are exposed. In a study conducted by the United Nations Children's Fund (UNICEF) on South African youths on mobiles (UNICEF, 2012), the primary risks faced by adolescents and young people online were talking to and meeting strangers, cyber bullying, and sexting. These risks have led to the most popular social network developed in the country (MXit) acquiring a bad reputation, despite its potential academic value (Chigona, Chigona, Ngqokelela, & Mpofu, 2009). Unfortunately, in most African countries, no coordinated activities in this regard are taking place, even though many children are already active in cyber space (Von Solms & Von Solms, 2014). The risks of ICT use relate to content, contact, and conduct, and are often determined by behaviours rather than the technologies themselves (Byron, 2008).

The South African government has compiled a set of e-safety guidelines to identify the different ICTs currently used by school communities, in particular by teachers and learners, and to recommend strategies for managing ICTs to determine their appropriate and optimal use in education (Department of Basic Education [DBE], 2012). Based on this, schools are expected to develop an Acceptable Use Policy (AUP) that covers different media platforms, most of which are available on

mobile devices. At the higher education level, institutions provide students and staff with appropriate “netiquette” guidelines for the use of ICTs. Scholars have recommended identifying and educating all stakeholders in the cyber safety of children (DBE, 2012), including the introduction of cyber safety curricula in schools (Von Solms & Von Solms, 2014). Nonetheless, the lack of a dedicated policy on mobile learning seems to indicate that matters have been left in the hands of individual ODL providers (UNICEF, 2012).

Contextualisation of UNESCO’s Suggestions

In order to contextualise UNESCO’s suggestions, the use of mobile technology by an ODL provider has been traced. The aim is to develop an adapted framework to assess ODL providers’ readiness to adopt mobile learning. According to UNESCO (2013), one of the reasons for its suggestions on the adoption of mobile learning is to support the “Education for All” goals in order to respond to the challenges of particular educational contexts. Therefore, one hopes that relevant stakeholders will find the framework useful and that they can adapt it to each context.

The use of mobile technology by an ODL provider. Distance education programmes at the University of Pretoria are only offered in the Faculty of Education. These programmes are geared towards assisting teachers who were seriously disadvantaged during the apartheid era. Most of these teachers are employed in predominantly rural areas.

Figure 1 provides a broad overview of the evolution of the use of technology in distance education programmes. The distance education initiative was launched in 2002 with the initial intention of running paper-based programmes, supported by online delivery, because of the capacity of the University’s technological infrastructure. Figure 1 also shows that this vision was redefined, because very few students had internet access (1% in 2002 and 3% in 2003). However, this has gradually changed over the years (reaching 29% in 2014). Therefore, the University decided to explore possibilities for augmenting the traditional paper-based delivery mode with SMS technology. Initially, SMS was used largely as a tool for administrative support, reminding students of important events such as tutorials, assignment deadlines and examination dates, and providing tracking numbers for parcels dispatched.

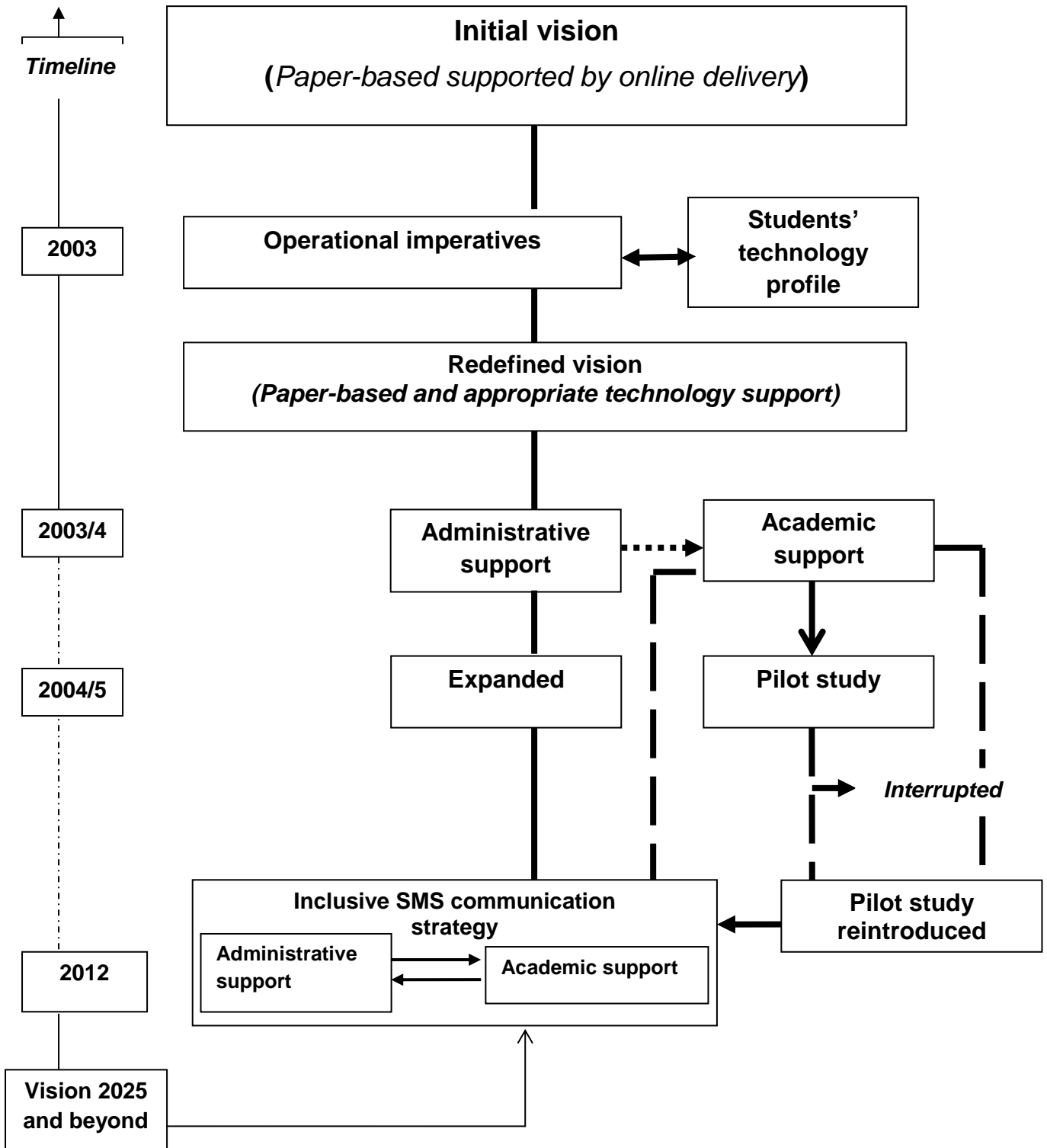


Figure 2. Development of the use of SMS for distance education students at the University of Pretoria. Adapted from Educational technology changes in Africa and its impact on ODL programmes delivery: the case of the University of Pretoria, South Africa, (page 10) by J. Hendrikz and F. R. Aluko, 2013. Copyright by ICDE 2013 World Conference. Adapted with permission.

The expansion of SMS use for administrative support prompted the University to think of innovative ways of extending the same facility to include academic support. The University piloted this expanded function for a while. Its purpose was to mimic what a lecturer does in a conventional face-to-face learning encounter and to translate that into an SMS to support distant students academically. Findings from the studies showed that it is possible and advantageous to use SMS technology to support students academically, albeit in a limited way (Viljoen, Du Preez & Cook, 2005; Aluko & Hendrikz, 2012). Despite the findings, the implementation of the project was interrupted by a number of factors, including staff turnover and a lack of interest on the part of academics using technology in this way.

Experiences at the University of Pretoria have, so far, shown that the interactive nature of both an administrative and an academic SMS leads to the blurring of boundaries between the impact of both the academic and the administrative SMS on students' learning (Hendrikz & Aluko, 2013). Presently, in alignment with the University's strategic plan, the Unit for Distance Education is exploring ways of presenting its programmes via the same medium, focusing more on mobile technology due to its ubiquity. Due to this focus, more training sessions with adequate support are being provided for academics. There appears to be a change in attitude and more interest towards the adoption of mobile learning.

A Framework to Assess ODL Providers' Readiness to Adopt Mobile Learning

According to the researcher's own experience and evidence from literature (UNESCO, 2012b; Makoe, 2010), a framework is presented that justifies the possible use of SMS technology to support distance education students academically. This framework is informed by UNESCO's policy guidelines (Kraut, 2013) and has been adapted from NADEOSA's quality criteria (See Figure 3, Welch & Reed, 2005).

1. Does the institution demonstrate processes and ongoing efforts to improve the quality of teaching and learning with regard to technology available to students through monitoring and evaluation processes?
2. Has the institution conducted a careful analysis of the most appropriate technology?
3. Does the technology meet the demands of cost-effective educational provision?
4. Is the selection based on the needs, resources and capabilities of the students and institutions?
5. Does it create equal educational opportunities for students?
6. Do students have sufficient access to the technology to succeed?
7. Does the technology provide for true two-way communication?
8. Does the management of the institution support the adoption of the technology?
9. Do staff development programmes equip staff to perform their roles and tasks effectively?
10. Does the institution have a policy in place with regard to the safe use of the technology?
11. Does the institution have a monitoring and evaluation plan in place to assess the impact of the technology on students' learning and performance?
12. To what extent are staff members, learners and other clients involved in the processes of quality assurance?

Figure 3. Framework for the Use of Mobile Technology for Teaching and Learning based on the NADEOSA's quality criteria for designing and delivering distance education identified by Welch and Reed (2005).

The link between the themes identified in UNESCO's guidelines and the adapted framework. A cursory look at Figure 3 shows that most of the aspects of the adapted framework are closely linked to UNESCO's suggestions. There are also some overlapping themes; however, fitting some aspects of the adapted framework into the policy guidelines poses some difficulties.

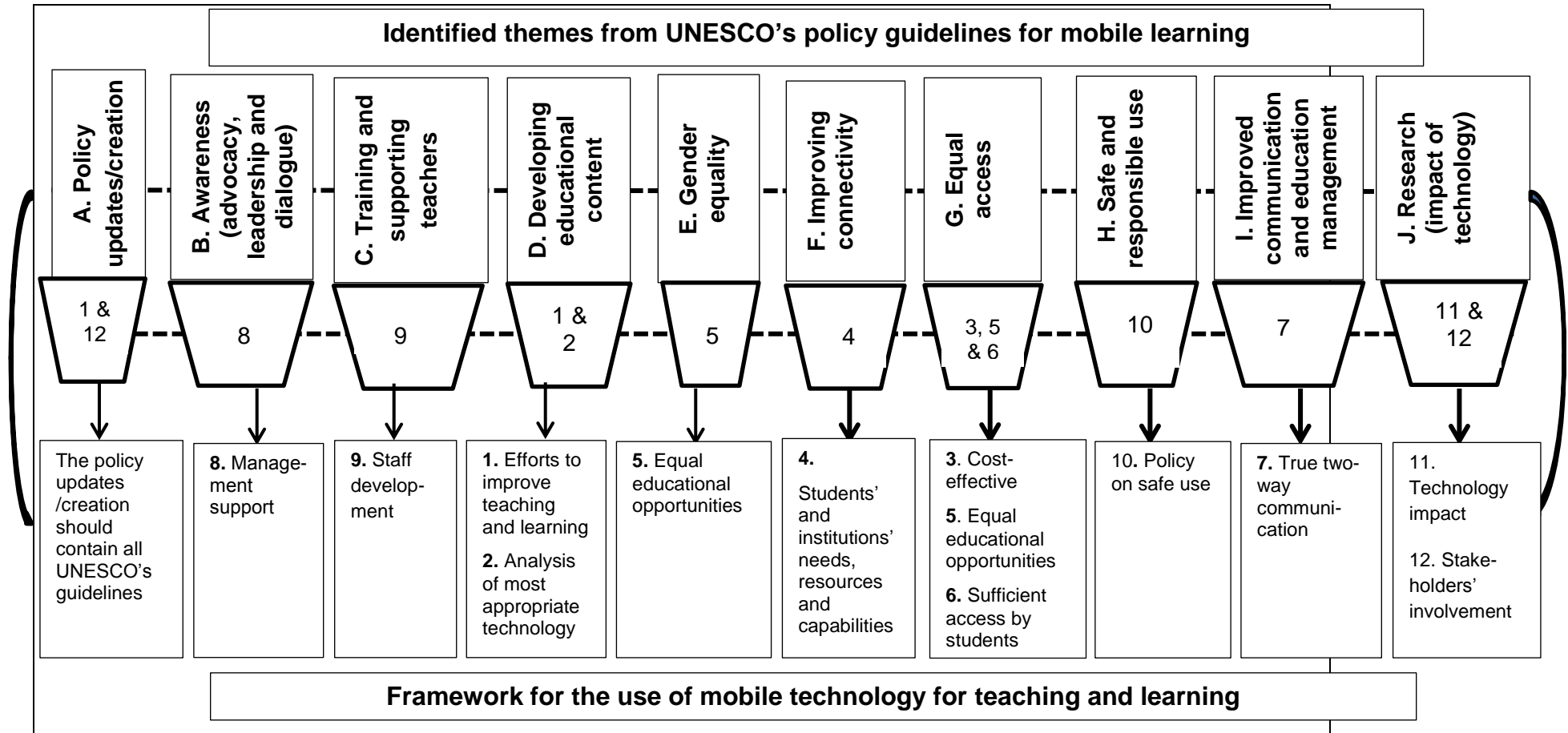


Figure 4. Integration between identified themes from UNESCO's policy guidelines and framework for the use of mobile technology for teaching and learning.

In relation to Figure 4, before one can talk of *policy updates* as indicated in UNESCO's policy guidelines, there should first be a policy in place on the use of the technology. This should lead to *policy creation* in the absence of none. The policy should then contain all of UNESCO's guidelines, which could be regularly updated as the need arises. Although mentioned in various UNESCO research projects (Isaacs, 2012), it is necessary to clearly state the need for a *monitoring and evaluation process in each country's policy to monitor the impact of the technology on students' performance*. All stakeholders should be involved in the *quality assurance process*. If this is not done, it tends to become a nice-to-have technology; the end needs to justify the means. This would also help alleviate the frustrations of policy makers with regard to the shortage of evidence-based research on and empirical evidence of mobile learning (Isaacs, 2012). The issue of *cost-effective educational provision* should also be examined and clearly stated. All these "missing links" should be clearly stated in the policy documents of all countries (and institutions) that would like to adopt mobile technology for learning. For an effective policy environment, it is necessary to avoid assumptions.

Lastly, ODL providers (irrespective of their contexts) need to provide sincere answers to the questions posed in the adapted framework for the use of mobile technology for teaching and learning (see Figure 3). This should be based on the continuous tracking of the technology profiles of their students, the providers' ability to meet students' technology needs and the technical know-how of their staff members (among others), before adopting the technology for teaching and learning.

Conclusion and Recommendations

Despite the hype around the possibilities of mobile technology for teaching and learning, quality assurance standards related to its use might be overlooked. This paper considers UNESCO's suggested guidelines on the adoption of mobile learning in relation to the South African policy environment. Findings have revealed that the country has been sensitive to the potential of this technology for some decades. This is evident from the documents perused. However, these documents are focused on the use of ICTs for teaching and learning in general. Although South Africa could be said to be more advanced with regard to mobile learning than many other African countries, findings reveal that South Africa, like most African countries, does not have a dedicated policy on mobile learning. In most instances, it seems that regulations for the use of this technology are left in the hands of individual providers (UNICEF, 2012). One of the ways in which an enabling environment could be created is to develop policies that ensure delivery on mandates. Therefore, it seems that a policy vacuum needs to be filled.

In order to encourage debate in this field, the use of the technology by an ODL provider has been traced and an adapted framework is suggested. Although the quality criteria indicated in Table 2 is neither comprehensive enough nor interpreted in the same way by different institutions (Welch & Reed, 2005), it is felt that they might go a long way in stimulating debate among ODL providers. This will hopefully develop into a policy for practice. It is believed that ODL providers could build on the suggested framework, irrespective of the context, especially when considering the constant changes that occur within the mobile technology environment.

ODL providers need to adopt the common sense approach in the use of mobile technology. If stakeholders could achieve this understanding from the onset, the adoption of educational technologies would become more relevant to their contexts, within their financial reach, and more sustainable in terms of the availability of relevant local human and technical resources. This would, in turn, not jeopardise the essence of capacity building to groom the home-based support of organisations that sponsor projects and thereby support governments. It is argued that most of UNESCO's suggestions are based on sound and prudent judgement and could be applied after an analysis of each context. Due to the immense value that mobile technology could add to education, one could argue that having a policy in place would go a long way in sustaining both research and funded projects, with benefits also accruing to the funders.

Having a national policy on mobile e-learning in place has the tendency to encourage government ministries and agencies to be involved in projects. It is also beneficial to link projects to the national school curriculum. Projects should not be left to gather dust, but teachers and students should be supported to encourage their active participation. Finally, it would be in the best interest of countries to encourage the local development of cheaper learning platforms to make such more available to their citizenry irrespective of the gender.

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A Case Study on Mobile-Blended Collaborative Learning in an English as a Foreign Language (EFL) Context



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Abstract

As learning a foreign language poses a number of challenges for the students, it has become indispensable to search for “optimal” conditions to enhance opportunities of engaging in the target language. Within this context, the Mobile-Blended Collaborative Learning model has been integrated in and out of the classroom learning in order to enable language learners to practice English by means of collaborative, authentic language activities based on project-based learning approach. The purpose of this study was to explore the effects of using mobile instant messaging application, WhatsApp on the language proficiency of EFL students. Participants ($N = 85$) were enrolled in five upper-intermediate prep classes at a foundation university in Istanbul and took part in a seven-week Project Work. Data were collected through semi-structured interviews and focus group discussions, self- and peer evaluations of group work, a rubric for assessing project work, and log files of WhatsApp conversations. Results revealed practicing English in an authentic setting where the students used the target language for a real purpose facilitated their language learning, improved their communication skills and vocabulary knowledge, and made them recognize colloquial English. Additionally, instant messaging in an informal platform for educational purposes had positive effects on their performance and the quality of their work.

Keywords: mobile learning, collaborative learning, instant feedback, foreign language learning, informal learning

Introduction

The broad use of mobile devices influences teaching and learning by enabling more flexible environments where learners can learn and practice anywhere and anytime. With the widespread ownership of mobile devices, young people search for new ways of developing their knowledge and experience of mobile technologies in out-of-school settings, which is obviously distinct from how they

use these technologies at school (Sefton-Green, Nixon, & Erstad, 2009). Furthermore, the use of mobile technologies has been influencing both modern communication ways and foreign language learning since situations which are rooted in daily life affect language itself (Ogata & Yano, 2005).

Mobile technology-enhanced learning activities employed by students in formal settings are different from those in informal settings. In formal settings, technologies are usually used in a systematic, planned, and administered way to execute curricular work in public spheres. On the other hand, in informal settings, technologies are socially and collaboratively used by young people in unorganized and non-administered ways to undertake individual interests in private spheres (Lai, Khaddage, & Knezek, 2013). Nevertheless, mobile technologies enable blending formal and informal learning by readjusting the present learning settings, which can result in improving students' learning skills and experiences inside and out of school (Faux, McFarlane, Roche, & Facer, 2006; Linsey, Panayiotidis, & Ooms, 2008). A report by Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sanchez, and Vavoula (2009) highlighted the recent mobile learning projects conducted both in formal and informal learning environments have reinforced the evolution of technology-enhanced learning from a different standpoint. In a sense, mobile learning projects not only build a bridge between formal and informal learning, but also incorporate a small or wider online learning community including participation of teachers and family in various modes of interaction.

Furthermore, research indicates mobile technologies can facilitate the learning mechanism in formal and informal contexts with the support of collaborative activities (e.g., Sharples, Taylor, & Vavoula, 2005; Lai et al., 2013) and reinforce both "opportunistic informal learning" and "collaborative informal learning" (Clough, Jones, McAndrew, & Scanlone, 2008, p. 359). Concerning the use of mobile apps, successful integration of apps requires novel methods and models to ensure active participation, engagement, interaction, and collaboration among students and teachers (Khaddage & Lattemann, 2013). Although mobile apps for teaching and learning are in their infancy, if they are integrated effectively into learning at schools, they can promote efficient teaching and feedback, thus simplifying the learning process (Khaddage, Lattemann, & Bray, 2011).

In the EFL settings, one of the common challenges is non-native speakers of English usually experience lack of access to authentic sources for a real-life communicative purpose. Therefore, most of the EFL learners have limited exposure to the target language in real-world settings. Regarding this, language learning could be more "authentic, efficient, relevant and effective" identifying and allying with global mobile technologies (Traxler, 2013, p. 2).

This study took place in EFL classrooms to provide the undergraduate EFL students with a learning setting in which they could gain authentic language learning experiences supported with project work. The research was grounded on the Mobile-Blended Collaborative Learning (MBCL) model as a first stage to conceptualize the use of mobile technologies and applications to combine formal and informal learning (Lai et al., 2013). The basic rationale behind this model is to overcome the drawbacks of traditional foreign language education. The MBCL model puts forward three application categories including "tools for collaboration," "tools for coordination," and "tools for communication" in order for the blend of formal and informal learning (Khaddage et al., 2011, p. 419). On this basis, WhatsApp as a mobile-instant message tool, was integrated into the project work to enable the students to collaborate, coordinate, and communicate in both synchronous and asynchronous modes. This model signifies the affordances of mobile technologies in a blended and collaborative learning setting. It puts

an emphasis on the advantages of informal learning to minimize the disadvantages of formal learning, thus creating “a more balanced and flexible learning environment” (Lai et al., 2013, p. 416). Basically, MBCL enables interaction, collaboration, sharing, and learning in informal settings unrestricted to time and location (Looi et al., 2010).

In a mobile-blended collaborative learning setting, students can be provided with various authentic tasks or activities in which they can actively participate. In this sense, project-based learning supported with mobile technologies is acknowledged as an effective way to combine both traditional face-to-face learning with informal learning (Lai et al., 2013). While engaging with real-world activities or projects, students may need scaffolding from teachers, and this is also essential to encourage students to focus on the task, the setting, and the community of learners. Through the apprenticeship process, students are urged to work in cooperation and be involved in collective attempts; likewise, they progress from a novice to an active contributor (Hung, Chee, Hedberg, & Seng, 2005).

In a study reported by Song and Fox (2008), undergraduate English learners had a positive attitude towards consistently utilizing personal digital assistants (PDAs) as a dictionary to extend their vocabulary knowledge in an out-of-class setting. Hockly (2013) conducted a classroom-based action research with two successive groups of international EFL learners from a private language school in the UK and found most students were satisfied with using mobile devices and desired to keep learning in this manner. Some studies (Motiwalla, 2007; Plana et al., 2013) found most of the students took advantage of instant messaging and supported the use of mobile devices for educational purposes. Another experimental study by Barhoumi (2014) was carried out to evaluate the effects of mobile learning activities via WhatsApp in a blended learning course called *Scientific Research Methods*. The experimental group experienced two hours of in-class learning and one hour of WhatsApp mediated learning activities and the control group was exposed to only in-class learning. It was found there were positive effects on the blended course experiment composed 70% of face-to-face and 30% of online learning via WhatsApp discussions.

In conclusion, this study aimed to address the overarching research question: “What is the effect of integrating WhatsApp mobile app into a group project work in out-of-school setting on EFL students’ language learning process?” Regarding the lack of specific studies on the variation of authentic language learning experiences in MBCL, as well as instant feedback via WhatsApp, this study might suggest practical implications for: (a) ensuring more opportunities of learner participation outside the school walls, (b) exploiting the benefits of colloquial or spontaneous language use in MBCL setting, and (c) enriching teaching models in different contexts for higher education EFL teachers.

Methodology

In the study, a mixed method case study was applied to gather data for an overall interpretation and investigate the data within a specific context. This research design was carried out based on its appropriateness and effectiveness for this study. The object of collecting data based on a variety of sources is to develop the theory suggesting the qualities of the case and to promote the validity to the arguments made by the researcher or the participants in the case (Stake, 2005). Accordingly, both quantitative and qualitative data sources were collected to answer the proposed research question.

Participants

This study was carried out in the spring term of the 2014-2015 academic year at a Turkish private university in Istanbul, Turkey. The university is both a Turkish and English medium university, but a one-year preparatory English program is compulsory for all undergraduate students who are not able to achieve at least a B1+ (Intermediate) language level. Upon completing B1+ level, the students can progress to B2 (Upper-Intermediate) level. In the study, a purposeful sampling method was used in the selection of the participants to elicit the potential of the students at B2 level of English. Participants included 85 EFL students (42 females and 43 males) who were enrolled in the English preparatory program and ranged in age from 18 to 24 years. Participating students were from five B2 level classes with 15-20 students in each class. The common characteristics of the participants were described as following: (a) the students were volunteered to take part in the project; (b) they were assumed as experienced users of current mobile technologies, especially Web 2.0 technologies or social media apps mediated via smartphones through which they were accustomed to communicating in text-based instant messaging online chat platforms in their native language; and (c) they would need to practice English more by making use of their knowledge, experiences, and language skills effectively in authentic settings. As a result, it would enable to elicit their potential at their target language level by performing a project work with their peers collaboratively.

Project Work Description

Participants were assigned to create a class magazine as an out-of-school activity with the support of WhatsApp throughout the seven-week module. The major objective of the project work was to provide the students with the opportunity of experiencing project-based, authentic, contextualized, meaningful, engaging, and collaborative mobile-blended learning. Moreover, the rationale behind creating a class magazine was it is one of the common projects carried out in language classes.

There were 22 WhatsApp chat groups with at least three students in each group. While the instructor as the administrator of each group facilitated the whole process, the students determined their group members and roles voluntarily, and further worked in cooperation toward the group success. An upper-intermediate course book was provided as an instructional material for the students to benefit from the proposed three units (beginnings in life, social issues, and great expectations). Overall, the students were expected to: (a) choose particular theme-based topics from the real-life issues; (b) determine their content, genre, and target audience; (c) use written and visual materials (e.g., short articles, anecdotes, interviews, illustrations, images, etc.); (d) gather information for each topic area; (e) design layout using Microsoft Word/Publisher or other programs; (f) form 20-40 pages with a cover illustration; and (g) lastly, print their magazine.

As for the instructional plan of the module, three sessions including in-class, face-to-face, and online instruction mediated via WhatsApp were conducted by separating the seven-week project duration into the systematic sessions regarding the ongoing module in the university. The first session (two weeks) was carried out to cover the predetermined units in the course book and facilitate the comprehension of each unit with various activities in the classroom. In the meantime, after the instructor formed the WhatsApp groups, the students initiated their group discussions on the selection of the unit and asked their questions to clarify the project scope and objectives via WhatsApp. The second session (one week) was focused on examining various real magazines to recognize essential elements of a typical magazine through both in class and WhatsApp discussions.

The third session (three weeks) was allocated all the groups to design their magazine maintaining the process via WhatsApp. The final session (one week) was executed for the assessment of the project work.

Data Collection Procedures

Data were gathered from: (a) a peer evaluation form, (b) a scoring rubric in the quantitative phase, (c) log files of WhatsApp chats, and (d) interviews in the qualitative phase. A peer evaluation form was developed to offer the students the opportunity to evaluate the performance and quality of the project work for themselves and their fellow group members, and to provide feedback to each other at the end of the project. The peer evaluation form included 10 criteria (e.g., took an active role during the project, contributed effectively to the group discussion). The content validity of the items was examined by an experienced faculty member in the field and two experienced EFL instructors. It asked each student to indicate to what extent they agreed or disagreed on the specified criteria by using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Each student was rated by themselves and three or four group members, generating multiple ratings of a single student, as a result, enabling the reliability of the peer evaluation form itself to be evaluated. The Cronbach's alpha coefficients of self-ratings were found $r = .90$ and peer ratings were found $r = .97$, indicating a very good internal consistency reliability for the scale.

An analytic scoring rubric was used as an assessment tool to identify the students' performance and their finished product at the end of the project. The rubric consisted of certain criteria including "planning and preparation," "design," "content," "collaboration," and "delivery and presentation" which were determined using feedback from the faculty colleagues and an experienced expert in the field. The descriptions of the dimensions were scaled through labels as following: "needs improvement," "satisfactory," "good," and "excellent," and specific performance criteria being observed were indicated for each label. After all 22 groups submitted their project work by the predetermined deadline, the researcher and a 15-year experienced EFL instructor from the same university, scored the overall performance and product of each group as independent of each other.

Semi-structured focus group discussions and individual interviews were conducted to add in-depth insights into the study. The interview guide comprised 15 questions for individual interviews and 10 for the focus groups. The questions were based on several key issues, such as instant feedback, group work, out-of-school activity, WhatsApp, and collaboration related to the research question. For instance, "How did you find the experience of working in the group out of school hours?," "What were the benefits of the project in terms of language learning?," and so on. Further, the interviews were held face-to-face in the mother tongue of the participants (Turkish) in two distinct methods, specifically with two focus groups, one with 16 participants while the other had 15 participants, and 10 one-to-one interviews. At least two students from each class were randomly chosen for the interview. The interviewees' responses were audio-recorded and transcribed verbatim for the further analysis.

Log files obtained from WhatsApp group chats were generated by the system software showing all conversations separately among the 22 groups and the instructor. All were systematically arranged according to the group codes. The log files indicated all of the processes the students experienced, thus providing clear outcomes for evaluating the effectiveness of instant feedback via WhatsApp and observing the interactions between the students and the instructor. Moreover, the mastery and application of collocations is highly fundamental for the EFL learners to deal with any written

messages and listening conversations. For this reason, in terms of the use of the target language, it was mainly focused on the use of collocations in their conversations. Further, it seems rather hard to acquire or utilize collocations for high-level language learners as well. Therefore, in the analysis of those log files, the collocations the students used in their chats were identified and compiled.

Data Analysis Procedures

Regarding the self- and peer evaluation process, each student was expected to assign scores to themselves and their group-mates respectively. Based on the overall mean scores obtained from self- and peer ratings, Pearson correlation analysis was performed to determine the degree of relationship between them. Subsequently, the analytic scoring rubric was utilized to analyze data in the quantitative inquiry. Two raters separately scored each criterion in the rubric on a scale of 1 to 4 and each score was summed up to reach a final score. Ultimately, inter-rater reliability was determined using Pearson's r to measure the correlation between the scores of the two raters.

In the analysis of the interviews, each of 10 one-to-one interviews and two focus group interviews, were analyzed through the content analysis approach. Lastly, 22 log files were analyzed by examining mobile text transcripts derived from those log files in terms of certain linguistic features including the structure of the sentences, the use of particular word items (collocations in particular) or formation, and functional and colloquial language used in a range of situations.

Results

Qualitative Results

In respect of the in-depth analysis of the convergence of focus groups and individual interviews, eight main emergent themes were generated based upon the high frequency of the common responses to the overall 15 semi-structured interview questions.

Management of the project work. Certain key points were touched upon by the students such as working out the scope of the project at first and taking initial steps including determining duties and responsibilities among group members, deciding on genre, and selecting topics. Based on the observations and remarks of the students, some groups appeared to experience lack of comprehension of the object of the project at the beginning as well as certain challenges such as poor time management and difficulty dealing with technical part of the project work, plus being unable to execute the project process properly. To illustrate, two students reported as follows: "We didn't talk...in the first week because we couldn't understand the project. The only thing we did was to go over the topics and units....In the second week we were able to decide on topics" (Female Student 1 - Class 3), and "First, we determined our group members, then we tried to decide on the subject of our magazine...related to the main subject each of us chose our own topic...finally we shared the tasks during the process" (Male Student 2 - Class 2).

Reinforcement of various skills. The students were able to bring their skills forward while working on the project with their friends. Although they were assumed to have already acquired certain skills such as language skills, computer skills, and communication skills, through cooperative working relationships, they had the opportunity to experience new skills and realize their potential.

The group work in the authentic learning environment seemed to enable them to encounter many blended skills consisting of research skills, project management skills, and transferable and interpersonal skills. Based upon that, some students reported as follows: “I learnt how to make a group work, collaborate with people...produce something collectively....the spirit of team work initiated in our minds and helped me to bring a new perspective” (Male Student 3 - Class 1), and “The most important thing I learned was to become patient....the project contributed me to improve my relationships with people ... thanks to the project I made many friends and felt more in peace in class” (Female Student 4 - Class 4).

Impacts on interpersonal learning. Working in groups during out-of-school hours appeared to have positive impact on the students’ interpersonal learning by providing more interaction among the students, giving them the sense of responsibility for performing a task in collaboration, encouraging active participation, and exposing them to gain real-world experiences in the target language. Related to the following comments, being aware of their final work to be assessed by their teachers, influenced their performance positively as well: “The sense of responsibility triggered me too much because you were not at school but you had to do something related to the school and also it was not an ordinary homework, so we all took it very serious” (Female Student 5 - Class 2), and “It was a good experience; I knew my friends better during the process and developed many different ideas while working out-of-school hours” (Female Student 6 - Class 4).

Cooperation in formal and informal settings. Since the students were expected to get actively involved in collaborating with each other, they utilized the opportunities of making consistent online and face-to-face communication by meeting outside or at school, and contacting their group members and the instructor anytime and anywhere. To illustrate, the comments of some students were indicated as follows: “Outside the school we arranged our own tasks together. Individually we were always in contact with each other in our WhatsApp group, for example regularly everyone joined the conversation, asked questions” (Male Student 7 - Class 1), and “We couldn’t have any chance to meet in somewhere to talk about the project because of the school hours...in the evenings communicated a lot about the details and discussed them via WhatsApp” (Male Student 19 - Class 5).

Pursuit of goal-oriented strategies. Several basic issues were mentioned by the groups related to the procedure of creating a magazine such as planning, designing, determining the content, and collaborating in group work. Therefore, the students applied certain strategies to facilitate their group work, and based on their remarks, it was found out some commonly used strategies were brainstorming, choosing favorite topics, searching for authentic magazines, consulting to experts in the field, making exchange of ideas, and utilizing technology to some extent. Regarding the explanations above, some students reported as follows: “We made brainstorming while determining our unit and topics by looking for real magazines and checking what they included ... tried to discover some different ways so that we could create some original and professional product” (Female Student 9 - Class 1), and “I benefited from the internet a lot in my search for information and images about my topics. I also checked out some real magazines to get a general idea about the design and layout of magazines” (Female Student 10 - Class 3).

Ease of communicating via WhatsApp. A number of advantages of using WhatsApp as a collaboration and communication tool were asserted. Most distinguishing among these advantages were providing contact anytime and anywhere between group members and the instructor,

maintaining punctual and clear decision making process, enabling synchronous and asynchronous communication, and having timesaving feature. To support these points, some comments are indicated as follows: “It was very practical; otherwise we had to send messages to each other individually; it would take so much time. However, in WhatsApp everyone was involved in the group and could see all sent messages” (Female Student 11 - Class 3), and “It was useful; I shared what I thought about the project with you and my friends immediately...when an idea came to my mind, I’d forget it later but via WhatsApp I could convey my messages on time” (Male Student 12 - Class 2).

Positive effects of instant feedback. Most of the students expressed their satisfaction about receiving instant feedback via mobile phone during the project work. Concerning the prevalent positive effects of instant feedback on group work, certain notable effects were specified including promoting effective exchange of opinions, asking questions anytime and anywhere, alleviating any potential concern, and helping manage time. “The best advantage was out teacher was in the WA group. As we felt like a fish out of water, having no idea about how to create a magazine, we had an opportunity to ask questions to her anytime” (Female Student 13 - Class 4), and “It gave me an opportunity not to make a lot of mistakes...to become aware of my mistakes and correct them... asked questions to our teacher as well as taking her advice at some critical points” (Female Student 14 - Class 5).

Engagement in language activities. The students gained the opportunity of using the target language for the benefit of carrying out their project, and practicing more in English. Furthermore, the students experienced using English for real world purposes such as doing research in English, discovering colloquial English words and phrases while texting on WhatsApp, making background readings from various materials, writing paragraphs or essays on their topics, compiling information and resources, engaging group discussions, and benefiting from multimedia. “(I) had a chance to experience daily English... (I) was able to find many different components of language, reading articles helped me a lot...you can see everything from formal to informal language” (Female Student 15 - Class 1), and “(I) improved my English in terms of speaking skill by chatting via WA. I did a lot of research about my topic...I’ve not had any experience to do such in English, but the project contributed a lot to my English” (Female Student 34 - Class 5).

Based on the log files, a total of 1711 posts were sent by the participants during the project. The average number of posts sent by each student ($n = 80$) was 21.3 (see Table 1); however, only five students were inactive, merely viewing the posts sent in the group. As the initial three weeks were allocated mostly for in-class activities related to the project work, the students started their conversations via WhatsApp in the following weeks. The average numbers of posts during the rest of the weeks were 58.9 (week four), 28.8 (week five), 7.4 (week six), and 4.7 (week seven). Those results showed the majority of the postings were sent during week four and the group discussions maintained weekly over the course of the project.

Table 1

Descriptive Statistics of the Number of Posts per Class

Class	# of groups	# of group posts	Percentage of total
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1 (<i>n</i> =19)	4	450	26,3
2 (<i>n</i> =16)	4	268	15,6
3 (<i>n</i> =17)	4	472	27,5
4 (<i>n</i> =18)	5	199	11,6
5 (<i>n</i> =20)	5	322	18,8

Regarding the content analysis of log files, two types of lexical collocations, which were commonly used, were identified in the collection of conversations: verb and preposition, and verb and noun collocations (see Table 2). Most particularly, “make” as a verb was examined due to the students’ variety in their use of lexical collocation “make + noun.” As an example, one student posted “We are planning to make interviews with tradesmen.” and another student responded “Yes, I checked it out, but we’ve not made any progress yet.”

Table 2

Sample Lexical Collocations Recognized in the Log Files

Type	Example
Verb + Noun	arrange meeting, catch points, use imagination, give attention, deliver project, pay attention, confuse one’s mind, take as a mission, do research
Verb + Noun (make)	make search, make progress, make up one’s mind, make improvement, make arrangement, make decision, make discussion, make an interview
Verb + Preposition	concentrate on, enquire about, write down, put forward, insist on, belong to, run out, figure out, get along with, search for, decide on, throw away, deal with, cut out

Although some students made certain grammatical mistakes while texting, they were usually able to use those collocations properly. Furthermore, it was noticed the most common *verb-noun* miscollocations were used between “do search” or “do research” and “make research” or “make search.” To illustrate, “I think we should do search before start” or “Who will make researches about places where we go?” Aside from those collocations, certain texting slang words were identified in the conversations: phonetic replacements, abbreviations, and acronyms including “u,” for “you,” “thx” for “thanks,” “gonna” for “going to,” “me2” for “me too,” and so on.

Quantitative Results

By means of the peer evaluation form, the participants evaluated their own performance and their peers’ at the end of the project. Correlations were computed between self- and peer ratings in student group work (see Table 3). The results suggested that 18 out of 30 correlations were statistically significant in a two-tailed test, in that 14 of them at the .05 level and four at the .01 level. Overall, the findings indicated there were high and weak correlations between self- and peer ratings.

Table 3

Pearson Correlation Matrix Between Self- and Peer Ratings in Student Group Work (N = 85)

	Peer 1	Peer 2	Peer 3
Self 1	-.086	.375	.115

Peer 1		.110	.685*
Peer 2			.239
Self 2	.581*	.613*	.386
Peer 1		.768**	.645*
Peer 2			.601*
Self 3	-.204	.211	.139
Peer 1		.582*	.662*
Peer 2			.970**
Self 4	.583*	.657*	.695*
Peer 1		.642*	.762**
Peer 2			.729**
Self 5	.724*	-.035	.423
Peer 1		.319	.744*
Peer 2			.519*

Note. * $p < .05$, ** $p < .01$ (two-tailed tests).

Regarding the rubric analysis, as a result of the assessment of the consistency of the scores of the two assessors, the correlation between the Rater 1 and Rater 2 scores was found to be moderate, $r(44) = +.442$, $p < .05$, two-tailed since five outliers were identified with some great differences, which were more than 5, between two scores given to these groups: 8, 12, 15, 16, and 22. However, by removing those five outliers in the data, the correlation was found to be statistically significant, $r(44) = +.855$, $p < .01$, two-tailed.

Discussions

This study aimed to investigate the effect of using instant messaging application enabling instant feedback throughout the process of project work on the EFL prep school students' language improvement in a mobile-blended learning setting. Concerning the findings of the study, it was indicated the students had the opportunity to use the target language in an authentic group work project, in particular, had a chance to practice vocabulary knowledge, including various topic-based words and lexical collocations, and distinguished between formal and informal language via instant text messaging system during the process of creating their magazines.

Having the experience of texting in English through discussions and conversations, the students usually paid attention to write their sentences accurately and choose appropriate words regarding the standard writing conventions. Therefore, through communicating in an informal setting, the students not only reinforced what they had already known about the basics in English, but also they were able to differentiate between "slang, texting lingo and correct English" (Russell, 2010, p. 223). On the other hand, the students were not restrained from the use of text messaging language including abbreviations or contractions, emoticons, omission of punctuation, non-standard expressions, and spellings as the focus was on efficiency: getting one's message on time and meaningfully as possible. The students reported they tried to negotiate and make exchange of ideas in the target language, pursuing a mutual goal, planning and managing multiple issues, communicating information, and ideas effectively to complete their project work. However, due to a lack of experience in working collaboratively to achieve a common goal, some students mentioned having difficulty agreeing with

certain decisions, and maintaining consistent interaction with their peers. On the other hand, they also reported that they managed to come to terms on any disagreements in the end.

Moreover, the students participated in rating each of their group member's contribution to the success or failure of their group, including themselves. However, the results showed that some self-ratings were poorly correlated with peer ratings or vice versa and indicated no consistent frame of being higher or lower than the others' assessment. The underlying reasons for such poor correlations could be associated with having different opinions or approaches towards the evaluations of the performance of each group member in terms of the sense of team spirit, the willingness of each peer to collaborate, the satisfaction with the quality of their work, and the active participation in discussions, as well as being cooperative regarding the individual differences in personality. Based on the observations, some group members behaved as free riders, not actively getting involved in the group work and leaving most of the work to other group members. In addition, few students reported as being not satisfied with working together with some of their friends in the same group. Thus, they appeared not so voluntary to take active roles and expected from the others to compensate for their lack of effort. Through peer evaluation, the hardworking students caught the opportunity of dealing with such free riding issues by giving low scores to their peers, although every group member received the same score based on the assessment of their final product.

Further, the results from the evaluation scores of the project work demonstrated there was a moderate correlation between the scores given by two instructors. This suggested that the raters met on less common ground on their rating, giving highly different scores from each other. Therefore, the raters seemed not to agree on some criteria in the assessment of several project works. On the other hand, there was a close relationship between the self- and peer assessment and the raters' assessment regarding the quality of project works, the contribution of each group to the project, and the overall group performance. This was also supported with the reports of the students during the interview. As an example, one student reported "I learnt how to make a group work, collaborate with people...(and) produce something collectively" underlying the related theme, *reinforcement of various skills*. Another student remarked, "(o)utside the school we arranged our own tasks together" illustrating another theme, *cooperation in formal and informal settings*.

As for the effects of receiving mobile instant feedback via WhatsApp, from the remarks of the students, it appeared the most notable benefit of using WhatsApp was "time management," which provided great convenience to communicate anytime and anywhere and facilitated the collaborative group work. In essence, the constant social interactions among the groups influenced the project process positively and eliminated the barrier between the formal setting of the classroom system and informal setting of the social networking tool. Moreover, Gillingham and Topper (1999) emphasized the effectiveness of instant messaging on the learning process through collaborative learning or social interactions. In a study examining the classroom communication between the high school students and the teachers using WhatsApp, the academic advantages of WhatsApp were indicated by the participants as follows: "the accessibility of learning materials," "teacher availability," and "the continuation of learning beyond class hours" (Bouhnik & Deshen, 2014, p. 217). However, whilst most students expressed as their satisfaction about regularly maintaining their conversations in the mobile platform, few students touched upon that from a different perspective and reported that it had a negative impact on their conversation amongst their peers. As an example, one student remarked "it might kill sincerity among the groups as the teacher was also involved in each group" because some

groups may have pretended to work hard, but they did not in reality. Due to this reason with fairness and equity in the group work, the students' perception of group members might have been adversely affected, as evidenced with the poor correlations between some self- and peer ratings as well as the related theme above mentioned as the cooperation in formal and informal settings.

Some issues might also be essential to note about this study. The study was carried out with the participants of B2 level EFL learners. To extend the findings of the study, a wider range of participants having diverse linguistic levels could be involved in a prospective study. In addition, a more representative sampling frame could have been utilized in the selection of the focus group and individual interview participants. Another issue is the students had the opportunity of improving their word knowledge, but they might have utilized the words they had already known. Nevertheless, the active use of words and collocations in the target language was taken into consideration to encourage the practice of different sorts of words. Finally, the privacy issues associated with the use of WhatsApp could bring about concern for some students due to the presence of the teacher in the group, thus, could be one factor to regard the use of mobile devices for educational purposes.

Conclusion

In conclusion, the previous reviews on mobile technologies and learning are mostly related to the use of these technologies in several particular curriculum areas. More specifically, upon tracing back to the literature on the issue of conducting project-based learning (PBL) in a mobile-blended learning environment, there are relatively few satisfactory empirical studies, in particular, in the scope of foreign language learning. Therefore, the results of this study could be beneficial for guiding prospective research studies in the current area and making contribution to the discussions of mobile learning. The findings of this study indicated that the EFL students favored improving their integrated language skills by involving in a variety of learning experiences, which provided meaningful interaction for real world purposes. In addition, nearly all of the students had positive attitudes towards participating in synchronous and asynchronous conversations with their peers and instructor for academic purposes. Besides language skills, the students developed their interpersonal and collaborative skills; however, the lack of literature about the subject of providing instant feedback mediated via a mobile application in an out-of-class language learning activity has enabled the rationale for this study. Thus, it could be suggested a well-designed language course supported with mobile technologies can encourage more effective and collaborative learning, not only in the classroom, but also outside the classroom, considering the needs and learning outcomes of the EFL students.

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The Impact of Whatsapp Use on Success in Education Process



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Abstract

The purpose of this study is to explore the effects of WhatsApp use for education and determine the opinions of students towards the process. The study was designed in mixed research model which combines both qualitative and quantitative data. In the quantitative aspect of the study, quasi-experimental design, with a pretest-posttest control group, was used and the data were analyzed by two factor variance analysis for mixed measurements. The analysis indicated that both learning environments have different effects on the success of students and that supporting the traditional environment by using WhatsApp is more effective for the increase of success. For the qualitative aspect of the study, content analysis techniques were employed to analyze the data which were collected by open-ended question forms. The analysis showed that students developed positive opinions towards the use of WhatsApp in their courses. They demanded the same practice in their other courses as well. They reported that learning could also take place unconsciously and the messages with images were more effective for their learning. However, a few students have expressed adverse opinions about the timing of some posts and the redundant posts within the group. Finally, it is suggested that use of WhatsApp in education process be encouraged as a supportive technology.

Keywords: WhatsApp, instant message, social network, mobile social learning, students' performance

Introduction

With their increasing time, scope, and frequency of use, internet technologies have started to shape the way people form and share content and their way of communication. Social networks, which are very popular among young people, are becoming prevalent due to their nature to meet the needs of individuals towards socialization. Their nature that focuses on individuals, started to shape users' process of interaction and has

become one of the important elements of the daily life. The high number of people joining social networks, which are defined as programs that ease the interaction between individuals and groups, provide various opportunities for social feedback and support the formation of tangled social relations (Boyd, 2003), show how immense the people's need is for these networks. Within the framework of these needs, development of mobile versions of these programs that carry the social structure from real life to virtual environment and eliminate the time and space limitations, has become inevitable. This process, which started by commonly used web based social networks (Facebook, Twitter, etc.) in particular, began to be approached in different dimensions after the introduction of the messaging applications rooted in mobile phones and are specifically designed for mobile phones (WhatsApp, BBM, Line, etc.).

Though they differ structurally to some extent (Boyd & Ellison, 2007; Taylor, Lewin, & Strutton, 2011), it hasn't taken much time for the social networks, which have become a part of users' daily lives, to be used in education. Consequently, together with the individual and social effects of social networks, their usability and effects in education started to be examined by the researchers. The studies indicate that social networks have both positive and negative effects over different variables (communication, motivation, social interaction, academic success, etc.) depending on their purpose and form of use in education. It is seen that these tools, each of which has different features for learning aims, have potentials to provide cooperation, increase social interaction, interest and motivation, sense of belonging, academic success, student-student and student-teacher interaction, support learning anytime and anywhere, provide peer support, feedback, and allow for sharing of information in education. Apart from the studies underlining the positive aspects of using them in education, depending on their purpose and form of use, concerns towards privacy and security, losing attention, getting beyond the limits in personal relations, use of slang language, and negative effects on academic life arising from excessive use, have also been determined in the results of the studies.

The presence of positive and negative sides of social networks does not change the fact that these tools are rapidly becoming popular, gaining an important place in our lives, and starting to take their place in education. In recent years, instant messaging applications, which can be identified as mobile-based social networks, have started to become popular. Though there are a lot of instant messaging applications that can operate on mobile devices, it is seen that WhatsApp application is one of the most favored mobile based applications (see SimilarWeb, 2016; Statista, 2016). In their study, Church and de Oliveira (2013) emphasize this fact and state that WhatsApp has grown in popularity due to its benefits such as, being able to send real-time messages to an individual or groups of friends simultaneously, low-cost, and privacy.

However, in studies on the use of different instant messaging platforms in education, it is also determined that these applications have potential to increase learning (Smit, 2012), learners' being active in their studies (Cifuentes & Lents, 2010), interaction between students on personal, school, and course related topics (Cifuentes & Lents, 2010; Smit, 2012), create sense of belonging (Doering, Lewis, Veletsianos, and Nichols-Besel, 2008; Sweeny, 2010), eliminate social barriers (Doering, Lewis, Veletsianos, Nichols-Besel, 2008), and increase students' motivation (Plana et al., 2013). By the help of these benefits, which are also supported by the studies conducted on WhatsApp (Bouhnik & Deshen, 2014; Church & de Oliveira, 2013; Nguyen & Fussell, 2016), it is noted that the application can be a useful tool within the scope of learning anytime and anywhere, and collaborative learning. In this case, as such in Facebook, Twitter, and other

social networks, it won't take a long time for WhatsApp to influence the learning environments as well as the social life.

The potential of the social networks when designed in accordance with the needs of science and information, is alleged to cause revolutionary changes (Zaidieh, 2012), and their influence on the educational environment is increasing rapidly everyday, especially with the help of the internet supported mobile technologies. This potential, which enables cooperative synchronous and asynchronous communication together with their multimedia support, and cover the features of social networks on a large scale, should not be disregarded. Recently, instant messaging has become a top-priority and popular for children (Cetinkaya & Sütçü, 2016; Harrison & Gilmore, 2012; Lenhart, Purcell, Smith, and Zickuhr, 2010), the studies on the effects of new generation instant messaging applications upon interaction between people and learning-teaching processes are very limited. On the other hand, the presence of evidence that support the fact that these applications have a great effect on the social development of young people necessitates the determination of their impact on their academic development and expectations. Consequently, the purpose of this study is to explore the effects of WhatsApp use for education and determine the opinions of students towards the process.

In line with this purpose, answers to the following questions are sought:

1. Do students' success scores show a significant difference when WhatsApp is used as a support to the traditional environment?
2. What are the students' opinions on the educational use of WhatsApp application and the study process?

Methodology

In this section, there are explanations about the model of the research, study group, data collection, and analysis of the data.

The Model of the Study

Mixed method model, which combines both qualitative and quantitative approaches, was used in this study. By using mixed methods research, strong aspects of quantitative and qualitative methods can be utilised and its limitations can be minimised (Creswell, 2003; Creswell & Plano Clark, 2007; Johnson & Christensen, 2008; Tashakkori & Teddlie, 2003). Particularly, complexity of social facts is eliminated by bringing different methods together then observing and discussing them, which hereby contributes to the better understanding of the fact (Creswell, 2003). In this study, explanatory mixed methods was employed, further described in Table 1.

Table 1

Explanatory Mixed Method Design

Quantitative	Follow-up	Qualitative
Quasi-experimental study and its results		Case study and data and results

In explanatory mixed method design, the researcher first collects the quantitative data and then the qualitative data respectively. This means in explanatory mixed method design, quantitative data collection and its analysis have the priority. In addition, in order to correct the results from the quantitative data, the researcher uses qualitative data (Creswell, 2005). Within this framework, in order to determine the effects of the information sent via WhatsApp with regards to success, a pretest-posttest control group quasi-experimental design, which forms the quantitative aspect, was used. In quasi-experimental design, which is described as the best research design to explain cause-effect relationships, the treatment is performed after the pretest and finally, posttest is given to determine the effect on dependent variable (Fraenkel & Wallen, 2006). The selection of experimental and control groups, and the research design of quasi-experimental design according to some pre-evaluations and criteria, are provided in Table 2.

Table 2

Quasi Experimental Design Research View

Group	Pre experimental	Experimental process	Post experimental
Experimental	PreTest (AT)	WhatsApp Info Message	PostTest (AT)
Control	PreTest (AT)	Traditional Environment	PostTest (AT)

*Note. AT=Achievement Test; Independent variable: Traditional environment in which WhatsApp is used as a supportive technology and traditional environment; Dependent variable: Success.

In the quantitative aspect of the research, the effects of the information packs that were sent to students as support to the traditional teaching via WhatsApp in the experimental group were compared. In the qualitative part of the research, the case study, which belongs to the qualitative research tradition, was utilised. Qualitative research is an approach that uses an inductive attitude in social studies and underlines descriptive data collection techniques in natural environments together with the views of the participants (Bogdan & Biklen, 2006). As for case study, it tries to reveal present examples of application by using the question “how” (Yıldırım & Şimşek, 2008). In this part of the research, students’ opinions on the application process were taken.

Study Group

The participants of the study were secondary education 10th grade students, aged between 15-16. In the study, criterion sampling which is one of the purposive sampling methods was used. In the selection of the study group, the criteria that ensure the continuity of the experimental processes, the ease of accessibility to participants, the proximity of prior knowledge levels, and the provision of the necessary technological infrastructure, are taken into consideration. Accordingly, two (X and Y) out of three, 10th grade literature

classes taught by the same teacher were chosen. Before the research, pretest was given to the students of these two classes to determine the prior knowledge and control the normality and the homogeneity of their distribution. After the pretest, homogeneity (Levene's Test $F=0.002$, $p>.05$) and normality (Kolmogorov-Smirnov test, $p>.05$) between the classes were observed. Before the experimental process, unrelated samples t-test was performed to see if there was a significant difference between the scores of the students in both groups, and as a result of the analyses, no significant difference was found in the arithmetic mean scores of the students ($t(58) = 0.361$, $p > .05$).

In line with these results, it was decided to evaluate the two classes under two different groups; experimental and control groups. In this way, no discrepancies could be made between students and applications, and the interaction between the individuals in the same class was avoided. In separation of the classes as experimental and control groups, their possession of smartphone, internet, and the usage of WhatsApp were taken into consideration. It was established that in class X, 2 out of 30 students did not have smartphones, and while three students had smartphones, they did not have WhatsApp installed on their phones. However, in class Y, all 30 students had smartphones, while two students did not have WhatsApp installed on their phones. From the prior knowledge of the students, it was inferred that, in terms of technical requirements, class Y was deemed more advantageous. As a result, class X was designated as the control group with class Y designated as the experimental group. Students in group Y were informed about the purpose of the research and were asked if they wanted to participate in the research. Students who did not have the WhatsApp on their phones but wanted to participate in the study, were provided seven additional days to resolve it. At the end of this period, all the students, including the ones who had not used WhatsApp before, met the prerequisites.

As detailed in Table 3, the study, which was conducted with 15 female and 15 male experimental group students, and 16 female and 14 male control group students, for a total of 60 student participants, ended with the complete participation of all students in the quantitative research stage. As for the qualitative research stage, 30 students from the experimental group after the posttest participated.

Table 3

Gender Distribution of the Study Group

Study groups	Gender				Total	
	Female		Male		f	%
	f	%	f	%		
Control Group	16	53,3	14	46,7	30	50,0
Experimental Group	15	50,0	15	50,0	30	50,0
Total	31	51,7	29	48,3	60	100,0

Implementation Phase

The face-to-face education of all the students in the study group was conducted by the same teacher. The researcher only sent information messages to the students in the experimental group without any interferences.

Creation of information messages. Information messages sent to the students to determine the contribution of WhatsApp use to education, comprised of the topics that 10th grade students had not covered before. Information texts to be given with 30 information messages, which were created by four teachers who had at least 10 years of teaching experience, were formed and supportive images were chosen to be given with 15 of the messages. Upon the revision of the information messages by two academicians from the department of literature education and one academician from the department of educational technology, they were finalized. Information texts, which had the number of words between 19-81, had the core information to cover the replies to questions during the pretest and posttest. Images were chosen by the same teachers and academicians who contributed to the creation of the texts.

Sending the information messages. Fifteen information texts which were chosen by expert views and 15 information messages consisting of information text and supportive images, were sent concurrently when the related topics were taught in the curriculum. Information messages were sent by the researcher, once per day and at random times, concurrently with the related course content during the day (08:30-21:00).

As can be seen in the WhatsApp screenshot in Figure 1, information messages were sent simultaneously with the supportive images and the text messages during the application process.



Harname is Seyhi's satirical masnavi of 126 couplets on the idea of social equality (1415). It was presented to Chalabi Sultan Mehmet. It is rumored that Seyhi cured The Sultan during his campaign to Iran and was rewarded with the village of Tokuzlar as timar. While he was on the way to the village, he was beaten by the former holders of timar and thus he wrote Harname.



Figure 1. Information message sample.

Data Collection

The quantitative data of the study were collected by open-ended questions having short answers both before and after the application. Teachers and academicians who prepared the information texts decided on the questions. During this phase, the curriculum for the face-to-face education was followed and questions to test different knowledge levels were prepared. The questions were clear and comprehensible, the answers

expected for the questions were clear and required single answers which were covered in the information messages sent via WhatsApp. Hence, the reliability of the evaluation phase of the exam was ensured. For example, after sending the information text:

NEDİM, an ottoman poet, gained his fame during The Tulip Period of The Ottoman Empire between the years 1718-1730. He is recognised as a representative of this period's spirit with his works and life. He is seen as a notable figure of this period which is salient with its poem and esthetics, art and fun trends. The poet, who is famous for his lyrics and odes, introduced the genre of song to the Ottoman Poetry. However, the first song poet is Nail-i Kadim.

The students were asked "What is the type of poetry brought to Ottoman Poetry by Nedim?" and their answer "song" was accepted as the correct answer. A pretest was given two weeks before, and the posttest two weeks after, the information messages were sent, which lasted 30 days. Pretest and posttest were given under the supervision of two teachers and the researcher in classroom environment.

Qualitative data were collected by using open-ended question form one week after the posttest was given to 30 students in experimental group. The students were informed about the open-ended question form and were asked to answer the research question; "Write your ideas about the process of sending information messages via WhatsApp application and your suggestions, if any." The question to determine their opinions was given in written form to the students in the classroom environment under the supervision of the researcher to enable them to give detailed answers.

Analysis of the Data

The achievement test with short answers were given simultaneously to both experimental and control group at the beginning and the end of the study. In achievement test, one point was given to each correct answer and zero points to each wrong or blank answer. The questions in achievement tests (pretest and posttest) were given in eight week intervals and evaluated. Since there was homogeneity in classes, the distribution met the assumption of normality, and the study was conducted with two groups, t-test was utilised for the analysis of the data. To test the effectiveness of environments 2X2 split plot design was used and two factor variance analysis for mixed measures was used to analyze this research question. The significance of the difference between mean scores was calculated at the level of $p=.05$ and SPSS was used in the analysis of data.

For the analysis of the written data obtained by open-ended question form which constituted the qualitative aspect of the research, categorical analysis which is one of the content analysis types and frequency analysis were utilised. In categorical analysis; (1) coding of the data, (2) forming categories, (3) organisation of categories, and (4) description of findings and interpretation stages were followed (Corbin & Strauss, 2007). Frequency analysis revealed the quantitative frequency of the data, thus determining the density and the importance of a particular factor (Ryan & Bernard 2000; Tavşancıl & Aslan, 2001). Hence, the qualitative data were digitalised and their reliability increased, biasness decreased, and comparison of the data was enabled (Yıldırım & Şimşek, 2008).

Findings and Interpretations

The findings are given below in the order of research methodologies and sub-problems.

Findings for Quantitative Data

To test the effectiveness of the learning environments, 2X2 split plot design was used. In the design, the first factor meant two separate experimental environments (traditional environment-WhatsApp as supportive technology to the traditional environment), second factor meant measurements (pretest-posttest) before and after the experiment (Büyüköztürk, 2007). Two factor variance analysis for mixed measurements was done to analyse the research question. Students' mean scores of pretest and posttest, depending on their learning environments and standard deviation value, are given in Table 4.

Table 4

Learning Environments Mean and Standard Deviation Values

Group	N	Pretest		Posttest	
		\bar{X}	S	\bar{X}	S
Control	30	3.83	2.44	11.57	3.41
Experimental	30	3.60	2.57	19.63	4.41

While the mean success scores of the students in traditional environment before the experiment is 3.83, this value increased to 11.57 after the experiment. Mean success scores of the students in the environment which WhatsApp is used as a supplementary technology to traditional environment are 3.60 and 19.63 respectively. Accordingly, it can be declared that there is an increase in the success of the students learning in both the traditional environment and in the environment which the WhatsApp is used as a supplementary technology. The results of the two factor ANOVA analysis which was made to analyse if the success scores of the students in two separate environments showed a significant difference are given in Table 5.

Table 5

ANOVA Results of Learning Environments Relating to Pretest-Posttest Scores

Source of variance	Sum of squares	sd	Mean squares	F	p
Between subjects	1393.491	59			
Group	460.208	1	460.208	28.600	.000
(Individual/Group)					
Hata	933.283	58	16.091		
Within subjects	5085.500	60			
Measurement (Pretest-Posttest)	4236.408	1	4236.408	739.168	.000
Group*Measurement	516.675	1	516.675	90.14	.000
Error	332.417	58	5.731		
Total	6478.991	119			

According to the findings, the success of the students in two different learning environments show a significant difference before and after the experiment, in other words, the common effect of being in a different environment and the factors of repeated measures on success is significant ($F_{(1-58)}=90.14, p<.001$). This finding shows that both learning environments have different effects on increasing the success of students. The environment in which WhatsApp was used as a supportive technology to traditional environment has been more effective in the increase of success.

Findings for Qualitative Data

Students' views in experimental group about the process of sending information messages via WhatsApp, were collected by an open-ended question form. The ritten data were analysed using categorical analysis, which is one of the content analysis types, and frequency analysis, which is displayed in Table 6 with the results of students' opinions (S+student code):

Table 6

Students' Opinions About Sending Information Messages via WhatsApp

Positive	f	%
The will for similar applications for the other course	25	83.3
Realization of learning (conscious or unwittingly)	18	60.0
Increase of the interest using posts with images	14	46.7
Negative		
Timing of the posts	7	23.3
Redundant messages within the group	6	20.0

It was determined that majority of the students believe that using the application for all courses would be useful. As stated by S14 "The application would be fine in biology lesson" and S22 "if used in other lessons they could be more enjoyable... I could learn easily," students emphasize their will to see the application in their other courses. One of the important factors that is effective in their will is realization of learning. At this point it is remarkable that, besides learning after a conscious process, there are students who had expressed that learning can also take place unconsciously: S13 explains that "I didn't know that the last exam would be held. But I could answer most of the questions without revising at all," S21 shares that "I realised that I learnt unconsciously during the exam," and S17 states that "even reading the messages I got was enough, I didn't do any revision at all but I could remember most of the messages." Such statements all underline that learning can take place unconsciously. This shows that without any special effort, even by only following the posts, it can contribute to learning positively. The other positive opinion is about the images that are sent within the information messages. S11 shares that "images sent with the texts helped me remember them easily," and S16 reveals that "I wish they were all with images." As stated above, information messages sent with related images are received more favorably by the students.

The most important factor that was characterised negatively by the students towards the process of sending information messages by means of the WhatsApp application is the timing of information messages. As can be seen in S10's statements, "we received some messages just in the middle of the lesson and this caused us to lose our interest in the lesson." Though these messages were limited in number, some students expressed

negative opinion on the timing of the messages; as stated by S9, there is a need to “be careful with the timing of the messages.” Another problem is sending messages within the group. Though the purpose in forming the group is known by the students, some messages which were out of purpose were sent as stated by K29: “some friends sent unnecessary messages in the group, so we warned them” and they were resolved within the group and without researcher’s intervention.

Results and Conclusion

In this research, which was conducted with 10th grade secondary education students, the determination of the impact of WhatsApp use on success in education process, which is one of the instant messaging application, and the opinions of the students towards the process was aimed. Depending on the purpose of the research, qualitative and quantitative data collection methods were employed and was designed in mixed research model which integrates the results of the study. After the analysis, the results are discussed within the literature and the recommendations are given under headings.

Results

Results for quantitative data. To determine the contribution of WhatsApp to education as a supportive technology, a pretest-posttest control group, quasi-experimental design was used. The data related to the effectiveness of information packages on success, sent via WhatsApp to the students in the experimental group as a support to traditional environment, were analysed by using two factor variance analysis for mixed measurements. The results indicated that there is an increase in the success of the students, both in the traditional environment and in the environment in which WhatsApp was used as a supportive technology. According to the results of the two factor ANOVA analysis, which was made to test whether these changes showed a significant difference, it was determined that the success of the students who studied in two separate environments showed a significant difference. This finding indicates that both learning environments have different impacts on the increase of students’ success, and supporting the traditional environment with WhatsApp, has been more effective on students’ success.

The researches made on social networks and the integration of instant messaging have shown that the features such as: encouraging collaborative learning which contributes to learning process, active participation, learning anytime and anywhere, and informal communication, are common in all platforms (Arteaga Sánchez, Cortijo, & Javed, 2014). Although there aren’t any experimental studies met on the use of WhatsApp, which is one of the instant messaging applications, towards its impact on academic success in educational environments, there are findings that show its support to collaboration and sharing of the content, provide an unstructured learning environment (Arteaga Sánchez et al., 2014; Bouhnik & Deshen, 2014; Church & De Oliveira, 2013; Nguyen & Fussell, 2016; Rambe & Bere, 2013; Rambe & Chipunza, 2013). The results of the study show that the application has potential to increase the success.

Results for qualitative data. After the implementation of open-ended question form to students in experimental group, content analysis was done and students’ opinions about the process were categorised and correlated accordingly. Majority of the students expressed that the application has a positive effect on motivation and its use in other courses would be useful. In their study, which they conducted through

WhatsApp on language education, Plana et al., (2013) have also found that the instant messaging application WhatsApp increase students' motivation and willingness to study in immersion programmes. Another important factor that influence students' willingness for similar implementation in their other courses, is the realization of learning. In his study, Smit (2012) stated that instant messaging applications have potential to increase learning. In the study, students' statements that learning can also take place unconsciously besides a conscious process, are remarkable. In his study on social networks, Leonardi (2014) also implied that learning can take place by observing others' studies and communications. Another factor towards the implementation process, which is responded positively to by students, is the images used to support information texts. Students stated that these images, which were sent with some information texts and were related to the texts, had a positive contribution to their learning. However, the fact that the learners learn better in environments when words and images are used together rather than single words (Mayer, 2001; 2003), is supported with theoretical basis (Dual coding, limited capacity, multimedia learning, etc.), and has been tested in many researches.

It is observed that the most important factor that students refer as negative in relation to sending of information messages via WhatsApp application is the timing of the messages. Though in limited numbers, some statements of the students, particularly about the untimely messages that may cause distraction, shows that special care must be taken in the timing of the messages. Another negativity in the process of implementation is the messages within the group. Although the students were informed about the purpose of the group, there were unnecessary and disturbing messages; however, this was resolved within the group without the interference of the researcher. This shows that there is self-control within the group and students can overcome such situations between each other. In their research on the use of WhatsApp, Bouhnik and Deshen (2014) state similar problems, but unlike this study, the students' solution was silencing the group. At this point, in research on social networks and the use of mobile devices, it is mentioned that students' untimely and unnecessary messages may cause distraction among students and their study process could get negatively effected (Kusnekoff, Munz, & Titsworth, 2015; McCoy, 2013, 2016).

Conclusion

As in face-to-face communication, disagreements are inevitable in virtual environments when there is a human factor. However, minimisation of the problems is possible by managing the process properly and making out the possible problems. However, social networks are applications that started to become a part of education in the natural flow of daily lives. In the studies on these applications, generally, minimisation of the problems and use of their potential to support education processes are emphasized. Also, in this research, it was mentioned that they provide unstructured learning environment and can be used as effective tools in education (Cain & Policastri, 2011; Lampe, Wohn, Vitak, Ellison, and Wash 2011; Madge, Meek, Wellens, and Hooley, 2009; Towner & Munoz, 2011; Arteaga Sánchez et al., 2014; Norman, Nordin, Din, Ally, and Dogan, 2015). Yet, it is early to know what impact the WhatsApp application, which has an important place in the daily lives of young people and has the qualities to be recognised as social network, will have on education. As a result of this study, it is determined that the application has a positive impact on success and its use is welcomed substantially. It should not be disregarded that WhatsApp technology has the potential of a natural educational technology and the qualities to contribute to education as a

supportive technology. Within this framework, there are a lot of theoretical and practical questions regarding the use of application in education to be answered, some of which can be listed below:

- The impact of WhatsApp on the process of education in other courses should also be researched.
- Necessary precautions should be taken to minimize the drawbacks expressed by the students.
- With reference to the students' opinion that the images increased their interest in the topic, studies which include other multimedia elements (audio, video, animation, etc.) should be conducted and their impacts be compared.
- In line with the results based on the qualitative data attained from the opinions of students, experimental studies should be conducted to verify the qualitative data.
- Educators' opinions on the use of WhatsApp and similar applications in education should be asked and they should be involved in the process.
- Similar studies should be repeated with other grades, as well.

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Striving Toward Openness: But What Do We Really Mean?



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Abstract

The global open education movement is striving toward openness as a feature of academic policy and practice, but evidence shows that these ambitions are far from mainstream, and levels of awareness in institutions is often disappointingly low. Those advocating for open education are seeking to widen engagement, but how targeted and persuasive are their messages? The aim of this research is to explore the voices often unheard, those of the teachers and professional service staff with whom we are engaging. This research presents a series of interviews with those involved in open education at De Montfort University in the UK, with the aim of gaining a better perspective of what openness means to them. The interviews were analysed through an interpretive lens allowing each individual to create their own story and reflect their own personal view of openness. The results of this study are that in this university, openness is represented by five elements – staff pedagogy and practice, benefits to learners, accessibility and access to content, institutional structures, and values and culture.

This work shows the importance of adopting critical approaches to gain a deeper understanding of the philosophical and pedagogic stances within institutions. By giving a voice to all those involved we will be able to develop appropriate and more persuasive arguments to widen our sphere of influence as a community of open educators.

Keywords: open educational resources, OER, openness, staff perceptions, institutional culture

Introduction

Openness has long been associated with education and has manifested through the ages in many guises. A number of pivotal initiatives have further sealed this association and become inherent within our definitions and understanding of what it means to be open. The advent of the Open University in the UK in the 1960's represented institutional commitment to widening access through adopting innovative and technology-based teaching methods (Lane, 2009). The use of open licenses have lessened copyright restrictions on academic knowledge and widened the availability of education

materials beyond the campus (Creative Commons, 2016). Open educational resources (OER) and open educational practice (OEP) are widely documented as means of opening up access to education at a more intimate level (Wiley, 2006; Beetham, Falconer, McGill, & Littlejohn, 2012). Openness permeates research practice (Anderson, 2007; Peters & Roberts, 2015; Atenas, Havemann, & Hammonds, 2015) and scholarship (Veletsianos & Kimmons, 2012). The armoury of the open educator is varied and contributes to a global movement striving to remove barriers to learning and the opportunities afforded by education.

In establishing these definitions, might we be losing a deeper sense of what it means to be open? In the literature, it features as a desirable trait or cultural value inherent within individuals and institutions. Openness as a cognitive trait is considered important in relation to divergent thinking and creativity (McCrae, 1987). Schools strive to foster a culture of openness in classrooms when debating social and political issues to encourage independent thought (Alivernini & Manganelli, 2011). In one study of psychology students, openness and “openness to experience” was identified as a personality trait linked to higher levels of engagement with learning (Bakker, Vergel, & Kuntze, 2015). At institution level, it is being expressed as a strategic value representing the important position of higher education in society (Wiley & Hilton, 2009).

As Lane (2009) suggests, the plurality of meanings of openness leads to unclear directions particularly in relation to teaching practice. Weller (2014) argues that today the human aspect is being partly lost in our use of the word, with openness as a value or state being more often associated with content and processes, and we are losing our understanding of open as a mind set and virtuous trait (Peters & Roberts, 2015). Part of the challenge is being able to understand and interpret openness in a coherent way. Farrow (2016) applies a philosophical approach and defines openness not as a binary quality or value attributed to one activity or feature, such as cost or licensing terms, but as a “constellation of elements.”

So in applying the constellation model, how do we delineate the essential characteristics of open that may have been lost in our more entrenched definitions? To explore openness in a wider social and cultural context, we can draw on its historical origins, as the idea of opening access to education is not new. In the 16th century Padua, anatomical dissection theatres were built to accommodate teaching sessions that were popular public events; learning was accompanied by musical performances until the precedent for private lessons was favoured (Klestinec, 2004). The first references to the term open education in the literature were made in the late 1960’s with the inception of the Open University in the UK and access to courses that were free from entry requirements (Lane, 2009). At that same time, open education related to innovative teaching practices in UK primary schools (Barth, 1969) where more humanistic approaches were providing a pupil-centric schooling, with self-directed learning, and time for reflection and play (Katz, 1972). “Open educators are more concerned about the kinds of experiences students should have in school than about the cognitive, conative, and affective outcomes students should be expected to display as a result of having attended school” (Traub, Weiss, Fisher, & Musella, 1972, p. 71).

There are parallels between the early definitions of open education and Freire’s (1998) later thinking, with schooling in the 1970’s very much about encouraging thinking and problem solving in children rather than the transmission of content. Freire states: “to teach is not to *transfer knowledge* but to create the possibilities for the production or construction of knowledge” (Freire, 1998, p. 30). The idea that technology would play a role in the newly founded open education was also described, with the

growth of “learner-controlled education systems” extending the learner-focused model, and building on individual motivations to “put the learning process as much as possible into the hands of the learner” (Resnick, 1972, p. 2).

But what of openness as a human characteristic? The primary school approach looked to foster pupils’ openness to new situations (Traub et al., 1972). Traub et al. (1972) gave an early indication as to one of the challenges facing open education if it were to be mainstreamed, that is, there wasn’t a basis for assessing student outcomes in relation to openness of programmes (Traub et al., 1972), and by the mid 1970’s, open education lost political ground in the UK and US which had followed suite in adopting these approaches.

One can argue that the aspirations for openness in education in the 1970’s are paralleled today with intentions to provide more humanistic and learner-centred approaches to widen access and inclusivity. It would be another 30 years before technological advances and global political support would drive forward the idea of an open educational ecosystem that could connect the learner to the education system in different ways (Peters, 2010). OpenCourseWare and OER have led to the distribution of educational materials beyond the classroom, and provided a means for formal and informal learners to become co-creators in a more transparent and communicative education system (Dalsgaard & Thestrup, 2015).

As all of this activity has unfolded, the voices more often unheard are those of the teacher and learner. We know very little about how openness is perceived by those individuals the closest associated with it. Surely it is vital to understand this as we strive for openness?

In examinations of the levels of awareness of OER in a UK university, members of staff surveyed were relatively unaware of the term, but were altruistic in outlook seeing the benefits of sharing with their teams, although were less willing to share outside of the institution (Rolfe, 2012). Similar low levels of awareness were reported in the UK in a second survey conducted at that time, and with the same positive attitudes to sharing locally (Reed, 2012). In a later study in the US, about half of teaching staff who were in an institution that had engaged in OER initiatives were aware of the activity, and those surveyed gave broad interpretations of what their perceived meaning; this included associating open with resources that were free from cost, or practices that were similar to open source computing (Spilovoy & Seamen, 2015).

Even less is known of learner attitudes to openness. In one study around the time of tuition fee rises in the UK, students valued a level of ownership over *their* resources rather than wanting to share materials widely (Hurt, 2012). Other learners were interpreting openness in terms of availability of Massive Online Open Courses (MOOC), and were placing a value on the access to content (Alraimi, Zo, & Ciganek, 2015).

As we aspire toward openness within the education community, we rarely examine it in depth. The aim of this paper is to draw on a series of interviews conducted within a UK University with staff that engaged in open education projects from 2009 – 2012. Using an interpretive lens to focus on the narrative and context in which related to open in their own individual stories (McCormack, 2000), this paper captures some of the many flavours of openness.

Research Methodology

Participants and Context

In March 2015, eight in-depth interviews were conducted in De Montfort University in the UK with volunteers who were willing to participate from a pool of individuals who had been directly involved in projects funded by the HEFCE Open Educational Resource (OER) Programme (2009 – 2012; Jisc, 2015). These projects shared OER on laboratory skills, sickle cell anaemia and blood disorders, and other life science subjects (Rolfe, 2016). Staff engaged in projects as OER creators, facilitated students as co-producers, and using OER in teaching sessions. The interviews were semi-structured and focused in drawing out stories relating to the lasting impact of these projects on students, the individual, and institution.

Interviews lasted up to one hour. There was flexibility within the interview to explore new lines of enquiry as they emerged. Interviews were recorded and transcribed verbatim by the author so as to be immersed in the subjects discussed.

Data Analysis

The study aimed to reconstruct definitions openness by interpreting the interview transcripts through a lens. McCormack (2000) describes approaches in which multiple lenses can give perspectives on for example narrative, language, and context of a chosen subject. The interview transcripts were labelled according to the individual and were examined to identify salient passages of text where the word open or openness was mentioned directly (e.g., “open education”) or in a more abstract form (e.g., “the spirit of open”). Where open was mentioned, any further elaboration toward an additional concept, or consequence or impact of being open, was also recorded. The analysis was done using NVivo software with responses with similar meanings were clustered and grouped into themes (<http://www.qsrinternational.com>).

Ethical Approval

This work was approved by the Faculty of Health and Applied Sciences Research Ethics Committee at the author’s institution. Participants provided their written consent at the time of interview.

Results

Those interviewed included six members of academic teaching staff and two learning technologists. Staff were at different stages of career including one Professor and one Education Centre lead, and more junior colleagues. Their academic disciplines included biomedical science, forensic science, and social science.

There were five facets of openness that emerged from the interviews. In their personal stories the interviewees used the words “open,” “OER,” or “openness” in relation to their teaching practice, impact on the learner, as an artefact of content, in relation to institutional requirements, and culture and values (Table 1).

Table 1

Five Elements Relating to Openness

Elements	Description
Personal practice	<ul style="list-style-type: none"> • Open having a personal benefit in enhancing the practice of teaching • Part of a community of practice
Learner benefits	<ul style="list-style-type: none"> • Open serving to address accessibility issues • Open providing access to education • Supporting the digital learner and developing open literacies • Open to promote science at open-days
Content	<ul style="list-style-type: none"> • OER creation by teaching staff • OER creation by students • OER reuse / dismantling • OER sharing • Knowledge of open licenses • Open licenses for more control over your resources
Institution	<ul style="list-style-type: none"> • Institutional OER agenda and policy • Tension with institutional priorities
Value and culture	<ul style="list-style-type: none"> • Openness as a personal value • Openness as a trait within the community “the spirit of open” • Culture of open within the university

Personal Practice

The interviewees spoke of their involvement in open education as being instrumental in enhancing their teaching practice. Those interviewed were widely using and creating OER predominantly in science laboratory classes for biomedical science and forensic science. They acknowledged that OER saved them time and allowed more time for discussion with students on the finer points of subjects. OER facilitated innovative pedagogies, such as circus-style, practical sessions, where students rotate around problem solving stations and can access OER via QR codes to self-direct their learning. OER were used as supplementary teaching aids and allowed students to control the pace and direction of their learning outside of lectures. Staff interviewed claimed better awareness of copyright and open licensing, and felt they had become more open and innovative as a result of these projects. They felt their teaching was more creative and effective. Interviewees commented that, “(i)t saves time you now? Instead of reading books you just see it in a few minutes and all the pictures and videos tell you much more than bits of text” and “(i)t makes the whole process of teaching more creative, with DMU with the emphasis on creativity, we should be doing this much more, and it is more creativity for the links and students.”

Learner Benefits of Openness

Staff talked considerably about access to education, both in terms of making resources more visible on the web (access) and also providing variety of content that was more inclusive to learners (accessibility). They saw benefits from not having to rely on a closed university platform, and believed sharing content that is visible is the right thing to do. In all of the eight interviews, there was an unspoken acceptance that learning took place off-proprietary university platforms and was at its greatest beyond the campus infrastructure. Staff stated that “(p)ersonally I think the resources have a bit more of a democratic distribution that is quite useful,” and

You could do it closed I’m sure, but the fact they are open and you can get them anywhere anytime that isn’t platform specific, there is a huge benefit and they can use it however they want to use it.

Some commented that OER facilitated inclusive learning and had taken pains to think about making their resources accessible, albeit still with questions to ask, but showing that their practice had become quite advanced in considering the technical requirements of their teaching content in relation to accessibility. Specifically, it was reported that “(q)uite a proportion have and need learning support and for those students they have benefitted from having a prevue of what is doing in the laboratory session, and give them the confidence to turn up and do it” and

So if you are using images and putting alternative text on the images, seeing the tab order of the page, so there could be barriers there to finishing the thing off and put it up, and if you want to make it open and accessible, thinking about all those things as well, there is that side of it.

Some commented that engaging in open education was an important part of digital literacy development, and there was a perception that students today are digital learners and favour these types of resources. One staff member expressed that “I think that they are used and there is great potential to do more and use more and students like being digital learners and media learners and they would appreciate that greatly.”

Open in Relation to Content

Those interviewed engaged in OER in a number of ways and described their creation of new materials, that they involved students in creating materials, the reusing and dismantling OER, and understanding open licensing terms. Students were involved in creating content as part of laboratory practicals, or had been employed as summer interns or on university work experience schemes. OER was most commonly produced in the form of video or audio. There was a strong sense that for those being interviewed, OER was part of day-to-day teaching practice and widely used in classrooms and for outreach events. One interviewee suggested “Even on the open days we use the link with visitors.”

Staff were thinking about the license implications for their work, and believed that sharing OER created longevity for learning resources and enabled them to contribute to a wider community of practice. The Creative Commons license was viewed as a useful means of maintaining control over how their shared resources were used. Staff expressed that “By licensing you are protecting yourself and keeping control over it but you are still offering it out under various different terms of licensing so you have flexibility choosing what you do haven’t you” and

I mean I think for me, it depends, practical difference I hope means there is longevity to them and other people can comment on them and other people can contribute if they wanted to or felt the need to, and there is a bigger community out there.

Institutional Agenda

At the time of these interviews in 2015, OER from the earliest laboratory skills project had been shared via the web since 2009. The clear outcome of this work was that in the intervening years after project funding had ceased, open education still thrived locally within the subject teams. At the level of the institution, however, the relationship with OER was a frosty one. OER was niche. The impact of the OER was not fully realised for the institution.

I think its really sad in some respects that we had those 3 projects and the institution never, didn't make, wasn't in a position to understand how to make more of them and how to drive and open educational agenda at the institution with students.

There were numerous factors discussed as to why this was the case. The reasons were not solely around intent, and part of the problem was staff turnover, changing institutional priorities and the introduction of higher student tuition fee rates in 2012 that diverted interest. One commented it could be time to have the discussion again: "(m)ore discussion more policy, thoughts, policy documents to go on probably is discussed and how, and again, maybe institutionally it might not be the right thing."

There were clear tensions between the strategy of the institution and pedagogic direction preferred by staff:

We need a lecture capture solution, we need a multimedia solution, an eAssessment solution, a synchronous solution, and the idea of open is kind of secondary. Not as shiny. It's a set of kind of cultural approaches, it is a mind set, it is not a shiny thing.

Open Values and Culture

Interviewees, unprompted, often commented on the culture of OER and openness as something that should have occurred. Open activity had no visibility in other parts of the institution, although these academics were able to work freely in their departments in ways that suited them: "(t)here doesn't appear to be anything stopping people from doing things" and "(t)here is no culture of openness. I don't know what the library does?"

One interviewee would often refer to the "spirit of OER" almost as a form of unspoken agreement with collaborators, but this also drew negative connotations such as when the terms of the Creative Commons license were not always fully understood by those reusing academic content. This individual had experienced the work being re-purposed but not in compliance with the terms of the license, and with no attribution to them as the author.

If you looked at their document you wouldn't really say it is plagiarised at all from mine they have created a new document. But they haven't taken up the spirit of the OER but that might be a cultural thing.

For some, openness and the sharing of resources had become a fundamental value and part of their daily practice: "It has changed my practice in terms of whenever I'm doing anything I think how could this be an OER or how could it supplement what I'm doing."

Discussion

The global open education movement is shaping Higher Education teaching and research agendas, and the idea of sharing content under open licenses via interactive digital environments is widening access to education (Wiley, 2006). From the principles and philosophies of open education in schools in the 1970's (Katz, 1972) to the advent of the UK's first Open University built on the idea of making learning more accessible (Lane, 2009), openness has so much grown in stature that it has become a commodity attached to education for commercial gain, where the principles of being open are often

exaggerated and misleading: “Openwashing: n., having an appearance of open-source and open-licensing for marketing purposes, while continuing proprietary practices” (Watters, 2014, para. 3).

We may seek to reclaim openness as a mind set and virtue (Weller, 2014; Peters & Roberts, 2015), and to continue widening participation in open education (Spilovoy & Seaman, 2015), but to do so we need to understand how our education communities engage with it. A voice largely unheard is that of university staff, and a qualitative enquiry such as adopted in the present study fits with Farrow’s (2016) idea that openness is formed from a constellation of elements, rather than fixed ideas of what it might be: “Many different interpretations of openness have been advanced, often favouring one or more elements at the expense of others” (Farrow, 2016, p. 11).

In this paper, the views of openness from eight teachers and professional service staff were examined. All participants were familiar with open educational resources. Openness was perceived in relation to five elements located around personal practice, learners, content, institutional agenda, and culture and value.

Those interviewed who were university lectures spoke of openness and how it had enhanced their teaching practice. For them, this related to the widening of pedagogic choice and providing flexibility in lectures and laboratory classes, and not being confined within the digital platforms offered by the institution. The “porosity” of our institutional boundaries is recognised, and our daily working habits play out on our personal devices, through social networks, and through the availability of learning resources outside of the university system (Oliver, 2015). This leads to questions regarding the technical and legal support needed to meet these changing agendas as we operate increasingly in spaces beyond our institutions.

Openness as an emerging pedagogy was seen as beneficial to students through widening access and being more inclusive to learners. Staff viewed open education activity as important for the development of digital literacies for their students, and it was a vehicle to work with students in new ways. Their activities aligned with some of the pedagogical ideals of Dalsgaard and Threstrup (2015), and staff were testing out more transparent learning processes and better communication with their students. It is interesting how little the pedagogical potential of open education features as a strategic driver, and it is observed that engagement and uptake of OER is sometimes disappointing and not as a mainstream practice (Spilovoy & Seaman, 2015). We are well versed in the barriers to engaging with open education, largely revolving around time and technical support (Spilovoy & Seaman 2015; Rolfe, 2012), but previous research tends not to focus on understanding what the benefits might be to individuals and institutions. As McGill (2013) suggests, it is important to be clear about the benefits and impact of open work, particularly when attempting to influence individuals who have other. In the present study, the support for learner diversity and ability to widen access were seen as benefits of OER, and this information will assist us in creating more meaningful messages to support advocacy work.

The central concept of open education is the ability to apply open licenses to reuse, remix, and redistribute content (Wiley, 2014). As examined in one US study, a third of those surveyed reported no awareness of the Creative Commons open license, and two thirds of staff in an institution that had engaged in open education activity claimed little understanding of it (Spilovoy & Seaman, 2015).

When staff participate in open education, they often cite copyright as a training requirement and area of confusion (Rolfe, 2012; Reed, 2012). This would suggest institutions need to strategically target this, and as the present study highlights, there are many benefits enjoyed by staff once they have acquired a degree of understanding. Staff claimed that adopting open practice was beneficial in helping them understand copyright, and they demonstrated this through reusing and dismantling the content of others, and working with students as co-creators of new materials. The use of Creative Commons licenses was seen as a way to create longevity for learning materials, and by clearly stating the terms of the license, this provided a means of control over their shared work. Again, these ideas could be used in creating persuasive arguments to engage wider sections of the academic community, and we rarely hear of the impact of open licensing of content beyond the immediate release of OER.

In this study, it was clear that open education activity was localised, and that there was a perceived decline in institutional buy-in since the start of these projects back in 2009. This was not in itself a barrier to the activity, but those interviewed felt the impact of OER could be more fully realised in the institution. It is not clear whether buy-in can be interpreted as the need for a relevant policy or just support. Other research suggests an intellectual property policy itself is more hygienic rather than a motivating factor, and that it is the culture that influences academics' decisions (Cox & Trotter, 2016). One might argue that as "little OER" exists and thrives (Weller, 2010), often managed by individuals or localised teams, there is no need for additional support. At De Montfort University, senior management was greatly in support of the work at the outset of the projects; however, the reliance on small pockets of activity and champions created vulnerability as people moved and local objectives changed (Rolfe, 2015). To secure sustainable and successful outcomes for open educational practice, certainly top-down policy in support of bottom-up formation of staff communities and academic cultures is suggested to be more beneficial (MacKinnon, Pasfield-Neofitou, Manns, & Grant, 2016). Within the institutional culture there needs to be an element of openness toward risk taking and the creation of spaces for experimentation as observed in the success of the Coventry University open media classes in the UK (McGill & Gray, 2015).

What Openness Wasn't?

Open wasn't discussed in relation to the nature of student relationships and classroom discussions (Alivernini & Manganelli, 2011) and this may have reflected the less philosophical and political nature of the subjects featured. Openness as an integral trait of academic communities as explored by Anderson (2007) did not feature predominately aside from one individual who referred to some co-workers engaging in "the spirit of open." With regards to the learner, openness related to being able to access content and develop digital skills, rather than an outlook or open mind toward learning new things (Bakker et al., 2015), so not reflecting the humanistic approaches developing in primary schools in the 1970's (Katz, 1972). Open practice described in the present study did not reflect the broader scholarly activities observed by Veletsianos and Kimmons (2012), such as open access publishing of journal articles and data, or maintaining a blog and/or social media presence. The overall narrative around openness was less about the technology as those interviewed seemed to have become immersed in their own ecosystem and operations, and it was not at all about the ethics or politics concerning access to education, two elements listed in Farrow's (2016) paper.

This study reinforces the importance of connecting with our perspectives of openness, in that it provides an understanding of our progress and awareness of barriers. An understanding of our individual and collective perceptions and values are important mechanics of the open movement

(Wiley & Hilton, 2009), and for its sustainability (MacKinnon et al., 2016). We collectively need to establish a more critical approach toward our frame of reference around open and in our evaluation of it. Farrow recognises the importance of defining openness not as a binary quality or value attributed to cost or licensing terms, but as a “constellation” of elements that help us understand “complexity and the diversity” (Farrow, 2016, p. 11). These elements need to be examined beyond individuals and institutions, and across the communities, cultural, and geographical contexts of our operations.

Recommended Next Steps

The research outcomes and approach taken can be used to help create targeted and meaningful messages. Table 2 provides an example of how this can be developed. The messages can be further tested for effectiveness via qualitative approaches to determine whether the messages have influenced awareness and/or behaviour (or whatever the desired outcomes are). More compelling messages can be built using quotations from those interviewed.

Table 2

Linking the Five Elements to Messages That Could be Used in Communication

Elements	Description	Message
Personal	<ul style="list-style-type: none"> • Open having a personal benefit in enhancing the practice of teaching • Part of a community of practice 	Open education is a means of enhancing your teaching practice, and allows you to participate in communities beyond your institution.
Learner	<ul style="list-style-type: none"> • Open serving to address accessibility issues • Open providing access to education • Supporting the digital learner and developing open literacies • Open to promote science at open-days 	Open educational resources in their truest sense provide accessible materials for students; these practices widen access to education and support diversity. Engaging in co-creation of open educational resources will support digital literacy development for your learners.
Content	<ul style="list-style-type: none"> • OER creation by teaching staff • OER creation by students • OER reuse / dismantling • OER sharing • Knowledge of open licenses • Open licenses for more control over your resources 	By creating content you will understand (technical) and legal aspects of applying open licenses; open licenses will help you keep control over your resources and specify how you'd like them to be used.
Institution	<ul style="list-style-type: none"> • Institutional OER agenda and policy • Tension with institutional priorities 	(Research suggests that policy alone is less motivating for staff, but culture and support is – below).
Value and culture	<ul style="list-style-type: none"> • Openness as a personal value • Openness as a trait within the community “the spirit of open” • Culture of open within the university 	Engaging in open education will catalyse change within your teams and institution; you will connect with global open communities united by “the spirit of open.”

Study Limitations

The conclusions drawn from this work are limited in that they are the views and interpretation based on the experiences of staff at a single institution. The methodology applied looked at the interview responses through a lens to focus on a given topic and highlighted the narrative, language, and context in relation to openness. The analysis is the work of a single researcher, and whilst this has advantages in being able to become immersed in the interview and transcription process, a second author could have verified the development of the thematic elements and descriptors. The interviewer was a former colleague of those involved which might have biased the responses, but that said, a number of critical components and examples emerged.

Conclusions

The purpose of this research was to capture the voices of university staff involved in open education, providing insight into *their* stories and understanding of openness. The work of the worldwide open education community is ever more pertinent with the rising costs of education, the need for creative pedagogies to support diverse learners, and to support education sustainability. We need to “remain critical of the systems we are creating” (Veletsianos & Kimmons, 2012, p. 181), and this includes understanding different communities of practice and those most closely involved. This study provided insight into open activities localised within one institution, and although the narrative as it unfolded was not reflective of broader definitions of open scholarship, the policies, and ethical considerations, it defined five elements of openness that were meaningful to this setting. This included a connection to the humanistic approaches of the 1970’s fostering independence and students as co-producers of knowledge.

These approaches are important, as they will allow us to design and deliver clearer definitions of openness and create more persuasive arguments and messages in our advocacy work. Moreover, as the global activity advances and diversifies, we will need to keep recalibrating our definition.

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Faculty Perception of Openness and Attitude to Open Sharing at the Indian National Open University



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Abstract

In the past decade, the educational scenario world over has significantly been impacted by open access and open education movements. The philosophy of openness and sharing forms the cornerstone of the open education movement. The distance education approaches, together with open educational resources (OER) and massive open online courses (MOOCs), are being used to serve the increasing educational needs of diverse communities. However, adoption of openness as a core value and as part of the institutional strategy still remains a challenge for academic institutions in general, and distance education institutions in particular, in developing countries like India. In this research study, the authors report an analysis of the perception of the faculty of the Indira Gandhi National Open University of India (IGNOU) about openness and their attitude towards sharing of resources in academic institutions. Data was collected through a structured questionnaire administered to the teachers and academics of IGNOU (N=69). The results indicated that: the faculty members valued sharing of resources in academic institutions; learning resources should be made available free of cost; there is a strong need for training on intellectual property rights, copyright, and creation and use of OER; and there should be an institutional policy on OER for its effective use.

Keywords: openness, open sharing, faculty perception and attitude, Open University, distance education

Introduction

The Open Access and Open Education movements are gradually reshaping the educational landscape worldwide. Open philosophies call for unrestricted access to knowledge and educational resources and

diminishing of barriers to education. The basic premises on which the open education movement is based postulate that knowledge should be free and open to use and re-use; that collaboration should be easier; that people should receive credit for contributing to education and research (Baraniuk, 2008). There is growing interest towards fostering of open practices of teaching and learning with a view to leverage education and lifelong learning for the knowledge economy and society (Geser, 2007). Weller (2011) refers to open education “as a response to, or at least as part of, a broader social change made possible by digital technologies” (p. 24). Openness and sharing are the basic principles of the open education movement. Adoption of openness as a core value and as part of institutional strategy, along with tremendous stress on sharing and collaboration, has become crucial for academic institutions to enhance the quality and outreach. The open and distance learning (ODL) system has played a crucial role in widening access to education in many countries. The ODL approaches are in keeping with the ideology of access and availability of knowledge at the doorsteps of the learners. Digital technologies, coupled with OER, could enable distance education institutions to serve the educational needs of diverse communities, provided the learners have easy access to open technologies. ODL institutions are also gradually gearing up to revisit open policies to maintain their competitive edge. In a developing country like India, there are a number of institutions which still continue to function under traditional academic practices, resisting the change towards a culture of openness. Perception and /or attitude play a crucial role in adopting this inevitable change in academic practices. The present paper analyzes the faculty perception about openness and attitude of faculty towards sharing resources at the National Open University in India. The study also aimed to highlight various issues related to sharing of knowledge and learning resources in open and distance learning (ODL) institutions generally. The findings could be useful to both the campus-based and distance teaching universities in reforming their teaching-learning practices.

Literature Review

Understanding Openness

Openness in education has been defined as an emerging paradigm of social production in the global knowledge economy (Peters, 2008). Wiley (2006) considers openness as an emerging academic culture stemming from the Open Source Software movement. Yuan, MacNeill, and Kraan (2008) mention that the concept of openness is based on the idea that knowledge should be disseminated and shared freely through the internet for the benefit of society as a whole. The term refers to a kind of transparency in terms of access to information, especially within organizations, institutions, or societies (UNESCO, 2014). In the present decade, openness has emerged as a technological, social, economic, and cultural phenomenon (Peter & Deimann, 2013). Peters (2008) opines that openness in education embodies democratic values such as freedom, equality, and creativity. As mentioned by Wiley and Hilton III (2009), “Openness is a fundamental value underlying significant changes in society and is a prerequisite to the changes institutions of higher education need to make in order to remain relevant to the society in which they exist” (p. 1). Openness has different meanings and forms depending on the context - which could be social, technical (Tuomi, 2006), organizational (Tapscott & Ticoll, 2003) or educational (Hysten, 2006). The term “openness” is evolving and encompasses open sources, open educational resources, open courses, open research, open data, and open application program interfaces (APIs) (Weller, 2012). The

concept of openness can be applied to institutions as well as to information and processes (Committee for Economic Development, 2009). Wiley and Hilton III (2009) argue that every educational institution must address “openness as a core organizational value if it desires to both remain relevant to its learners and to contribute to the positive advancement of the field of higher education”(p. 1).

Openness and Sharing in the Context of Education

According to Wiley and Green (2012), “education is, first and foremost, an enterprise of sharing” (p. 81). Sharing and openness are altruistic arguments that are in line with academic traditions (McNamara, 2012). The emerging open education movement combines the established academic tradition of sharing and the collaborative and interactive culture of the Internet (Peters, 2008). As mentioned by Cheng (2013), “the idea of openness in education predates late 1910, where it was determined that education should be open” (p. 57). It was in the 1960s and 70s that open education began as a reform project to liberate education from any kind of oppression (Deimann & Sloep, 2013). The establishment of the United Kingdom Open University (UKOU) in 1969 brought to spotlight the role of openness in higher education (Lane, 2009). The first Chancellor of UKOU, Lord Crowther (as cited in Daniel, 2007) delineated dimensions of openness when he declared the Open University “open as to people, open as to places, open as to methods, and finally open as to ideas” (p. 3), with the aim to widen access to higher education. This has formed the cornerstone of openness in higher education across the world with “the common belief in the power of education to transform lives, communities and nations” (Olcott, 2013, p. 16).

The open education movement calls for “unrestricted access to educational materials and diminishing of geographic and economic barriers to participation” (Knox, 2013a, p. 21). Tuomi (2006) distinguishes three areas where openness is perceived to make a difference in education: technical characteristics, social characteristics, and the nature of the resources. Openness in the social domain is fundamentally motivated by the expected social benefits and by ethical considerations related to the freedom to use, contribution, and sharing. Openness in the technical domain, in contrast, is characterized by technical interoperability and functionality. The paradigm of openness in higher education provides opportunities for sharing of ideas, collaboration among institutions, educators, and learners locally and internationally, thus facilitating more meaningful engagement in teaching and learning (Yuan & Powell, 2013). Openness in education, thus involves systems and processes which are more transparent in nature, provide accredited qualification and skills to the learners so that they may be gainfully employed and contribute to the economic growth of the state (Mishra, 2012).

Several researchers (Bayne, Knox & Ross, 2015; Edwards, 2015; Moe, 2015; McNamara, 2012; Olcott, 2013) have discussed the idea of openness in educational practices through varied perspectives. The notion of openness is related to: access and choice (as exemplified in the context of open universities); no cost or low-cost access (as in the context of OER); and being freely available (as in the context of open access) (Jones, 2015). The idea that knowledge is a public good is closely aligned to unfettered access to educational opportunities and the demolishing of established barriers to education (Torres, 2013). Openness in education seeks to bring about a more equitable educational future by expanding access to learning for everyone, especially for the non-traditional learners and marginalized sections of the society (Oliver, 2015; Olakulehin & Singh, 2013).

Openness, Sharing, and the OER Movement

Open Education Resources (OER), followed by Massive Open Online Courses (MOOCs), form an important part of openness in education. The beginning of the OER movement was marked by the OpenCourseWare (OCW) initiative by the Massachusetts Institute of Technology (MIT), in the year 2001. In the UNESCO forum on the potential of open courseware for higher education in the developing countries V.S. Prasad (UNESCO, 2002a) from India mentioned that “the Open Courseware concept is based on the philosophical view of knowledge as a collective social product and so it is also desirable to make it a social property” (p. 15).

As the OER movement spread across the world, the definition of OER also expanded to embrace the characteristics of open license and knowledge sharing, and to include course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge (Chen & Panda, 2013). The OER movement is characterized by sharing and reuse (Pegler, 2012). The Cape Town Open Education Declaration (2007) propelled educators, learners, and organizations to pursue additional strategies in open educational technology, open sharing of teaching practices and other approaches that promote open education. The rapid growth of OER, enabled by open licensing and new digital technologies, provides new opportunities for teaching and learning, and at the same time, challenges established views about teaching and learning practices in higher education (Yuan et al., 2008).

Previous research studies have largely discussed openness in the context of OER (Rolfe, 2012; Butcher, 2011; Iiyoshi & Vijay Kumar, 2008; Wiley & Hilton III, 2009; Downes, 2007; Hylén, 2006). Walker (as cited in Downes, 2007) defines open as "convenient, effective, affordable, and sustainable and available to every learner and teacher worldwide" (p. 2). According to Hylén (2006), the two most important aspects of openness have to do with free availability over the Internet and as few restrictions as possible on the use of the resources. Schaffert and Geser (2008) identified four key attributes in the context of the concept of openness in OER – open access, open license, open format, and open software. Dalsgaard and Thestrup (2015) provided three pedagogical approaches to openness as transparency, communication, and engagement. Wiley (2009) proposed 4R framework to measure the openness of content in terms of the rights granted to the user of the content – reuse, revise, remix, redistribute (Wiley, 2009). He further expanded this to include the 5th dimension of openness - retain, which pertains to the right to create and own copies of the content (Wiley, 2014). Ehlers (2011) presented a model which conceptualized three degrees of openness – low, medium and high. Hodgkinson-Williams and Gray (2009) described four key attributes in terms of social, technical, legal, and financial openness. Wiley and Hilton III (2009) identified key areas for educational transformation as connectedness, personalization, participation, and openness. They noted that a culture of openness in higher education is a critical prerequisite to large-scale progress in the other three areas. Conole (2010) argued that OEPs, which are activities and support around the creation and use of OER in the form of guidelines, policy, and broader management, are critical for leveraging OER effectively. Downes (2007) mentioned that most of OER initiatives offer a most basic level of openness, where open means “without cost” but not “without conditions” (p. 32). Olcott (2012) underlined that there is a need for imposing more structures in educational institutions to expand openness. This critical literature suggests a fair degree of clarity in the framework and practice of openness in teaching-learning today.

“Sharing” forms a key concept in the discussion on open education, OER, and in the context of Web 2.0 technologies. As mentioned by Hug (2014), notions of sharing play a crucial role in the open content and open education strategies. The fundamental importance of practices of sharing with respect to the socio-political aspects of opening-up lends credence to this aspect. According to Lerman, Miyagawa, and Margulies (2008), open sharing of knowledge is at the heart of the academic process and becomes a customary practice in education at all levels. Hylan (2006) points out that the open sharing of research results and educational materials is essential, otherwise the traditional academic values will be increasingly marginalized by market forces. In the OER movement, education systems face the greatest challenges of breaking the aversion to openness (Torres, 2013). The author argues that this bias towards change and rejection of openness may lead to obsolescence; with the closed educational content being a proof of lack of innovation, lack of quality and lack of commitment to sharing knowledge with everyone. Researchers have also indicated a lack of sharing culture in educational institutions (Kim & Ju, 2014; Ehlers, 2011). According to Mckerlich, Ives, and McGreal (2013), one of the main issues that inhibit sharing and openness in higher education is intellectual property. A report (Falconer, McGill, Littlejohn, & Boursinou, 2013) on a survey of OER initiatives from 12 countries mentioned investment in openness as one of the major challenges.

Openness and Sharing in the Context of Distance Education

Open education movement reflects “an affinity with distance education” as both address wider access to educational opportunities (Knox, 2013a, p. 22). Openness was also enabled by further developments in distance teaching-learning (Peter & Deimann, 2013). Open learning and distance education represent approaches that focus on opening access to education and training provision, freeing learners from the constraints of time and place, and offering flexible learning opportunities for individuals and groups of learners (D’Antoni, 2009). Open universities and distance education institutions play a key role in providing education to a variety of learners across geographical, social, and economic barriers, especially in a developing country like India. India has one of the largest distance education systems in the world with one National Open University and 14 state open universities, and more than 200 distance education providers (University Grants Commission, n.d.). The use of open and distance learning to expand access to underserved populations has been critical to the growth of open education in both developing and developed nations (Olcott, 2013).

As mentioned by Feldstein (2008), “the commitment to open sharing of ideas provides a foundation for leveraging resources both within and among institutions, to strengthen the creation, transmission, and preservation of knowledge” (para. 2). Education globally is going through transformation towards a culture of openness, sharing, and collaboration. ODL institutions are also gradually adopting these practices to face the global challenges of changing educational needs, shrinking resources, and rising costs. In this context, knowledge sharing and openness among educators becomes all the more crucial. A number of research studies (Banzato, 2012; Reed, 2012; Masterman & Wild, 2011; Kim & Ju, 2008) explored the attitude of educators towards OER. Rolfe (2012) assessed staff awareness and behaviors surrounding OER with a focus on attitude to sharing resources. Veletsianos (2015) explored engagement of the academics in open practices and sharing. Allen and Seaman (2016) in their study on the use of OER by higher education faculty, found them to be interested in the “open” concept of OER. Villamejor-Medozza (2013) explored openness at the UPOU (University of the Philippines Open University) based on

four main parameters – open admissions, open curricula, distance education on a scale, and creation and use of OER. In the distance education scenario, openness is seen in the form of relatively flexible organizational structures, delivery and communication patterns, and the use of various technologies to support learning (UNESCO, 2002b).

Given that studies on openness and open sharing in distance education are scanty, there was a need for research studies discussing various aspects related to the culture of openness and sharing in ODL institutions, especially in India. It can be seen from the review of literature above, that most of the international research is focused on open educational resources and various issues related to technology, access, implementation, and use. Empirical research on the culture of openness and sharing in educational institutions, which is a prerequisite for the success of open education movement, is minimal. There was a strong need to investigate the perception, especially of the faculty, towards openness in open and distance learning institutions in India. This assumes significance at a time when the country is moving closer to establishing the platform for single-window national repository and teaching-learning (SWAYAM, i.e., Study Webs of Active-Learning for Young Aspiring Minds). The present study, therefore, examines the perception of the faculty towards openness in the mega open university in India. The study also investigates the intention and attitude of the faculty toward sharing of knowledge and learning resources in ODL institutions.

Conceptual Framework

At the core of open education lies the commitment to access and equity (Phelan, 2012). The underlying aim is to “solve longstanding educational problems of access and inclusion” (Knox, 2013b, p. 822), through “provision of access to learning opportunities to those who would not otherwise be able to obtain them” (Downes, 2011, para. 1), and who are “distributed by geography and income” (Edwards, 2015, p. 252). Openness and sharing are the underlying principles of Open Access, Open Education and OER movement (Villamejor-Mendoza, 2013; Pantò & Comas-Quinn, 2012). Knox (2013b) discussed the notion of openness in education in the context of principles of individual freedom. He noted that openness in education has similarities with negative liberalism, which is mainly concerned with the emancipation from hierarchies of institutional control. OER must be considered in relation to a combination of political, social, and economic factors (Jones, 2015). As mentioned by Jones (2015) “openness in an open university is an ongoing dialogue between political objectives (often expressed via the state), pedagogic practices (embedded in the institution) and the available technologies” (p. 335). The wider framework for understanding the various aspects of openness in education can be viewed in terms of themes related to, content, university-based educational structures (institutions), pedagogy, learners, technology use, and related socio-economic factors. Several theoretical and empirical studies have highlighted issues such as:

- Diminishing of the traditional institutional structures (Jones, 2015; Knox, 2013b; Barber Donnelly, & Rizvi2013);
- Downplay of the pedagogical functions of the university (Edwards, 2015; Knox, 2013b);

- Learner-centered methods where learners can manage their own learning autonomously (Knox, 2013b, Phelan, 2012);
- Marketization and commodification of higher education and its subjects (Hall, 2015; Oliver, 2015; Jones, 2015; Macintosh, McGreal, & Taylor 2011); and
- Costs associated with production, distribution, curation, and reuse of open resources (Jones, 2015; Pegler, 2012; Caswell Henson, Jensen, & Wiley. 2008).

Edwards (2015) mentions that all forms of openness entail forms of closed-ness, which makes it important to consider what forms of openness are worthwhile and for whom. Moe (2015) remarks that open is often defined in economic terms of consumer cost and not in theoretical terms of remix or appropriation. It, therefore, becomes important to consider openness in the context of contemporary academic practices of institutions to address the barriers to participation (Oliver, 2015). Openness is a broad concept, debatable, and ever evolving; and, as mentioned by Tuomi (2013), has social, economic, cognitive and technical dimensions. In the present study, only the key notions, associated with openness in academic institutions, and relevant to the objectives of the study, were considered. These are:

- Open access and open publishing;
- Sharing and collaboration;
- Openness of resources;
- Creation and use of open educational resources; and
- Open and collaborative pedagogy.

The key underlying concepts related to knowledge sharing and openness were synthesized to formulate the conceptual framework to guide the present research study. The aim was to provide an understanding of the faculty perception of openness and their attitude to sharing in an ODL institution. The faculty perception of openness was analyzed in terms of 12 dimensions mentioned below:

- Belief in open education;
- Idea of knowledge as a public good;
- Willingness to share and collaborate;
- Attitude towards sharing;
- Recognition of benefits of sharing (both personal and institutional);
- Awareness of copyright permissions;
- Knowledge of creative commons licensing;

- The interest in providing courses free;
- Stance on attribution and authorship;
- Creation and use of OER;
- Willingness to make a resource open; and
- Training requirements.

The present study investigated the faculty perception of openness and attitude towards sharing of knowledge and learning resources in the National Open University in India. The results may facilitate future implementation of open educational practices, in ODL institutions in India in particular, and in other contexts in general.

Objectives of the Study

The main objectives of the study were:

- To identify the perception of the faculty, of the national open university in India, about openness in education.
- To study the attitude of the faculty, of the national open university in India, towards sharing of knowledge and learning resources.
- To ascertain the willingness of the faculty of the national open university to share knowledge and learning resources.

In view of the above-mentioned objectives, the present study addresses the following research questions:

- What is the perception of the faculty in the national open university in India about openness in education?
- Is the faculty of the national open university engaged in the sharing of knowledge and learning resources?
- What is the willingness of the faculty in the national open university towards sharing of knowledge and learning resources?
- What is the attitude of the faculty in the national open university towards sharing of knowledge and learning resources?

Methodology

In the present study, a positivist paradigm was used as it relies on quantitative data and the focus is on the objectivity of the research process. The methodology is descriptive, and the survey method was adopted to gather information regarding the perception of the faculty towards openness and sharing. The study involved the faculty (teachers and academics) of Indira Gandhi National Open University (IGNOU), the only national open university in India, which had a cumulative enrolment of above three million in-country and overseas students, studying through more than three thousand study centers.

Sample

The data for the study were gathered from the teachers and academics of IGNOU at its main campus, New Delhi, using the survey method. At the time of the study, there were 315 full-time faculty members (teachers and academics) at the main campus of the Indira Gandhi National Open University, New Delhi, in 21 schools of studies and some academic divisions. The survey was conducted by administering the questionnaire in person to the faculty members (and also sent by e-mail). This approach was preferred to ensure unbiased and high participation. The questionnaire was handed in person to the faculty members, of which 70 were returned, and 69 filled in questionnaires completed in all respects were considered for further analysis.

Survey Instrument

A structured questionnaire and an attitude scale were used in the survey. The development of the instruments was guided by the relevant literature on OER and the aspects of openness. The survey questionnaire had four subsets:

- i) Demographics (6 items),
- ii) Creation of learning resources (2 items),
- iii) Perception about openness (11 items), and
- iv) Intention towards sharing of knowledge and learning resources (5 items).

The Attitude Scale on attitude towards sharing among faculty members had 8 items.

The questionnaire consisted of multiple choice, ranking, and opinion questions. The face and content validity of the questionnaire were established through review by eight subject experts in educational technology and OER in higher education institutions in India. Based on their suggestions and feedback, required modifications were made to the questionnaire before employing it for data collection.

The responses to questions regarding the perception (11 items) and intention (5 items) were measured on a 3-point scale having “1” (as Yes), “2” (as No), and “3” (as Not Sure). The scale used for attitude had 8 items measured on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The reliability of the scales was assessed using Cronbach’s alpha. The Cronbach’s alpha level of attitude scale was found to be 0.89, indicating the high internal consistency of the items. The internal consistency for

perception and intention scales was found to be acceptable with Cronbach’s alpha values of 0.70 and 0.73 respectively. The high value of Cronbach’s alpha indicated a high level of internal consistency.

Data Collection

The questionnaire and the attitude scale were administered personally to the faculty and through e-mail. Complete responses were received from 69 faculty members and academics of the university. The data were collected during November to December 2015.

Data Analysis

The gathered data were coded and transferred to SPSS to carry out further analysis. The responses thus collected were analyzed and interpreted based on the objectives of the study. Using SPSS, quantitative analysis was carried out and the results were tabulated. Personal data of the participants, their subject area of interest and types of learning resources created were calculated as frequency and percentage. The analysis of faculty members’ perception towards openness, intention to share (Yes/ No/ Not sure scale); and the attitude to sharing (5-point Likert scale) involved calculating frequencies and percentages of the level of agreement and disagreement of the respondents. The findings of the study are presented in the following sections.

Results

Participant Demographics

Out of the 70 questionnaires administered, 69 completed responses were considered. As shown in Table 1, out of the 69 respondents, 53.6% (n=37) of the respondents were females; 40.6% (n=28) were associate professors; 29% (n=20) were over 46 years of age, and 55% (n=38) had work experience of 6-15 years in distance education.

Table 1

Demographic Profile of the Respondents

Demographic status	Items	n	%
<i>Professional Group</i>	Professor	7	10.1%
	Associate Professor	28	40.6%
	Assistant Professor	22	31.9%
	Other	12	17.4%
<i>Age</i>	25 years and under	0	0.0%
	26-35 years	15	21.7%
	36-45 years	34	49.3%
	Over 46 years	20	29.0%
<i>Experience</i>	1-5 years	11	15.9%
	6-10 years	25	36.2%
	11-15 years	13	18.8%
	16-20 years	8	11.6%

	21 years and above	12	17.4%
<i>Gender</i>	Male	32	46.4%
	Female	37	53.6%

Subject Area of Interest

The respondents were asked about the subject areas they were interested in for the creation and use of learning resources. As shown in Table 2, the academics were from a wide range of subject areas - Sciences (30.4%), Education (29%), Social Sciences (24.6%), and Arts, Language, and History (15.9%).

Table 2

Subject Area of the Respondents

Subject areas	N	%
Arts, Languages, and History	11	15.9%
Mathematics, Computing, and Engineering	6	8.7%
Sciences and Environmental Sciences (including Geography)	21	30.4%
Health and Medicine	8	11.6%
Social Sciences	17	24.6%
Education	20	29.0%
Business and Management	4	5.8%
Others	6	8.7%

Types of Learning Resources Created

The respondents were asked to indicate the type of learning resources they created or used during instruction. As shown in Table 3, textual materials were most common (92.8%), followed by videos (75.4%), images (53.6%), and tutorials (52.2%). Use of e-books and individual websites was much less preferred.

Table 3

Learning Resources Created

Items	N	%
Textual materials	64	92.8%
Videos	52	75.4%
Images	37	53.6%
Tutorials	36	52.2%
Audio podcasts	25	37.7%
Pre-recorded Lectures	20	29.0%
E-books	17	24.6%
Quizzes	16	23.2%
Individual websites	13	18.84%

Perception Towards Openness

The respondents were asked to rate their perception about openness in academic institutions on a scale where “1” = Yes, “2” = No and “3” = Not Sure. The responses were gathered in terms of eleven parameters

viz., i) idea of knowledge as a public good, ii) making the program and courses available free, iii) providing learning resources freely and openly, vi) reaching a wider audience through OER, v) credit for the author or creator, vi) awareness of open licenses, vii) concern about intellectual property rights (IPR) and copyright permissions, viii) use of open source tools, ix) training for creation and use of OER, x) use of collaborative pedagogical approaches in teaching and learning, and xi) ease of customization of OER (Figure 1).

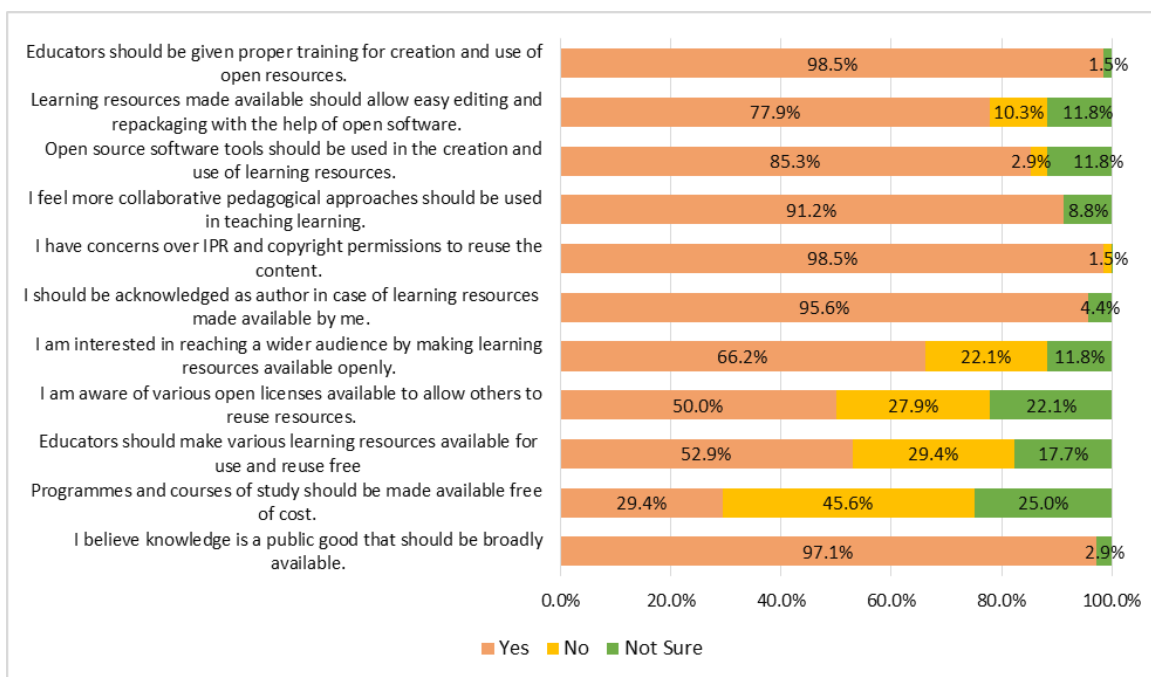


Figure 1. Perceptions towards openness.

As shown in Figure 1, 98.5% respondents expressed a strong need for proper training (i.e., specific training related to OER, Copyright, IPR, etc.) in the creation and use of OER, and an equal percentage of respondents were concerned about IPR and copyright permissions to reuse the content. This was followed by the recognition that knowledge is a public good that should be made broadly available (97.1%), desire to be acknowledged as an author for the educational resources made available by them (95.6%), and inclination towards the use of collaborative pedagogical approaches in instruction (91.2%). The results showed that while 52.9% were positively inclined towards making learning resources available free of cost, a large percentage (70.6%) were not in favor of providing programs and courses of study free of cost to the students.

Intention to Share Knowledge and Learning Resources

The respondents were asked to indicate their intention to share knowledge and learning resources on a Yes/No/Not Sure scale (Figure 2). The majority of the respondents (92.7%) indicated a positive inclination towards sharing of knowledge and learning materials among the faculty. A total of 91.2% respondents felt that sharing of knowledge and teaching resources will be useful in research and teaching activities, and a large number of respondents (79.4%) indicated a willingness to share learning resources they developed.

**Faculty Perception of Openness and Attitude to Open Sharing at the Indian National Open University
Panda and Santosh**

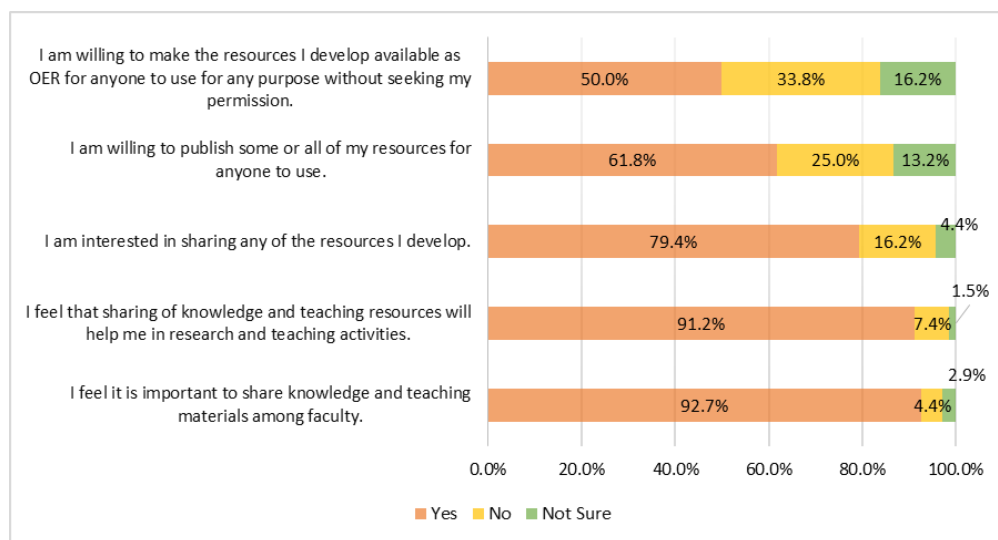


Figure 2. Intention to share knowledge and learning resources.

Attitude Towards Sharing of Knowledge and Learning Resources

An attempt was made to assess the attitude of the academics towards sharing of knowledge and learning resources. The respondents were asked to identify and rate a list of 8 statements on a 5-point Likert scale (where “1”= strongly disagree and “5”= strongly agree). The mean attitude score for the sample (n=69) was calculated at 4.50 indicating that the majority of the respondents had a strong positive attitude towards the items rated (Table 4). The standard deviation ranged from 0.581 to 0.782. The attitude measure also demonstrated good internal consistency with the Cronbach’s alpha coefficient of 0.89. It may be noted that the strongest favorable attitude statements concerned with the reputation of an educator, the reputation of the institution, and sharing leading to professional development and better performance, though pathways to innovation and enhancement of professional efficiency were indicated as “strongly agree” at above 50% of agreement.

Table 3

Attitude Towards Sharing of Knowledge and Learning Resources

S No	Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	SD
1.	Sharing of resources and knowledge enhances the reputation of an educator.	64.7%	30.9%	1.5%	2.9%	0.0%	4.57	0.68
2.	Sharing of resources and knowledge is essential in today’s competitive environment.	61.8%	33.8%	4.4%	0.0%	0.0%	4.57	0.58
3.	Sharing of resources and knowledge enhances the reputation of the institution.	61.8%	33.8%	2.9%	1.5%	0.0%	4.56	0.63

4.	The sharing of resources amongst the educators should be encouraged at the institutional level.	60.29%	36.8%	0.0%	2.9%	0.0%	4.54	0.66
5.	Sharing of knowledge and resources is in line with the academic traditions.	58.82%	36.8%	2.9%	1.5%	0.0%	4.53	0.63
6.	Sharing of resources and knowledge leads to professional development and better performance.	61.8%	29.4%	4.4%	4.4%	0.0%	4.49	0.78
7.	Sharing of resources and knowledge leads to innovation in pedagogy.	58.9%	29.4%	10.3%	1.5%	0.0%	4.46	0.74
8.	Sharing of resources and knowledge enhances the effectiveness and efficiency of the educators.	57.4%	33.8%	4.4%	4.4%	0.0%	4.44	0.78

Discussion and Conclusion

The aim of this study was to understand the perception of teachers and academics in an open and distance learning institution towards openness and sharing, as these are essential elements of the open educational practices that the educational world globally is moving towards. The present study focused on three key aspects related to openness in education – perception towards openness, willingness to share, and attitude towards sharing. The findings of the study are discussed in relation to the existing relevant research studies, wherever deemed appropriate.

The study revealed that textual materials were the most commonly created learning resources (at 92.75%), followed by videos (75.4%), images (53.6%), and tutorials (52.2%). The findings suggest that the faculty generally had a positive inclination towards sharing of knowledge and learning resources and believed that the learning resources should be made available free of cost to all.

The study analyzed the perception of the educators towards openness in education based on 11 parameters mentioned above. These parameters covered various aspects related to the implementation of openness in higher education institutions. Several researchers have discussed the altruistic motivations of openness and sharing in keeping with the academic traditions (Kursun, Cagiltay & Can, 2014; Awang, Ismail & Kareem, 2013; McNamara, 2012; Pena, 2009; Downes, 2007; OECD, 2007; Hylén, 2006). Lerman et al. (2008) noted that open sharing of knowledge is at the heart of the academic process. It is widely believed that world’s knowledge is a public good to be shared, used, and reused (Olcott, 2013; Torres, 2013; McNamara, 2012; Jones, 2015). This idea is central to the OER movement (Smith & Casserly, 2006). The findings of the present study indicate that the majority of the respondents (97.1%) believed that knowledge is a public good and should be widely available. The findings are consistent with the findings of a study conducted by Rolfe (2012) in a UK University, where a strong belief in open education emerged as a major driving factor, and 52.9% of the respondents believed that educators should make various learning resources available for use and reuse for free. However, the respondents in the present study were not in favor of making the academic programs and courses available free of cost, with only 29.4% of respondents supporting it. This could be attributed to the culture and belief among Indian educators generally that anything which is available for free might not be valued by the learners (Chavan, 2012); and also that institutions need to earn from student fees for their sustenance.

The results highlight a strong need for proper training (i.e., specific training related to copyright, IPR, OER, etc.) in the creation and use of OER. This is also consistent with previous research findings (Kursun et al., 2014; Okonkwo, 2012; Clements & Pawlowski, 2012). In the case of the present study, the findings indicated that the majority of the respondents (98.5%) were concerned about the IPR and copyright permissions to reuse the content. Previous research has indicated that there is considerable ambiguity among the educators regarding copyright permissions and that they have concerns about protecting their intellectual property rights (de Hart, Chetty, & Archer, 2015; Kursun et al., 2014; Brent, Gibbs, & Gruszczynska, 2012). Only 50% of the respondents were aware of the available licensing options to enable reuse of the existing resources. Similar results were reported by Veletsinos (2015), who in his case study on open and sharing practices at a North American university, found a lack of understanding of the concept of Creative Commons licensing among the faculty.

Other researchers (Pantò & Comas-Quinn, 2013; Pena, 2009) have emphasized the need for increased awareness of copyright issues and appropriate training on legal, technical, and operational issues in educational institutions. The study by Rolfe (2012) also revealed staff requirements for technical assistance and clarity over copyright. The issues of attribution, authorship, and ownership are complex tasks, especially while remixing and reusing content, and the issues of language and context make the straightforward reuse of resources difficult (Amiel, 2013). The findings of the present study suggest that a large number of respondents (95.6%) desired proper attribution to the resources made available. The results also indicate that 91.2% respondents favored the use of collaborative pedagogical approaches in teaching and learning. According to Chen and Panda (2013), making OER easier for selection, revision, and use, as well as making it suitable to the context are key issues in OER utilization. The study also highlighted the need for enabling easy remixing and use of the available learning resources.

The study further analyzed the willingness of the faculty to share knowledge and learning resources (Figure 2). The results indicated that a large percentage of faculty members (91%) recognized that sharing of knowledge and learning resources is helpful in research and teaching activities. The respondents (93%) were aware of the importance of sharing within the faculty. Previous research has often highlighted the reluctance of faculty towards sharing their resources openly as OER (de Hart et al., 2015; Rolfe, 2012). The results revealed that a large number of respondents (79%) were interested in sharing the resources they had developed and 50% were willing to make the developed resources available as OER without the requirement to seek their permission for use or re-use. This strengthens the findings about faculty perception towards openness - that they are interested in sharing the learning resources but not their academic programs and courses for free.

The study also investigated the attitude of the faculty towards sharing of knowledge and learning resources. The attitude scores reflected that the respondents had significantly positive inclination towards sharing of knowledge and learning resources, sharing of knowledge and resources enhances the reputation of the educator and the institution; sharing of knowledge and resources is essential to meet competition, and it should be encouraged at the institutional level. These findings are in alignment with the findings reported by Rolfe (2012), where faculty's belief in the ability of OER to enhance individual and institutional reputation emerged as a major motivating factor. Based on detailed analysis of evaluation reports of MIT, Hodgkinson-Williams (2010) mentioned that the opening of the courses by

MIT led to an enhanced public image and attracted learners from all over the world. Moreover, in the present study, 29% of the faculty reported the positive influence of MIT OCW on their professional standing.

The above findings are valuable and indicative of institutional and faculty preparedness in terms of policy, provision, preparedness, and training for effective utilization of OER for open and distance learning in general and the national open university in particular. The faculty suggestions are in order in the sense that: there is a need for institutions to put in place OER policy (consistent with ICT, IPR, copyright, and plagiarism policies); there is a need for effective institutional system and provision for OER and sharing of resources; and a strong continuing professional development regime for ICT, OER, MOOCs, etc., needs to be in place. The findings need to be read in relation to further research on student perception and use of OER.

Limitations of the Study

The major limitation of the study is that quantitative survey method was used to assess the perception and attitude of the faculty. Though a questionnaire always has limitations as compared to qualitative methods such as interview, it makes possible the inclusion of a greater number of participants in the survey. Another limitation is that the questionnaire did not have any open-ended question which could have provided more profound insight into the complex issue of openness among the educators. Further, a large number of institutions and faculty can be sampled for the globalization of the findings.

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First Year Learning Experiences of University Undergraduates in the Use of Open Educational Resources in Online Learning



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Abstract

This study investigated -the first year University undergraduates' experiences in the use of open educational resources (OER) in online learning and their in-course achievement. The design selected for the study was survey and quasi-experimental. A total number of 106 University undergraduates participated in the study after a preliminary study was conducted to ascertain undergraduates' perception and acceptability of OER. A structured questionnaire on 4-point Likert scale and Achievement Test were used to collect data. The two instruments were validated and trial tested to established reliability using Cronbach's alpha. Data were analysed using simple percentage and t-test. The results clearly shown that understanding of online learners' skills, acceptability, perception, and competencies is necessary to provide intervention strategy and appropriate support service which could facilitate their understanding and learning of difficult concepts. It was also discovered that that students that have positive perception of OER performed very well in the achievement test administered.

Keywords: open and distance education (ODE), e-learning, learning management system (LMS), open education resources (OER)

Introduction

First year undergraduates are faced with challenges of adjusting to new expectations for learning when transitioning from secondary education to University education. This is especially true for Open and Distance Education (ODE) where learners are expected to transform from passive to active learners providing opportunities to explore and acquire new knowledge on their own (Prensky, 2001; Secret0, 2013).

Facilitating Physics courses in Distance Learning Institute, University of Lagos, Nigeria could be challenging as facilitators are confronted with the problem of learners coming with different previous knowledge of Physics background from their secondary schools education. Comprehending and mastering quantitative concepts characterized by Physics courses, and connecting them to real life situations are among challenges facing learners. Another prominent challenge is that a fraction of first year undergraduates are not versatile in the use of technological tools for learning. These could be some reasons why first year undergraduates underachieved in Physics courses in their first year. To support learners, the Institute provides printed learning materials and the Learning Management System (LMS) which covers a wide range of different applications such as assignment, quiz, wiki, workshop, forum, lessons, etc.

Distance Learning Institute (DLI), University of Lagos provides support services for their undergraduates where they can interact with facilitators, ask questions, discuss and brainstorm with their peers while a facilitator clarifies their misconceptions, and grades assignments given online. Efforts of the Institute were channeled towards creating educational experience of equal qualitative values for learners to suit their needs outside the classroom. Despite these efforts put in place, undergraduates' academic achievement in some concepts in physics has not improved to an appreciable level. Hence, there is a need to introduce, adopt, and adapt more viable support services which involves active participation, capable of sustaining and stimulating the interest of learners for a better academic achievement in Physics. Therefore, the thrust of this paper is to investigate the experience of first year University undergraduates exposed to the use of OER in online learning. The hope is that the use of OER will contribute appreciable academic achievement of undergraduates in physics.

Open Educational Resources (OER) are defined as technology enabled open provision of educational resources for consultation, use, and adaptation by a community of users for non-commercial purposes (Harsasi, 2015). Downes (2011) defined OER as materials used to support education that may be freely accessed, reused, modified, and shared by anyone. In the same vein, Organisation for Economic Co-operation and Development (2007) defined OER as digitized materials offered freely and openly for educators, students, and self-learners to use and reuse for teaching, leaning, and research.

OER was first used by UNESCO in 2002 at its forum on the impact of Open Courseware for Higher Education in Developing countries, and has since then gained significant prominence in recent years throughout the world (Hew & Cheung (2013). Types of OER include lessons, modules, full courses/programmes, guides, e-texts, articles, audio tracks, videos, multimedia, and any other learning materials (Hysten, 2007; Baloyi, 2014). OER has been designed to support learning by providing easy accessibility, and potential to reduce barriers to learning through enhanced attention, motivation, and engagement of students (Sclater, 2010).

The advantages of using OER as outlined by Harsasi (2015) include the followings:

- the materials are free to use no subscription fee attached,
- there is easy accessibility to materials,

- there is continuous access to resources without restriction,
- OER provides students the ability to pursue topics thoroughly, and learn for personal knowledge or enjoyment, and
- OER are available in different visual representations among others.

However, barriers associated with the use of OER as enumerated by D'Antoni (2009) are:

- the broad band access,
- time and expense associated with gaining permission to use third party owned copyrighted materials or its removal from material,
- inadequate resources to invest in the necessary software and hardware,
- lack of skills needed to use technology, and
- lack of academic recognition of the development of OER by teaching staff.

Despite barriers enumerated above, the use of OER has demonstrated its effectiveness for educational contributions in recent years. Hilton and Laman (2012) compared the performance of 690 students using open textbooks in an introductory psychology class to the performance of 370 students who used a traditional textbook in a previous semester. They concluded that students who used the open textbook achieved better grades in the course, had a lower withdrawal rate, and scored better on the final examination.

Additionally, undergraduates believed that having a connection between face-to-face and OER enable them to receive knowledge from multiple sources, to relate to the subject matter of the course, and to gain confidence in applying acquired knowledge into practice (McCarthy, 2010).

According to Kember, McNaught, Chong, Lam, and Cheng (2010), and Resis and Steffens (2010), they found that students believed using interactive technologies helped them to increase learning productivity, encouraged a deeper approach to learning productivity, encouraged a deeper approach to learning, promoted the development of communication skills, and improved their understanding of course content.

Hew and Cheung (2013) found out that the use of OER has been limited to the western countries and only very few students believed that an open courseware site would be valuable to enhance their own knowledge about certain topics. Research on the use of OER in Africa is new and uncommon. This study therefore, will investigate the experience of first year University undergraduates when exposed to the use of OER for learning difficult concepts in physics. However, a preliminary study is required to ascertain level of their acceptability and perception of using OER.

Theoretical Framework

This study is founded in Diffusion of Innovation (DOI) Theory of Learning. Diffusion of innovation theory is the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 2003). The characteristics which determine an innovation's rate of adoption are: relative advantage, compatibility, complexity, trialability, and observability to those people within the social system.

Though, Rogers (2003) opined that innovation offering more relative advantage, compatibility, trialability, and observability will be adopted faster than other innovations. He then cautioned that getting a new idea adopted, even when it has obvious advantages, is difficult. Therefore, the availability of all these variables of innovations speeds up the innovation-diffusion process (Baloyi, 2014).

Statement of the Problem

This study attempts to explore the learning experiences and achievement of first year University undergraduates when exposed to the use of OER (audios and video clips) in learning difficult concepts in Physics.

Purpose of the Study

The study is specifically designed to achieve the following objectives:

1. To determine if the introduction of OER is a useful innovation to online learning by University undergraduates.
2. To determine if introduction of OER is compatible with learners' past experience or change of work habit is required.
3. If the use of OER is comfortable to be used by undergraduates in online learning
4. If the use of OER will improve first year undergraduates' understanding difficult concepts in Physics

Research Questions

For the purpose of the objectives stated above, the following research questions were raised:

1. Does OER have user advantages?
2. Is the use of OER compatible with past experience?
3. Does OER allow trial ability with respect to gender?
4. Is the result of using OER visible to you? (learners?)
5. Is OER difficult to use and understand?

Research Hypothesis

The following hypothesis are tested at $P < 0.05$

- There is no significant difference between achievement of first year undergraduates exposed to the use OER and those not exposed to OER in learning difficult concept in Physics
- There is no significant difference between pre-test and post-test performances of undergraduates exposed to OER and those not exposed to OER

Research Method

This study adopted survey and quasi-experimental research designs. The survey was used as a preliminary study to examine the acceptability and perception of OER usage by undergraduates before designing and applying OER as an intervention for teaching difficult concepts in Physics. The population consisted of all University undergraduates of Distance Learning Institute, University of Lagos in the Department of Education Science who registered for courses in Physics either as elective or compulsory at first year. Thirty-five undergraduates were used as control where 71 were used for the main experiment. A total number of 106 undergraduates participated in the study. Data were gathered from them by sending a 19-item questionnaire to predetermine responses whereby the experience and perceptions of University undergraduates can be measured via e-mail. All questions were answered on 4-point Likert scale; Strongly Disagree = SD, Disagree D, Agree = A Strongly Agree =SA. Thereafter, OER Physics Achievement Test (OPAT) was administered to ascertain if the intervention was able to improve their achievement in understanding difficult concepts in Physics (Waves) more so, if it is gender friendly. To identify difficult concepts, the researcher sampled the opinion of learners by asking them to identify the most perceived difficult concepts in Physics via e-mail. Their various responses were collated as displayed in the Table 1.

Table 1

Undergraduates' Rating of Physics Concepts Difficulty

$N=71$

Concepts	Motion	Nuclear Physics	Waves	Conservation principles
Frequency of occurrence	14	16	29	12
Percentages	19.72	22.54	40.85	16.90

University undergraduates rated waves PHS 205) has the most difficult concepts among others with highest frequency of (29) and highest percentage (40.85%). This supports the findings of (Ownioduokit, 2000) which pointed out that waves is a concept involving a function of two variables -distance and time- where other concepts and situations require a function of a single variable.

Facilitators exposed all first year undergraduates to interaction with OER for one week using topic one as an example. There-after, first year undergraduates were left to interact with and search for relevant OER on their own and provide answers to questions raised for a duration of two weeks on the stated topics. At

the end of the due date, questionnaires were collected and analysed according to the stated research questions. The results obtained allowed the researcher to design an intervention. A total number of 86 questionnaires were sent out to learners, only 71 questionnaires were returned.

The test of reliability result of the responses on first year University undergraduates experience in the use of OER was calculated to be 0.855 using Cronbach's alpha. This indicates that the instrument is reliable. Generally, there is an internal consistency of the answers provided by the respondents and therefore, the data do not violate the assumptions of reliability.

Results

Research Question 1: Does OER Have User Advantage?

Table 2

Relative Advantage of Using OER

Items	Frequency (%)				Mean response rating	
	SD	D	A	SA	Mean	SD
The OER is a positive innovation	2 (2.8)	6 (8.5)	23 (32.4)	40 (56.3)	1.82	0.703
OER makes it more convenient to communicate with facilitators and friends	4 (5.6)	19 (26.8)	33 (46.5)	15 (21.1)	2.17	0.828
Using OER saves time	3 (4.2)	5 (7.0)	38 (53.5)	25 (35.2)	1.80	0.749
OER makes learning more meaningful	10 (14.1)	2 (2.8)	17 (23.9)	42 (59.2)	1.96	0.706
OER is the fast and efficient way of getting information	13 (18.3)	7 (9.9)	23 (32.4)	28 (39.4)	2.06	0.954

Table 2 shows that 40 (56.3) and 28 (39.4) strongly agree that OER is a positive innovation and fast and most efficient way of getting information. Few of learners disagree (12+23) that OER make it more convenient to communicate with facilitators and friends and makes learning more meaningful. If the good responses are merged together, one could conclude that OER has a relative advantage in its usage in online teaching of physics concepts. This is in agreement with the findings of Harsasi (2015) that OER enhances students' online learning and facilities usage.

Research Question 2: Is OER compatible With Your Past Experience

Table 3

Compatibility of OER

Items	Frequency (%)				Mean response rating	
	SD	D	A	SA	Mean	SD
Using OER would require me to change my study habit	16 (22.5)	5 (7.0)	18 (25.4)	32 (45.1)	2.11	0.871

I am eager to respond to the discussion group on OER via LMS	17 (23.9)	3 (4.2)	22 (31.0)	29 (40.8)	2.01	0.853
OER is compatible with the way I work	15 (21.1)	8 (11.3)	23 (32.4)	25 (35.2)	2.11	0.994
Using OER increases my interaction with the subject matter	10 (14.1)	2 (2.8)	17 (23.9)	42 (59.2)	1.96	0.706

Table 3 clearly displayed that the majority of University undergraduates found OER compatible with their study habits (45.1 and 25.4) and the ways they work, which must have led to increase in interaction with subject matter (59.2 and 23.9) and eagerness in responding to discussions on the LMS (40.8 and 31.0). This could be as result as stated by Rumble, (2000 Govender, Dhurup, and Mudaly (2014), that new generation of learners witnessing the era of digital technologies which has been fully integrated into their lives that could be a reason while OER was able to change their study habit.

Research Question 3: Does OER Allow Trialability?

Table 4

Trialability of the OER

Items	Frequency (%)				Mean response rating	
	SD	D	A	SA	Mean	SD
OER does not intimidate me	9 (12.7)	7 (9.9)	25 (35.2)	30 (42.3)	2.42	0.839
I am confident in my ability to use OER	11 (15.5)	8 (11.3)	11 (15.5)	41 (57.7)	2.27	0.910
I do trial and error in working with OER	10 (14.1)	10 (14.1)	17 (23.9)	34 (47.9)	2.38	0.909
I can learn at a comfortable pace using OER	14 (19.7)	6 (8.5)	17 (23.9)	34 (47.9)	2.13	0.877

Table 4 shows that (47.9 and 23.9) agree that the working with OER is on trial an error while 47.9 and 23.9) which may appear the same set of undergraduates uses OER to learn at their comfortable pace. As first year undergraduates, it is good to note that (42.3 and 35.2) were not intimidated but developed more confidence (57.7 and 15.5) in the use of OER. This supported Rogers (2003) and Mbaty and Minnar (2015) that believed that trialability is positively related to the likelihood of adoption.

Research Question 4: Is the Result of Using OER Visible to You? (Learners?)

Table 5

Observation Recorded on the Use of OER

Items	Frequency (%)				Mean response rating	
	SD	D	A	SA	Mean	SD
I am aware of OER before I got admission	11 (15.5)	24 (33.8)	18 (25.4)	18 (25.4)	2.61	1.035

OER makes teaching real	18 (25.4)	15 (21.1)	20 (28.2)	18 (25.4)	2.46	1.13
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I have seen other schools using OER	25 (35.2)	33 (46.5)	8 (11.3)	5 (7.0)	1.90	0.864
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Table 5 indicates that majority of undergraduates (46.5 and 35.2) have not seen the use of OER before or heard from other schools. This shows the background of the learners and difficulty they experience during the period of their transition from secondary school to tertiary institutions. However, (25.4 and 25.5) percentage are aware of OER before they got admission but do not use it. It is interesting to note that (25.4 and 28.2) agreed that OER made teaching real. This is in line with Rogers (2003) assertion that if observability is positively received then the rate of adoption is greater.

Research Question 5: Is OER Difficult to Use and Understand?

Table 6

Complexity of the OER

Items	Frequency (%)				Mean response rating	
	SD	D	A	SA	Mean	SD
OER is user friendly	13 (18.3)	9 (12.7)	20 (28.2)	29 (40.8)	2.15	0.980
When using OER, I find it easy to navigate from one screen to another	10 (14.1)	4 (5.6)	23 (32.4)	34 (47.9)	2.30	0.782
Am confident in my ability to use OER	13 (18.3)	7 (9.9)	23 (32.4)	28 (39.4)	2.06	0.954

Table 6 revealed that (40.8 and 28.2) agreed that OER is user friendly while (47.9 and 32.4) also found OER easy to navigate. This might have built in them confidence and believe in the use of OER. This also indicates that it is a good condition for students to work independently.

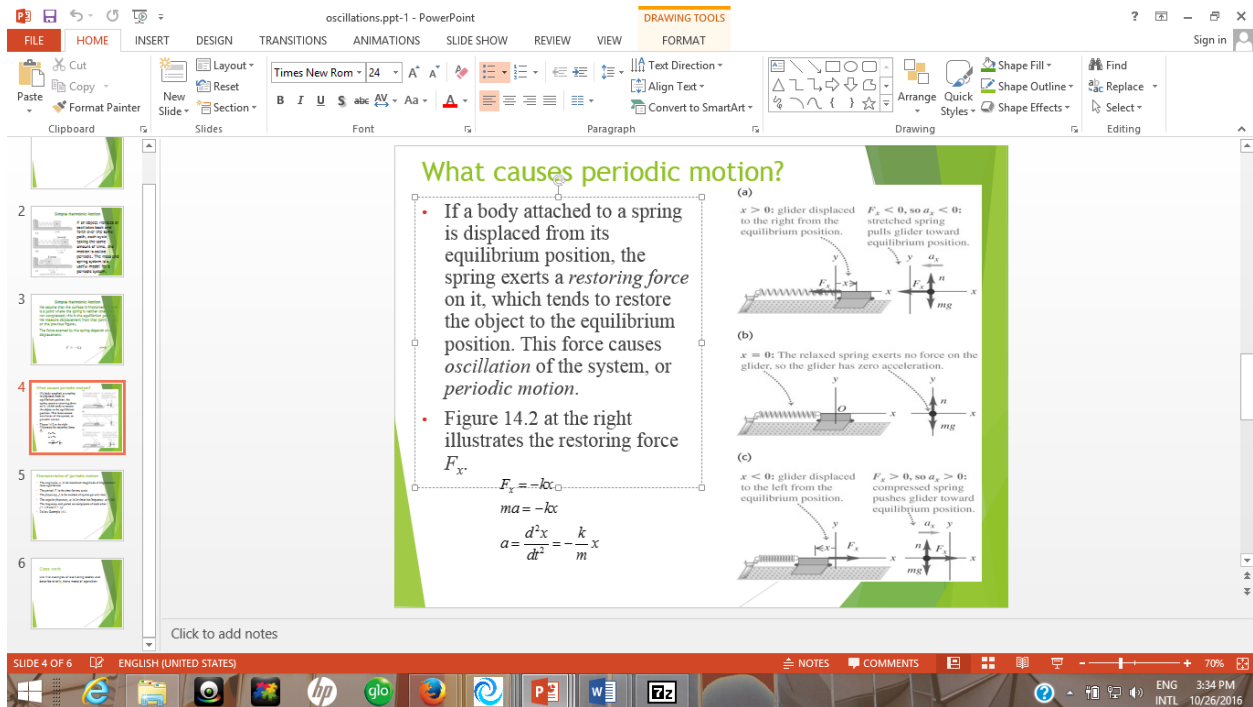


Figure 1. Sample of audiovisual OER (screen shot).

Based on the results of the preliminary study which showed a positive acceptability and willingness to make use of OER by the undergraduates, an intervention was designed and carried out to ascertain if OER could help at improving undergraduates' achievement in difficult concepts in Physics and as identified. Thirty-five undergraduates who did not participate in the preliminary study because of late registration, were used as control while 71 undergraduates who participated in the preliminary study were used for the experiment. The interaction with both groups went on simultaneously. The control group interacted on the LMS without the facilitator introducing any other learning support services whereas OER was introduced at every stages of interaction on the LMS ranging from video clips, audio, additional delivery notes, among others, to facilitate learning. Before the commencement, the researcher deployed achievement test titled *OER Physics Achievement Test* (OPAT) on the LMS (multiple choice with only one distracter), learners were given 24 hours to answer with only one attempt, thereafter, the results were downloaded for marking which served as the pre-test score for the participants.

The researcher introduced the treatment which lasted for four weeks with the help of a facilitator. Then, the posttest was administered and results analysed. Hypotheses were tested at $p < 0.05$ and the result were as follows:

**First Year Learning Experiences of University Undergraduates in the Use of Open Educational Resources in Online Learning
Afolabi**

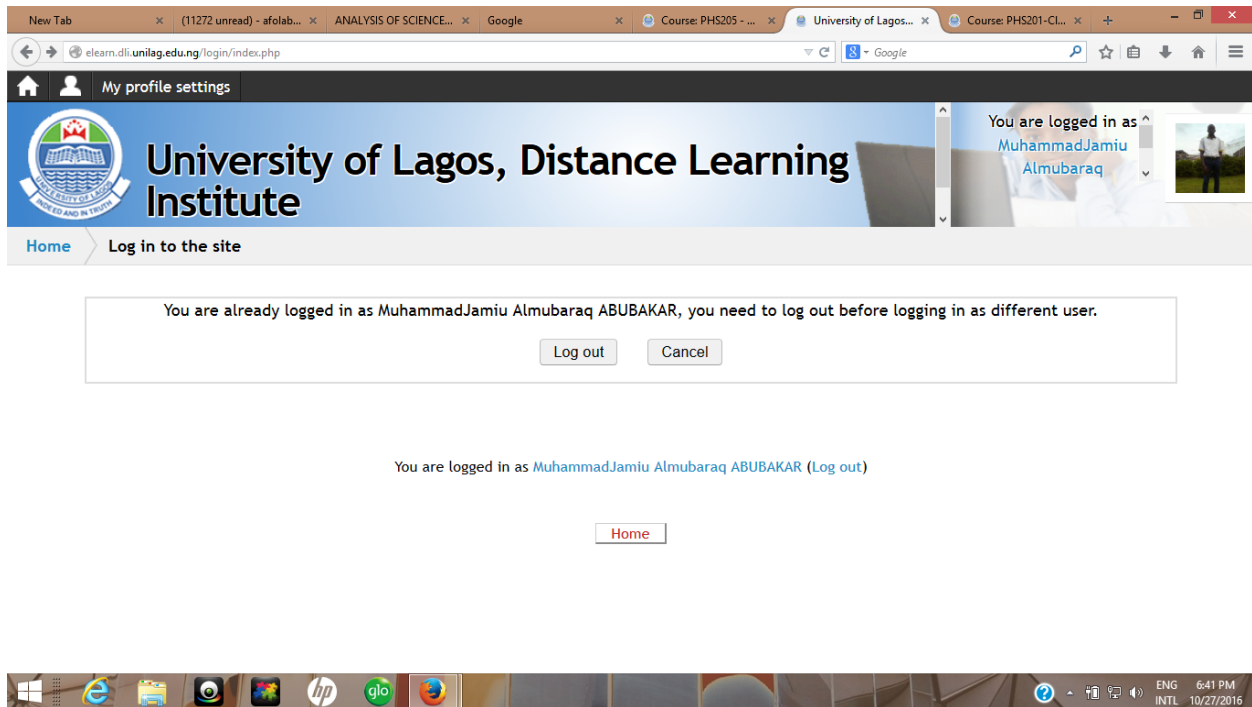


Figure 2. Student login page (screen shot).

Hypothesis I: There is no Significant Difference Between Achievement of First Year Undergraduates Exposed to the Use of OER and Those not Exposed to OER

Table 7

Descriptive Statistics and t-test for Equality of Means

Score	Treatment	Group descriptive statistics				Levene's test for equality of variances		Equality of means for t-test			
		N	Mean	SD	CV	F	Sig.	Mean Difference	T	df	Sig.
Pre-test achievement Score	Exposed to OER	71	9.68	5.419	0.56	2.393	0.125	1.876	2.035	104	0.045
	Not exposed to OER	35	7.80	3.909	0.50						
Post-test achievement Score	Exposed to OER	71	63.11	12.145	0.19	1.158	0.284	40.198	17.630	104	0.000
	Not exposed to OER	35	22.91	10.453	0.46						

*Note. SD = Standard Deviation, CV = Coefficient of Variation

The descriptive statistics indicates that the mean pre-test achievement score for the respective groups is obtained as 9.68 (Exposed to OER) and 7.80 (Not exposed to OER) with CV = 0.56 and 0.51 > 0.50 threshold value, respectively, indicating that the scores are not homogeneous. The test for significance difference is carried out using independent samples t-test. The result indicates that, when unequal variances are assumed based on Levene's test, there is a significant mean difference (1.876) between undergraduates exposed to OER and undergraduates not exposed to OER on pre-test achievement scores at $t = 2.035$ ($p < 0.05$). The null hypothesis is rejected; there is significant difference between undergraduates exposed to OER and those not exposed. Hence, better performance is achieved when the undergraduates are exposed to OER. Further, the mean post-test achievement score for the respective groups is obtained as 63.11 (Exposed to OER) and 22.91 (Not exposed to OER) with CV = 0.19 and 0.46 < 0.50 threshold value, respectively, indicating that the scores are homogeneous. The independent samples t-test result indicates that, when unequal variances are assumed based on Levene's test, there is a significant mean difference (40.198) between undergraduates exposed to OER and students not exposed to OER on post-test achievement scores at $t = 17.630$ ($p < 0.05$). The null hypothesis is rejected, and concluding that there is significant difference between undergraduates exposed to the use of OER and those not exposed. Hence, better performance is achieved on exposure to OER.

Hypothesis II: There is no Significant Difference Between Pre-Test and Post-Test Performances of Undergraduates Exposed to OER and Those not Exposed to OER

Table 9

Descriptive Statistics and t-test for Equality of Means

Treatment	Score	Group descriptive statistics				Correlation		Equality of means for t-test			
		N	Mean	SD	CV	R	Sig.	Mean Difference	T	df	Sig.
Exposed	Pre-Test	71	9.68	5.419	0.56	0.621	0.000	-53.437	-46.177	70	.000
	Post-Test	71	63.11	12.145	0.19						
Not exposed	Pre-Test	35	7.80	3.909	0.50	0.616	0.000	-15.114	-10.383	34	.000
	Post-Test	35	22.91	10.453	0.46						

*Note. SD = Standard Deviation, CV = Coefficient of Variation

The descriptive statistics indicates that the mean pre-test and post-test achievement score for the undergraduates exposed to OER is obtained as 9.68 (Pre-test) and 63.11 (Post-test) with CV = 0.56 > 0.50 and 0.19 < 0.50 threshold value, respectively, indicating that the scores are homogeneous in post-test while not homogeneous in pre-test. The test for significance difference is carried out using pairwise samples t-test. The result indicates that, there is significant mean difference (-53.437) between pre-test and post-test achievement score of undergraduates exposed to OER at $t = -46.177$ ($p < 0.05$). The null hypothesis is rejected; there is significant difference between pre-test and post-test performances of undergraduates exposed to OER. Hence, undergraduates' performance is better in the post-test achievement test. Further, the mean pre-test and post-test achievement score for the undergraduates not exposed to OER is obtained as 7.80 (Pre-test) and 22.91 (Post-test) with CV = 0.50, 0.46 ≤ 0.50 threshold value, respectively, indicating that the scores are homogeneous for both tests. The pairwise samples t-test result indicates that there is significant mean difference (-15.114) between pre-test and post-test achievement score of

undergraduates not exposed to OER at $t = -10.383$ ($p < 0.05$). The null hypothesis is rejected, and concluding that there is significant difference between pre-test and post-test performances of undergraduates not exposed to the use of OER. Hence, post-test performance is better. The correlation analysis shows that there is a significant relationship between pre-test and post-test for both exposed and not exposed to the use of OER at $r = 0.621$ and 0.616 ($p < 0.05$), respectively.

Findings

From the data gathered from the study it was clearly shown that understanding of online learners' skills, acceptability, perception, and competencies is necessary to provide intervention strategy which could facilitate their understanding and learning of difficult concepts. This is what the preliminary study conducted has managed to expose.

The study also noted that students that have positive perception of OER performed very well in the achievement test administered. This might have been one of the reasons while significant difference occurred among the undergraduates exposed to the use of OER.

OER can successfully improve learners understanding of difficult concepts in Physics. It was found out that a significant relationship exist between the pre-test and post-test for both exposed and not exposed to the use of OER respectively.

Recommendations

The online education has come to stay as an acceptable mode of education and rapidly growing in developing countries of the world. There is the need to develop skills and technology applications among online learners. The findings of this study could inform that there is need to guide, support, and enhance online learning to reduce the dropout rate. In the same vein, facilitators should make use and engage their learners using OER to facilitate learning.

Efforts should be geared towards promoting online application and emerging technologies for online teaching. Facilitators should be trained in the use of emerging technology which can facilitate understanding of learners.

Conclusion

This study investigated first year University Undergraduates experience when expose to the use of OER in teaching difficult concepts in physics. According to DLI undergraduates, introduction of OER makes learning real and exposure to the new technology changed their perception and attitude to understanding difficult concept in Physics. High achievers are very satisfied with the use of OER, find OER to be convenient and flexible, are very engaged with their studies, and appeared to learn key concepts better. This conclusion however, is tempered by many limitations. Some OER videos which learners prefer most are of poor quality and sound. Another challenge is high data consumption rate which make the use of

OER expensive. To this end, distance educators should provide wide range of learning support services to distance learners which will enhance their academic achievement not only in Physics but all courses. It is evident that OER is useful and its use must be encouraged in teaching and learning among distance learning institutions especially in developing countries.

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Assessing the Savings from Open Educational Resources on Student Academic Goals

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Abstract

Our study found that most students considered OER to be as good or better in terms of quality and engagement as traditional texts, while also allowing them to put saved funds toward their educational pursuits. As rising costs in higher education affect current and potential students, faculty and students are looking for ways to cut costs where possible. Open educational resources (OER) are a viable option to replace expensive traditional textbooks without sacrificing quality. This article presents the results of a study conducted with students at a Virginia community college who took courses that used OER. At the end of the semester, students were asked to rate their perceptions of the OER quality and their level of engagement with OER as compared to traditional textbooks. Results indicate that a majority of students found the OER to be as good as or better than traditional textbooks in both quality and engagement. While similar studies have been conducted, this study also asked students to briefly describe how they used the money saved by not having to purchase a textbook. Many students indicated they used the money to reinvest in their education by paying tuition, purchasing materials for other courses, or taking additional courses; day-to-day expenses and savings were the next most common responses. Further research needs to be conducted to understand the effect these savings and reinvestment have on students' completion of academic goals.

Keywords: open educational resources, open textbooks, engagement, quality, savings, costs

Introduction

Costs for students in higher education are rising and moving college out of reach for more and more prospective students (Mitchell & Leachman, 2015). Chen (2016) also found that freshman enrollment rates are inversely proportional to the costs of university tuition and fees. Costs of higher education include items such as tuition and fees, room and board, books and supplies, and transportation. While tuition and living costs constitute a sizable portion of the expenses, faculty and students have limited ability to influence these expenditures. One area where faculty and students can affect higher education prices is textbook costs.

Many professors assign at least one required textbook while some assign two or more textbooks with the intent to only use portions of each (Wiley & Green, 2012). Due to copyright laws, which often prevent professors from selecting and remixing relevant content in traditional textbooks, instructors may require students to purchase multiple resources. A recent report estimates that students should budget between \$1200 to \$1350 in an academic year for textbooks and supplies (The College Board, 2016). For some lower-tuition institutions, this amount can be nearly 40% of the price of tuition (Senack, 2015). Open educational resources (OER) are one alternative to traditional, high-cost textbooks. The William and Flora Hewlett Foundation define OER 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 and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge. (Hewlett Foundation, n.d.)

These types of materials are low-cost resources that can be adapted to meet instructor and student needs. When using OER, professors have legal permission to revise, adapt, and continually improve materials specific to their course (Wiley & Green, 2012). Other researchers have found OER to be at least as effective as traditional materials when measured by student performance and by soliciting student feedback (Allen, Guzman-Alvarez, Molinaro, & Larsen, 2015; Bowen, Chingos, Lack, & Nygren, 2014). For open materials to have any effect on students, positive or negative, a professor must first choose to adopt OER.

Faculty and student perception of such materials often influences their decision to adopt and continue using OER. As more open educational resources are created and adopted, the perception of OER has the potential to change significantly. In order to further understand, and therefore improve student perceptions, more research must be conducted. The purpose of this study is to better understand student perceptions of the quality of OER, the effect of OER on student engagement, and how students repurpose money saved by using OER.

Literature Review

Although the term *open educational resources* was coined by UNESCO in 2002, and is gaining popularity and becoming more widespread, awareness of OER is still relatively low (Allen & Seaman, 2014). In a survey involving over 2,000 faculty respondents, Allen and Seaman (2014) found that that only 20% of all participants considered themselves *very aware* or *aware* of OER while 65% considered themselves

unaware. Similarly, a 2012 Florida study found that over 72% (10,007 students) of participating higher education students had never heard of open textbooks (Florida Virtual Campus, 2012). Programs in the United States such as Tidewater Community College, Mercy College, Salt Lake Community College, among others, have helped increase awareness and provided support for faculty members to adopt OER in their courses (Fischer, Robinson, Hilton, & Wiley, 2015; Pawlyshyn, Braddlee, Casper, & Miller, 2013). Studies have been conducted to gauge faculty and student perceptions of the open resources, the pedagogical benefits afforded by OER, and student savings due to foregoing the purchase of a traditional textbook. We have referenced and separated some of these studies into the following categories: *perception*, *effects on pedagogy*, and *cost*.

Perception

While cost can greatly influence faculty and student attitudes towards OER, their perception of the quality of open resources also plays a role in their willingness to use or adopt OER. Jhangiani, Pitt, Hendricks, Key, and Lalonde (2016) explored faculty perception of OER at British Columbia post-secondary institutions through an online survey disseminated using email and social media. More than half of respondents rated OER *as good as or better than* proprietary materials; those who had adopted OER rated it significantly higher than those who had not (Jhangiani et al., 2016).

Faculty who are more prepared tend to have a better experience with OER. In a survey of 128 educators with awareness of OER, Kelly (2014) found that faculty who were more comfortable with technology in general considered themselves more confident in using OER. However, when respondents found OER difficult to use, they perceived it as less useful (Kelly, 2014). The author suggested that in order to be widely adopted, OER must be both easy to locate and easy to use. Even if the content is adequate, these concerns may hinder it from adoption.

While faculty make most decisions about textbooks, student perceptions also play an important role. In a previous study, Bliss, Hilton, Wiley, and Thanos (2013a) explored the perceptions of open textbooks from community college students and faculty members. Of the 132 students who responded to the survey, 56% (67 students) thought the open textbook was *same as the quality of texts in other courses*, 41% (49 students) considered it *better than the quality of texts in other courses*, and only 3% (4 students) felt the open textbook was *worse than the quality of texts in other courses*. Measuring perception of quality based on student preparedness, faculty members found a majority of students were equally prepared (60%) or more prepared (30%) than they were with traditional materials. Roughly 75% of students surveyed in that same study responded with completely positive comments about the open text, 14% were a mixture of positive and negative comments, and 10% were completely negative (Bliss et al., 2013a). Lindshield and Adhikari (2013) found similar results in their study, which took place over the course of three semesters at a large Midwestern, public institution of higher education. A survey was administered to 198 students, comprised of online and campus students, asking them to rate their experience with an open textbook, which they referred to as a flexbook (Lindshield & Adhikari, 2013). Both online and campus students preferred the flexbook to a traditional text and rated the quality of the flexbook as high (Lindshield & Adhikari, 2013).

Effects on Pedagogy

Improved pedagogy and student outcomes can be an important issue for faculty decision making. Beyond the effect of perceived quality of the text, Petrides, Jimes, Middleton-Detzner, Walling, and Weiss (2011) found that OER had a positive impact on both teaching and learning. Using the open textbook increased student interactivity with the material; students reported this increased interactivity positively impacted their study habits. Rowell (2015) surveyed 80 students in various community college courses that used an open textbook and discovered that students rated their motivation to learn, which may be correlated with academic achievement, highest among the varying metrics. Faculty members also reported being inspired by the advantages afforded by OER, such as customization and the ability to tailor course content to their own students (Jhangiani et al., 2016; Pawlyshyn et al., 2013).

Cost

The potential for reducing the costs associated with education through the adoption and use of OER has been a focus for research conducted regarding open resources (Bowen et al., 2014; Hilton, Robinson, Wiley, & Ackerman, 2014; Florida Virtual Campus, 2012; Murphy, 2013; Wiley, Hilton, Ellington, & Hall, 2012). Petrides et al. (2011) surveyed 31 faculty members and 45 students regarding their perception of the open statistics textbook, *Collaborative Statistics*. Both faculty members and students cited reduced cost as the most important factor for their interest in continuing to use OER or adopt OER in the future. One faculty member cited expensive textbooks as “an obstacle to college access” (Petrides et al., 2011, p. 43). Hilton et al. (2014), in a study with seven community colleges across the nation, found the average textbook cost to be \$90.61, which would result in a full-time student spending over \$900 on textbooks per year. To cope with these high costs, some students forego purchasing the required text, drop or withdraw from a course, or take fewer courses (Florida Virtual Campus, 2012).

Costs on the institutional level can also be lowered by adopting OER. Bowen et al. (2014) created a rough cost simulation at three university campuses for adopting hybrid courses using OER as a way to decrease costs. They estimated the costs of personnel and facilities to implement a hybrid course and compared them to the current costs of a traditional course. These universities can expect a 19-57% savings on these courses depending on the sort of hybrid model adopted. While the authors stipulate that there are many further variables to consider in terms of costs, they feel that these findings suggest that adopting OER and hybrid learning can cut costs while maintaining, or even improving, student outcomes, which is a concern for many educators looking to adopt OER.

Although it is beyond the scope of this study, the efficacy of open materials is of importance to many faculty members and students. For those interested in this topic, Hilton (2016) provides a comprehensive review of research studies on about efficacy and perceptions as they pertain to OER and college textbook choices. The most cited reason that students mention for preferring OER over traditional resources is cost savings. However, what they do with those savings is unknown. While previous studies have addressed valuable aspects of OER, this study aims to add an understanding of how students use the money they save from courses that opt to use OER instead of traditional textbooks. Currently, there is limited literature regarding this issue. Understanding how students repurpose saved funds from using OER materials can help us identify long-term implications of OER usage beyond the scope of a semester-long course.

Methodology

During the Fall 2014 semester, 11 faculty members from a variety of subject areas at Reynolds Community College met regularly to develop OER materials for their assigned courses. These efforts were the result of the Textbook Costs and Digital Learning Resources (TCDLR) initiative in the Virginia Community College System (VCCS) that culminated with a final report in 2014. The Reynolds OER Initiative was established in the summer of 2014, preceded by an OER Committee that had been formed the previous fall in the School of Humanities and Social Sciences. The OER effort at Reynolds was able to gain traction due to strong support from the college's executive cabinet. The college received a Chancellor's Innovative Fund grant through the VCCS in 2014-2015 to develop OER in 11 courses that lead to a general education certificate (the first year of the two-year transfer degree).

OER sections in these 11 different courses were piloted during the Spring 2015 semester. These courses included College Composition I and II, British Literature, American Literature, United States History I and II, Precalculus, Biology I and II, Principles of Psychology, and College Success Skills. A total of 15 faculty members chose to participate, resulting in 17 sections using open materials; 12 of these sections were face-to-face, while five were taught at a distance.

Most courses used open textbooks from OpenStax, which can be accessed in a digital format or, if students are willing to pay the cost of printing, requested in a professionally printed format. Literature faculty members provided students with links to online resources and PDF files of works available in the public domain while English Composition faculty used resources from free sites in addition to other materials. Faculty members in the biology department also developed their own materials that were used with the OpenStax textbooks. A repository of OER materials was created for use among participating faculty.

In late April 2015, students (N=425) were asked to respond to a survey regarding their perception of the quality of the OER materials in their course and the level of engagement they experienced with the OER materials compared to a traditional textbook. Students gave a rating from 1 (poor quality/not engaging) to 5 (excellent quality/very engaging). After each question, respondents had the opportunity to elaborate on their response with short answers. The last item on the survey asked students to explain what they did with the money they saved by not having to purchase a textbook.

Prior to emailing students with a link to the survey, faculty members in face-to-face sections conducted informal discussions about the use of OER. The survey was sent to a total of 425 students (each of the 17 sections contained 25 students), and 206 completed the survey. Responses were recorded through SurveyMonkey. We analyzed the numerical data using descriptive statistics. All 206 students who completed the survey also included free responses for each of the three questions. Free responses from students were analyzed and coded for patterns and themes exploring why students may have rated OER materials as high or low.

Each student comment received at least one code but, depending on statements made within the comment, could be assigned multiple codes. For example, in response to the question of how money saved from using OER materials was repurposed, one student replied, "I [was] able to use that money for gas, groceries, and other things I need in my day-to-day life." This response received codes of 1 (Day-to-day Expenses), 6

(Groceries/Food), and 7 (Gas/Transportation). Comments could receive multiple codes but could not receive any specific code more than once. For instance, a single student comment that mentioned purchasing food or groceries twice would only receive code 6 once.

Data Analysis

Based on student responses, our analysis will focus on three specific areas for which data was collected: *student perception of quality, level of engagement, and how students spent money saved from OER usage.*

Perception of Quality

Students were asked the following question: “On a scale of 1 (poor) to 5 (excellent), how would you rate the quality of the OER material versus a textbook?” A majority (54.9%, 113 students) of the participants rated the open material as *excellent* (Figure 1). Roughly 39% (81 students) considered the quality as good as a traditional text or slightly favored the quality of the OER material. Less than 6% (12 students) considered the quality of the OER material to be less than that of a traditional textbook. These data are consistent with previous studies (Bliss, Robinson, Hilton, & Wiley., 2013b; Lindshield & Adhikari, 2013; Petrides et al., 2011), which found students overwhelmingly considered OER materials to be as good as or better than traditional materials.

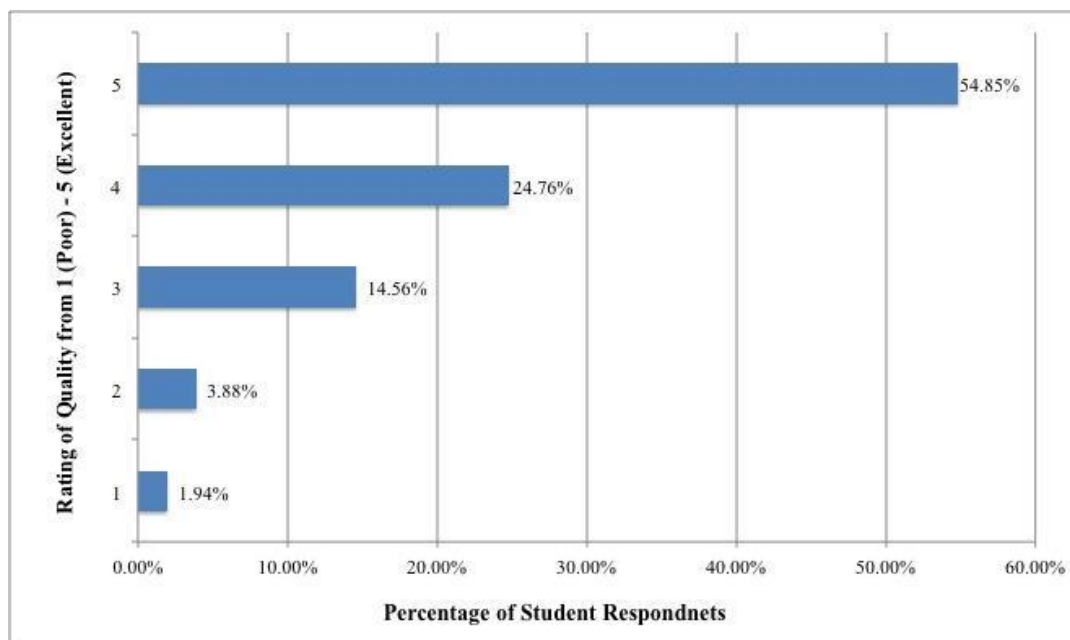


Figure 1. Student perception of the quality of OER materials (n=206).

Common themes among positive perceptions of the open resource quality were improved content (23.3%, 48 students), reduced costs (22.8%, 47 students), greater accessibility (18.4%, 38 students), and easier comprehension of the material (17.5%, 36 students). One respondent was “highly satisfied with the OER material” and went on to share that OER was

a learning tool in my [math] class. It allowed me to focus more on the lesson plans due to the interactive elements found with the material. I found it more interesting and engaging than the normal textbook use in the classroom.

Of the 48 responses that indicated improved content, 11 students (23%) considered the OER materials more engaging and interactive. Multiple responses mentioned how the OER materials were easier to use and that students preferred them to a traditional text, however, these 19 responses did not specifically state why. The ability to adapt resources to a specific course played a role in students' positive perception of open materials content as shown by the 17 students (35.4%) who included this in their comments. One student said that "OER material seemed to provide for a class in which the professor was allowed flexibility to teach something they could be enthusiastic about, creating a more engaging environment."

Students appreciated content that was tailored specifically to the course. Traditional textbooks, which are protected by copyright laws and unable to be revised, may include, in one student's view, "a lot of information that may or may not be necessary to the exact line of learning that we are doing." This student continued that when using OER materials "the information that we have been given to use for our studies is more directly related to the assignment we are working on." Another student expressed a similar sentiment that "not only does [OER material] save money and increase accessibility, but it ensures that the readings are both precisely what we need, and current to the day." The flexibility to remix and revise content means educators can cull from a more abundant source of material. Students recognized the benefit this provides and believed "there is no way a single text book could have covered all that we covered using all the sources that [the professor] used." Fifteen students specifically mentioned the variety of open resources their professor incorporated as a beneficial aspect of using OER materials.

In addition to the improved content, reduced costs influenced student perceptions of the quality of OER materials used in their courses. One of the 47 students who included the impact of price in their comments stated, "I learned just as much with the OER material as I would with a textbook and the textbook cost way too much." For one student being able to save money from OER materials "impacted [the] decision on taking the course" and "assisted with financial difficulties." The "best part" according to another student was "[the textbook was] an expense I no longer need to worry about, and that alone relieves much unnecessary stress."

Easy access to the course information also affected student perceptions of OER materials. Because the sources were available online, 16 (42.1%) of the 38 students who mentioned accessibility included this as a positive aspect of using open materials in their course. One respondent thought "OER materials [were] easier to carry around" and "easily accessible." The issue of portability was included in 15 (39.5%) comments regarding accessibility. Another respondent said, "OER did not require me to lug a heavy textbook around campus and the readings were just as informative and much cheaper." Even with the added benefit of reduced costs and greater accessibility, some students felt the quality of the material was more important than saving money. Multiple students expressed that it was "easier to understand OER information as opposed to a regular textbook" because the open material was more direct, better organized, and more specific to their courses.

Table 1 illustrates the frequency of each of the six overarching themes mentioned in student free responses regarding the perception of quality. The third column does not total 100% because many comments received multiple codes.

Table 1

Number of Comments Coded, by Category, from Student Perception of OER Quality

Comment code	N	Percent of total
Improved content	48	23.3
Reduced costs	47	22.8
Accessibility	38	18.4
Easier comprehension of material	36	17.5
OER just as good as traditional	14	6.8
Included negative statements about OER	44	21.4

Although students were mostly positive about the quality of the OER used in their course, 44 (21.4%) of the 206 responses included negative perceptions of the open resources. More than half of these were made in comments that also included positive feedback, such as “I enjoyed using the OER material, however sometimes it was difficult to read portions of it and I had to print a lot of it out” and “It clearly explains the material, but requiring internet access can be challenging.” Issues concerning the digital nature of OER conflate “OER” and “digital,” a topic that we address further in the “Discussion and Limitations” section below. Needing internet to access the material was a downside cited by 14 students (31.8% of the 44 students). The next most common theme (29.5%, 13 students) was students having a preference for paper to more easily flip between pages, highlight material, and mark pages. This did not inherently mean these students perceived the quality of OER to be lesser than that of traditional texts. As one student shared “the OER material is absolutely beneficial and helpful, actually having a text book makes it easier to go back and reference rather than having to scroll through previous weeks assignments or through paper we have to print with the information.” Another group of 8 students (18.2%) shared that they do not like reading on a computer screen, which affected their view of OER materials.

Level of Engagement

Students were asked to rate their level engagement with the OER materials as compared to a traditional textbook on a scale from 1 (not engaging) to 5 (very engaging) (Figure 2). Most students (74.2%, 153 students) found the OER textbook more engaging than a traditional textbook. Only a handful of students (10.2%, 21 students) found it not as engaging in comparison.

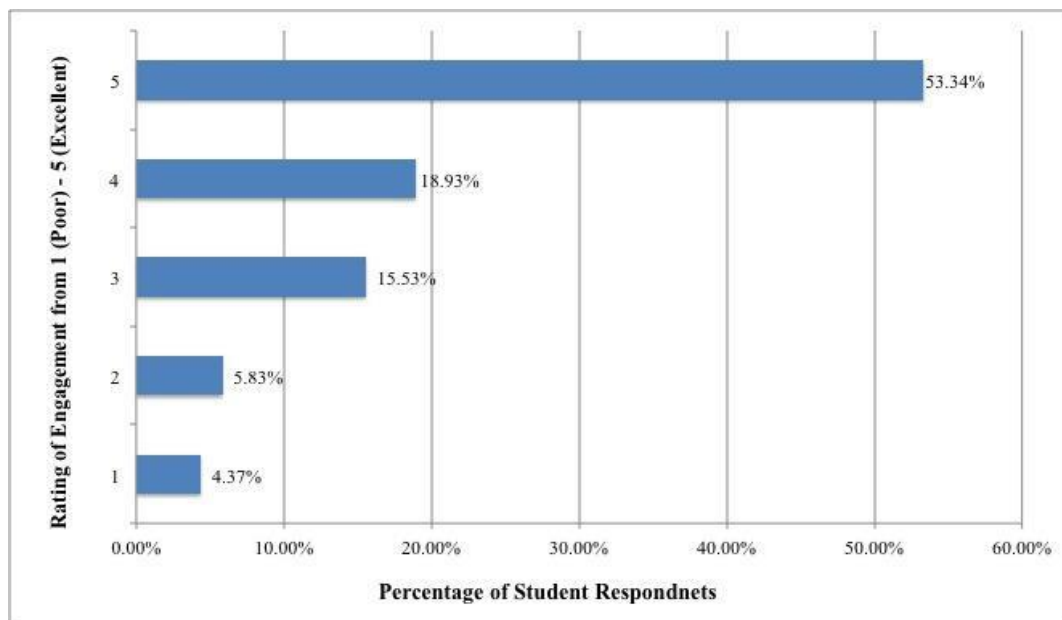


Figure 2. Student engagement with OER materials (n=206).

In addition to providing a numerical rating, students were asked to comment on their engagement in a free response question. All 206 students who completed the survey provided feedback in the free response. Of these comments, 130 (63.1%) included positive statements, 18 (8.7%) were neutral, 32 (15.5%) included negative statements, and 35 (17.0%) did not provide enough information to respond to the question, such as “I use it a lot” or “I was able to complete assignments.” Students who found traditional textbooks more engaging than OER materials shared a number of ways that OER can improve. Quality was the most common culprit in terms of visual cleanliness, organization, and materials despite generally positive reflections on quality in the above question.

Those who found OER more engaging than traditional textbooks reported a variety of reasons including time savings, flexibility, and interaction. Almost half (43.8%, 57 students) of the 130 students who provided positive comments mentioned being more engaged. Respondents discussed a perceived improvement in available content, especially in terms of resources and applicability. Students appreciated how OER allowed their instructors to provide “a lot of resources...in order to understand the material.” Another elaborated, “I think you are more likely to get into the material more when you are looking at different things (websites, articles, etc.) than just looking at a text book.” While the ability to point to different materials is not unique to OER, when materials are openly licensed and able to be freely used by others, it increases the pool of resources professors can incorporate in their courses and adapt accordingly.

Twenty-eight students (21.5% of students who gave positive comments) included that they valued content tailored to their course and the variety of sources they were able to choose from. As one student said, “All the OER material was specifically aimed at the assignments we had that week. It also allowed the instructor to find material relating to our assignment, instead of finding assignments to relate to material.” Another felt more control over the course because of OER.

It is very engaging because my professor has an ability to pick readings due to taste and not the limitations of a textbook. This leaves more options for me, as a student, to give my input and hopefully study something of my own interest.

Students also enjoyed the flexibility of organizing the material that OER provided. “OER material is VERY engaging because it provides the ability for students to learn material that interests them. It is material that stimulates one's mind, not useless linear banter.”

A theme amongst positive comments was that of OER material being easier to follow due to the organization of information. One literature student remarked:

I really enjoy being able to study literature based on the timeless issues being addressed, instead of just chronologically. Every literature textbook I've previously read goes by decades, lumping authors together according to when they were alive, not the issues they wrote about. This way is much more engaging, in that there is more of a purpose for reading the literature presented.

While this student focuses on an instructional design issue, it does highlight a benefit of OER. Because teachers had the legal and technical ability to make revisions to the text they were able to rework it in a manner that was appreciated by many of their students. Approximately 17% (22) of students included the influence of the OER materials' digital capabilities on their perceived engagement. Being able to make digital annotations, zoom in and out with text, and search within the text for keywords, helped students interact more with the material.

Of the 18 students who indicated they were just as engaged with OER materials as with traditional textbooks, many comments echoed the same sentiment, such as “It was about the same level as a textbook” or “I think that it is just as engaging as a textbook because we still learn and do the same things as someone would with the textbook. We just get to do it for free.” Among the negative comments, 14 students (43.8%) said they preferred printed materials to online materials; this was by far the most common response. Again, this conflates “digital” with OER, as some commercial textbooks are available in digital format, and open textbooks can be printed. The second most common response, given by 8 students (25%), pertained to the difficulty they experience reading on a computer. Six students believed the organization and format of the OER material made it less engaging than a traditional textbook. Other responses from respondents included getting distracted from being online while accessing the open materials and being impeded by the need for internet to access OER. Overall, however, we found that students perceived OER materials to be more engaging than traditional materials.

Table 2 summarizes the most common themes identified while analyzing student free responses about the level of engagement they experienced with OER materials as compared with traditional materials. The third column does not total 100% because only the top six themes were included.

Table 2

Number of Comments Coded, by Category, from Student Perception of Engagement with OER

Comment code	N	Percent of total
Considered OER more engaging	57	27.7
Appreciated content tailored to course	28	13.6
Engaged with digital capabilities OER	22	10.7
OER just as engaging as traditional texts	18	8.7
Student does not use textbook	12	5.8
Included negative statements about OER	32	15.5

How Students Used Savings from OER Usage

Although a number of perception studies have been conducted, one unique purpose of this study was to explore what students did with the money they saved from using no-cost OER materials. Based on the cost of materials in comparable courses, it is estimated that students in the 11 OER pilot courses during the Spring 2015 semester saved over \$34,000. Three major areas emerged from participant responses about how they used the money: reinvesting in education, day-to-day expenses, and savings. Of the 206 responses, 87 students (42.2%) said they reinvested in their education, 63 students (30.5%) indicated they applied it towards daily expenses, and 42 students (20.3%) said they saved the money. Additional codes such as “Spent It Anyway,” “Do Not Purchase Own Textbooks (Receive Money or Books from Other Sources),” and “Leisure,” were used, but these categories were relatively small (6.3%, 2.9%, and 0.97%, respectively).

For students who responded that they invested the money back into their education, 57 of them (65.5%) used the funds to purchase materials for other classes. The majority (54.4%) of these students reported that they applied the money towards purchasing textbooks for other classes. Some of the other school materials mentioned were calculators, laptops, and flash cards, but these categories contained less than three students each. One student was “able to afford the textbooks I needed for other classes, as well as was able to take the money I would have spent on a textbook for this class and save it to pay for another class next semester.” The remaining 30 students (34.5%) who reinvested in their education did so in the form of paying current tuition (11 students), taking an extra class that semester (9 students), and using it in their other classes (7 students). Students did not specify how they used it in their other class, whether they purchased materials or if they meant to imply it was additional course they would not have been able to take otherwise. One student stated, “I was able to take another class and take a step closer to achieving my dreams and my degree.” A student who self-identified as a single mother said, “I am trying to better myself...I was able to put the funds to another class...to take three classes instead of two.”

Day-to-day expenses was the next highest cited area. Many of the 63 responses in this category included various elements, resulting in these comments receiving multiple codes. More than half (51%) of these responses clustered around the necessities of buying groceries and paying bills. One student reported, “It gave me more money for bills and food, my basic needs.” Nearly one-third of the 63 comments mentioned applying the money to transportation needs through purchasing gas (20.6%, 13 students) and car

maintenance (11.1%, 7 students). Four students (6.4%) said they used it to pay off student loans, six students (9.5%) bought clothes, and five students (7.9%) added it to their household budget and to pay rent. One comment shared, “I’m from a very low income family where all the money from my low-wage job goes to the house.” Five students specifically indicated these expenses were not for themselves but for their children and other members in their household.

Having saved money “helped relieve some financial stress” for a respondent and allowed them to “live more comfortabl[y], thus focusing more on school instead of working hard to make the money for the textbooks.” Various students expressed the stress caused by the burden of textbooks costs was removed when using OER materials. “The money not spent on textbook books actually benefited me and my overall stress...The money helped me fix my [flat] tire, and also allowed me to buy sets of ink cartridges for all of my assignments for the semester.”

A total of 42 free responses said that they saved the money instead of spending it during the semester. Of that number, 18 students (42.9%) were saving the money to pay for future classes and tuition, 6 students (14.3%) kept it in their savings account, and 3 students (7.1%) planned to use it when they transfer to a four-year university. Approximately 29% of the comments stated the money was saved but did not provide any additional information. The remaining three indicated “savings” by being able to take out a smaller loan.

Discussion and Limitations

Throughout this study, a number of students commented on issues that may not be directly connected to OER, but that they perceived as relevant to their perception of quality and experience of engagement with OER materials. These other factors include the preference for printed resources, the accessibility and portability of an online textbook, interactive online features of the text, multimedia materials such as videos, and the role of the course professor. While we recognize that all of these items can influence student perceptions, they are not specific to using OER materials. For example, a traditional textbook, which does not permit instructors to adapt the resource, can be purchased in an online format providing the same digital features and making it just as accessible and portable as online OER materials.

A limitation of the study is the dependence upon student self-reports, which may not be standardized across all students. For example, a value of 4 on a scale from 1 to 5 can be interpreted differently among participants. Another possible reason is that students may have written responses according to what they believed was the “correct” answer, even though all data was collected anonymously. Self-report data about how students spent the money they saved from OER usage may also be subject to inaccuracies due to the amount of time that passed during the course of the semester. Students had a general idea of how they used the funds, but were not completely sure in some cases. Another limitation is the sample size used in the study. We analyzed the OER usage at one community college across a limited set of OER materials. Due to this, these findings cannot necessarily be extrapolated to other populations.

Conclusion

As the costs of higher education continue to rise, open educational resources are a possible solution to ease the financial burden students face. These resources have been found, in previous studies, to be just as effective as traditional materials used in the classroom. In our research we found that most students who

participated in the study believed the quality of OER was better than that of traditional textbooks. They also reported feeling more engaged with open materials because of the interactivity these materials facilitated. Although increased engagement is not a defining attribute of OER, and may be due to the instructional design behind the open materials and course layout, OER provide more flexibility and adaptability for professors to influence the materials and restructure their courses. Further research is needed to more carefully tease apart the potentially conflating variables. While many previous studies have been conducted about student perceptions of quality, this study aimed to understand the impact of financial savings from OER on students. Our main finding is that a majority of students reinvested that money in their education or had plans to do so in the future. Students reported taking more classes in a given semester with the money they did not have to put towards a traditional textbook. This means OER could help students achieve their educational goals in less time by freeing up funds to pay for additional classes. Further research needs to be done in this area, but the potential of OER to aid students in the quality of their learning and the quantity of time it takes to reach their educational goals is promising.

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Evaluation of the UNED MOOCs Implementation: Demographics, Learners' Opinions and Completion Rates



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Abstract

The paper is a study about the MOOC experience at the Spanish National University of Distance Education (UNED), where we have collected initial and final information about learners' profiles and opinions, as well as enrolment, completion and certification rates. It is a survey-based study covering 17 MOOCs offered in UNED's own platform, and collects information from a sample of more than 24000 learners (initial survey) and 2003 learners (final survey). The paper first presents an overview of the MOOC experience at UNED, introducing the main features of these courses. Afterwards, it focuses on the methodology used in the study and in the information gathered in the second edition of UNED MOOCs, which took place from November 2013 until March 2014. Learners' average profile is a Spanish female, approximately 37 years old, with a University degree, and generally employed. For many of the participants, UNED MOOCs were their first experiences with these sorts of courses, and the main reasons for enrolment were the course topic and the perceived usefulness for professional development. The expectations regarding completion and certification were initially very high, but completion rates remain below 14%. In the final survey, the overall experience in the MOOCs and the different tools used in the courses were highly valued by learners, except the support figures (curator, facilitator, peers), which received lower ratings. These findings are of interest for the institution and further research, refining learning analytics, is encouraged.

Keywords: MOOC, open education, higher education, Spain

Introduction

The so-called Massive Open Online Courses (MOOCs) have become the most dominant emerging phenomenon in recent years in the field of higher education. Although the objectives have been different in different cases –institutional, promotional, advertising, etc.,– the most prestigious universities in the world have created a growing and, above all, varied range of courses, both in terms of content and quality. Attentive to the development of this phenomenon, and assuming responsibility within the Spanish educational system for spearheading innovative initiatives, especially in the field of higher education distance learning, the Spanish National University of Distance Education (UNED, <http://www.uned.es>) has, from October 2012

onwards, launched a number of courses using this teaching modality and with significant success, in terms of the large response achieved and the number of people enrolled in the various courses that have been offered.

At the end of the second series of these courses (November 2013 to March 2014) and bearing in mind the commitment of the UNED to the quality of the courses it offers, we have made a first assessment of the experience, focusing specifically on: the analysis of the socio-demographic profile of the students of MOOCs offered by the UNED; the assessment of the MOOCs from the learners' perspective; and the analysis of the various activities of the students related to the courses (registration, completion, and certification rates).

Veletsianos and Shepherdson (2016) identify demographics of MOOC users as one of the themes that emerge across systematic analyses of the MOOC literature. This paper tries to fill one of the gaps in MOOCs literature, which is the geographic distribution –most studies about MOOCs proceed from North-American authors (Gašević, Joksimović, Kovanović, & Siemens, 2014) and refer to North-American or European (mainly UK) participants (Liyana Gunawardena, Adams, & Williams, 2013), thus native English speakers—. This is the first empirical analysis of one of the main MOOCs' offering university in Spain, i.e., UNED, through UNED MOOCs.

UNED MOOCs Overview

UNED's mission is the public service of higher education through the modality of distance education, characterised for utilising a specific didactical methodology by a conjoint use of printed, audiovisual, and technological media, along with face-to-face support from tutors in regional centres (more than 60 all over Spain) and communication means with professors (virtual fora, email, phone). It has the largest student population in Spain: more than 150000 registered students in Graduate programmes, almost 8000 in Master's programmes and more than 1000 in Doctorate studies, almost 13000 in the access to university course and more than 18000 in language courses in 2014-15 (UNED, 2016).

UNED has offered open educational content (especially in an audiovisual format) since its creation in 1972, joined the OpenCourseWare movement in mid-2000's and launched its first massive open online courses (MOOCs) in 2012 (Gil-Jaurena, 2014). The first institution offering MOOCs in Spain was UNED, in its pilot project launched in October 2012, UNED COMA (*cursos online masivos abiertos* – MOOCs), with 22 courses offered in the first edition and 25 –three of them new– in the second edition (November 2013-March 2014). The courses are in Spanish and remained open during approximately three months. Until 2015, UNED MOOCs were offered in its own platform (<https://coma.uned.es/>) using the openmoooc software developed in Spain (<https://github.com/OpenMOOC>), which had the basics features for running a MOOC: infrastructure for hosting videos, online tests, peer-assessment, communication forums, and open digital badges. Given the difficulties for developing the software in order to incorporate new functionalities and keep it updated in a changing and evolving scenario, UNED analysed other alternative widespread and open source platforms; since 2015, UNED uses OpenEdx in its own server (<https://iedra.uned.es/>). The 17 courses on which this paper focuses were run in openmoooc.

UNED MOOCs can be considered x-MOOCs, as they fall into the cognitive-behaviourist pedagogy and rely primarily on information transmission, computer marked assignments, and peer assessment (Rodríguez, 2013). Instructional design is based on providing content -mainly using videos- and proposing activities,

mainly multiple choice question tests (computer marked) and other activities like peer-assessed essays, open questions, etc. According to Bates (2015), UNED MOOCs have the following design features supported by a specially designed platform software (openmoooc in this case): video lectures, computer-marked assignments, peer assessment, supporting materials, a shared comment/discussion space, badges or certificates, and learning analytics. Regarding a remaining feature that this author identifies (Bates, 2015, p. 154), i.e., "no, or very light, discussion moderation," UNED MOOCs use different approaches to this aspect and two agents are in charge of supporting learners, as will be explained later, thus approaching to network-based MOOCs (Lane, 2012).

Regarding this mixture, there has been an opportunity to explore and experiment diverse pedagogical models through UNED MOOCs. Professors could use different approaches to tutoring and teacher-presence. Some professors have preferred to be actively involved in the delivery of the course, by encouraging debates in the fora, solving learners' doubts about content. Others have been actively involved in preparing material for self-learning and not so present in the delivery of the course. Regarding support to learners, besides professors-curators (authors of the contents, designers of the course, and in some MOOCs, actively involved in the implementation of the courses), there have been two different figures with active roles during the delivery of the courses: assistant tutors-facilitators (in charge of motivating and supervising debates along with professors, reordering messages, compiling FAQs, solving doubts about how to get access to the course content, about how to apply for completion certificates, etc.) and technical support staff (in charge of solving technical problems: registration, duplicated users, downloading badges and certificates, etc.) (Marauri, 2014; Gil-Jaurena, 2015).

Learners who complete the course (at least 80% of progress) have the following certification options:

- Digital badge: based on Mozilla Open Badges Infrastructure (OBI), it is free and it doesn't have academic effect.
- Digital credential: digital certificate with no academic effect, it costs 15€.
- Certificate: digital certificate for learners who, besides completing the course, take an exam in any of our regional centres. It costs 50€ and can have academic effect (recognition in UNED degrees).

Purpose of the Study

Taking into account a wide variety of MOOCs of different subjects and structures, the purpose of this study is to know which dimensions and elements of MOOCs provide a satisfactory experience. What is the place of the perception of methodological design of the MOOC in such an experience? Are personal and relational aspects preferable? Is technological support more important than personal support? And what about the offered material?

Methodological Strategy and Data Collection

In order to carry out a comprehensive evaluation of the experiences during the second series of the UNED MOOCs, the following objectives, dimensions of analysis and information sources (in parentheses) have been established:

1. Methodological evaluation, at a meta-level, especially designed to reflect on the empirical material and information which is currently available and which would be necessary for future evaluations.
2. Analysis and evaluation of records produced by the users of the courses (database of the UNED MOOCs platform)
 - a) Number of students registered.
 - b) Number of students who start the course.
 - c) Number of students who successfully finish the course.
 - i. Those who complete 85% of the course.
 - ii. Those who obtain a credential or certificate.
3. Socio-demographic profile of the enrolled students (gender, age, education level, employment status, country of residence), previous experience of MOOCs, motivations, expectations, and assessments about the use and usefulness of the elements of the course was gathered by two online surveys. Initial survey was completed by registered students, given at the beginning to the students enrolled in each course, and it was composed by nine questions, three of which were multi-choice questions. The average time to complete this questionnaire was between two and three minutes. On the other hand, final survey was given at the end of the course and mainly replied by those students who had completed at least 85% of the course (it includes watching the videos, passing the tests and undertaking peer activities if it is the case) and voluntarily agreed to participate. This end survey was composed by socio-demographic variables and 26, 10-point (1-5: insufficient, poor, 5-7: enough, sufficient, 7-9: notable, good, 9-10: outstanding, very good) scale items (6 in Q7, 8 in Q8, 8 in Q9, and 4 in Q10). Learners were informed that the surveys are anonymous. Internal consistency reliability can be considered high: 0.938 Cronbach's coefficient *alpha*. Validity is obtained from the significance and strong correlation (0.701 Pearson's correlation coefficient, $P < 0.01$ two tails) between additive score from the responses to Q7, Q8, and Q9 items and responses to recommendation of the course to other people interested in the subject (Q10 item 3). The average time to complete this second questionnaire was between six to eight minutes. Both online surveys were conducted by Lime Survey software and analysis was carried out using SPSS v.24 software for Windows. The level of statistical significance was established in $P < 0.01$.
4. Analysis and evaluation of dimensions linked to the learning experience:
 - a) Disposition of the users (initial survey).
 - i. Reasons for enrolling in the course (Q8).

- ii. Course expectations (Q9).
- b) Course experience (final survey).
 - i. Overall level of satisfaction.
 - ii. Satisfaction with the platform (Q7.6).
 - iii. Satisfaction with the organisation of the course (Q7.5).
 - iv. Satisfaction with the length of the course (Q7.4).
 - v. Degree of fit with previous expectations (Q7.1).
 - vi. Satisfaction with the methodology (Q7.3).
 - vii. Satisfaction with the content (Q7.2).
- c) Assessment of the use and usefulness of the elements of the course (final survey).
 - i. Videos (Q8.1 and Q9.1).
 - ii. Complementary material (Q8.2 and Q9.2).
 - iii. Tests (Q8.5 and Q9.5).
 - iv. Self-assessments (Q8.10 and Q9.10).
 - v. Evaluation of the activities of peers (Q8.6 and Q9.6).
 - vi. Support from the facilitator (Q8.7 and Q9.7).
 - vii. Support from the curator (Q8.8 and Q9.8).
 - viii. Support from peers (Q8.9 and Q9.9).
- d) General assessments and future expectations (final survey).

The methodological strategy followed is based on two main principles:

- Given that the questionnaires have been customised to suit the needs of each course, our analysis only considers questions common to all courses;
- The focus is on the overall experience of the project, without going into a detailed analysis of each course.

The 17 courses analysed were the following (ordered by size: number of registered learners):

1. Start with English: learn the thousand most used words and their communicative possibilities.
2. Professional English.
3. Accounting: the language of business.
4. ICT for teaching and learning.
5. The human resources function in non-profit entities: competence-based management.
6. School tutoring.
7. Great works of Spanish art of the Renaissance and the Baroque in their international context.
8. The transversal skills of the entrepreneur.
9. Basics of circuits and practical electronics.
10. Entrepreneurship and social innovation.
11. Corporate social responsibility: path to sustainability.
12. Happiness, economics and business practice.
13. Modular teaching mini-videos: a critical element in the design of a MOOC.
14. Logic and uses.
15. Ibervirtual COMA: basic digital skills.
16. Non-profit organisations (NPOs) in the network society: analysis and challenges.
17. Basic analytical chemistry.

These 17 courses were selected among the 25 offered considering that they were 100% run by UNED with their professors. The other eight courses were developed in partnership with other institutions and had specific characteristics, this they are not part of this study.

The main characteristics of both surveys are summarised in Table 1.

Table 1

Population, Sample, Objectives and Dates of the Initial and Final MOOC Surveys

	Initial survey	Final survey
Main objective	Explore registered learners' socio-	Explore learners' satisfaction with

Evaluation of the UNED MOOCs Implementation: Demographics, Learners' Opinions and Completion Rates
 Gil-Jaurena, Callejo, and Agudo

	demographic profiles, expectations, and motivations for taking MOOCs		MOOCs' elements and overall satisfaction	
Survey dates	November 2013 – January 2014		December 2013 – July 2014	
MOOC (ordered by size)	Population: Learners registered in each MOOC	Sample distribution per MOOC (initial survey)	Population: Learners who have completed each MOOC	Sample distribution per MOOC (final survey)
Start with English	13651	9356	2254	125
Professional English	8352	5436	608	463
Accounting	3375	2232	508	280
ICT	2337	1455	280	93
Human resources	2108	349	387	338
Tutoring	1532	1090	287	136
Great works	1284	775	235	141
Skills ¹	1274	--	224	98
Basics of circuits ²	1261	922	74	--
Entrepreneurship	978	355	161	67
Responsibility	976	443	160	--
Happiness	665	283	74	40
Mini-videos	664	313	72	30
Logic	650	312	44	26
Ibervirtual	623	551	80	42
NPOs	523	162	99	102
Chemistry	515	378	41	22
Total population / sample	40768	24412	5588	2003

¹ No initial survey results are available

² No final survey was conducted

English courses were the most popular (Basic and Professional English courses). Financial accounting and ICT were also popular. More specialised courses, such as chemistry or logic, had fewer learners, but still more than 500 in the second edition.

Results and Discussion

Socio-Demographic Profiles

The gender distribution is the same in both the initial and the final surveys, being 36.4% men and 63.6% women (Figure 1). The equal distribution suggests that gender is not a relevant factor in determining whether or not the course is finished, or at least almost entirely completed. But the predominance of female learners challenges other studies that report that a majority (Ebben & Murphy, 2014) and more than 70% of participants in MOOCs (Ho et al., 2014) were males. But if we compare with learners registered in regular courses at UNED (graduate, master's, etc.), female are also a majority, as in the MOOCs (55.2% in the school year 2013-14)³. The skew towards a female majority in the UNED MOOCs could be also related to the knowledge area: most MOOCs in this study belong to Social Science and Humanities areas, where females are more present, as opposed to STEM courses where males are majority. As reported by Jiang, Schenke, Eccles, Xu and Warschauer (2016), only 23.89% females were enrolled in the Harvardx and MITx STEM MOOCs in 2012-13.

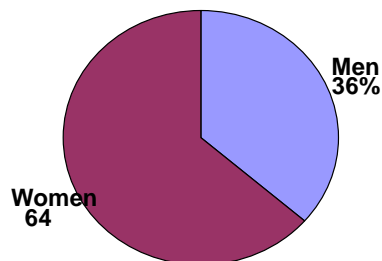


Figure 1. Distribution of samples by gender.

The average age of those completing the initial questionnaire is 36.17 years; while for those completing the final survey the average age rises slightly to 37.89 years, almost two years more. Worth mentioning the presence, even if the percentages are very low, of people under 18 and also of elderly people carrying out the courses, although the bulk of the students are found in the middle age ranges, especially between the ages of 31 and 45 (Figure 2). However, Table 2 shows that the age group that is most likely to complete a substantial part of the course –given indirectly by the completion of the final questionnaire of the course– is the group of students between 46 and 60 years of age.

Table 2

³ Info obtained from the UNED statistical portal: <https://app.uned.es/evacal/>

Age Groups of the Participants in the Surveys on the MOOCs

Age groups (%)		
	Initial n=24412	Final n=2003
Less than 18	.4	.3
18-30 years	36.2	29.5
31-45 years	42.7	45.2
46-60 years	18.8	23.0
More than 60	1.8	2.0
Total	100.0	100.0

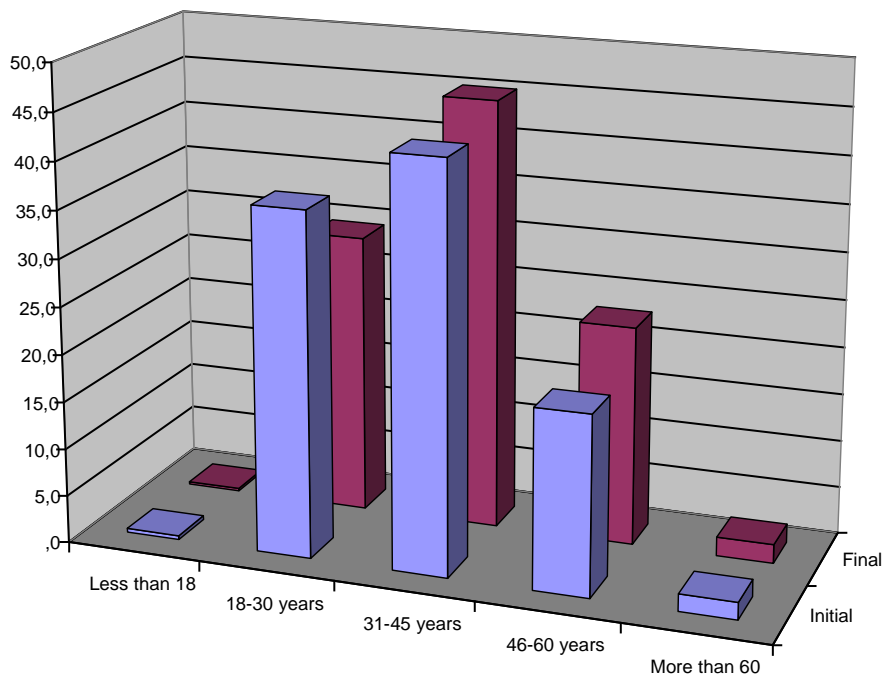


Figure 2. Distribution of respondents by age group and initial/final survey.

By nationality, almost four out of five of those responding to the initial questionnaire reside in Spain (79.5%). When referred to the general MOOC offer in the world, Oliver, Hernández-Leo, Daza, Martín, and Albó (2014), explain how “from the demand side, Spain also stands within the top-five countries with more participants, right after USA, UK, Canada and Brazil” (p. 5).

It is important to note the presence among those surveyed of residents from other Spanish-speaking countries: 2.8% Argentinians, 4.7% Colombians, 3.7% Mexicans, 1.4% Peruvians, 0.9% Chileans, 0.6% Venezuelans, and 0.7% from other Spanish-speaking countries. If these figures are added to the previous figure, it can be seen that residents of Spanish-speaking countries make up almost all of the students.

In the sample of students who completed the final questionnaire, the vast majority (89.3%) are resident in Spain, while the 1.9% residing in Mexico and 1.6% in Colombia are also worth highlighting.

The majority of people who have attended the UNED MOOCs are either currently studying or have completed higher, university-level education (Table 3). This result is in accordance with findings reported by other authors (Emanuel, 2013; Ho et al. 2014; Jordan, 2014; Bates, 2015). The persistence in MOOCs only achievable for privileged learners (those who have previously attained higher education qualifications) has been identified by Schuwer et al. (2015) as an example of inequality in access to education, and as one of the threats of MOOCs on the macro level.

Table 3

Percentage Distribution of Samples by Level of Education (Completed or in Progress)

	<i>Initial</i> n=24412	<i>Final</i> n=2003
No studies	.1	
Basic /primary education	1.9	1.1
Secondary education	4.7	1.5
High school	11.1	6.5
Vocational training	17.6	10.4
University level	52.5	59.5
Postgraduate studies	12.0	21.0
Total	100.0	100.0

In view of these distributions, and if we assume that those who have completed the final questionnaire have more or less satisfactorily completed their respective courses, we can see there is greater likelihood of this completion occurring for those who are either currently studying or have completed higher education than for those who have achieved a lower level of education (Figure 3).

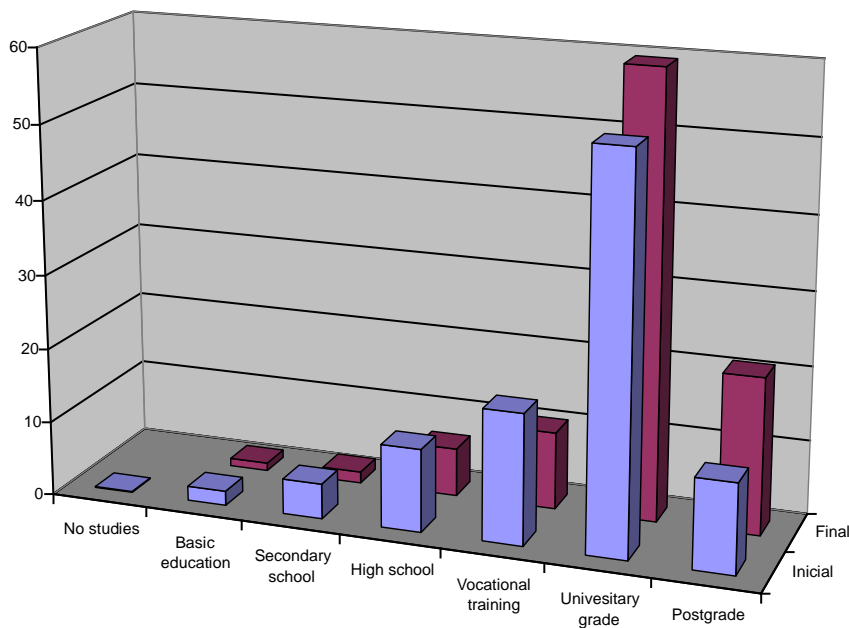


Figure 3. Respondents by level of education and initial/final survey.

Regarding employment status, those making up the initial sample and, generalising, the body learners enrolled in the MOOC courses analysed, are mainly employees (35.2%) and unemployed (36.3%) (Figure 4). Students make up the third largest group with 19%. Self-employed represent just 7.7% of the total; but their high presence in some of the courses, such as the Mini-Videos and Social Responsibility courses, should be highlighted (Table 4).

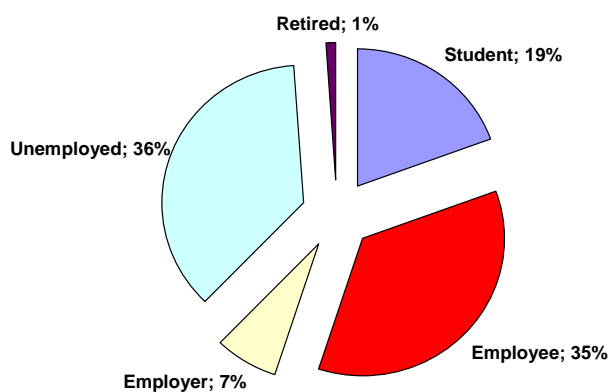


Figure 4. Respondents by employment status in initial survey.

Table 4

Learners' Employment Status (%)

	Student	Employee	Self-employed	Unemployed	Retired	Total
Start with English	17.1	37.1	7.8	35.4	2.5	100
Professional English	19.9	30.9	7.3	41.0	0.8	100
Accounting	15.2	28.5	7.5	47.9	0.9	100
ICT	19.4	37.4	8.2	33.4	1.5	100
Human resources	23.8	41.0	7.7	26.2	1.4	100
Tutoring	24.7	38.9	4.3	31.9	0.2	100
Great works	21.8	40.7	5.6	25.1	6.8	100
Basics of circuits	24.2	35.3	9.3	29.8	1.4	100
Entrepreneurship	22.0	29.3	8.2	38.7	1.8	100
Responsibility	17.5	36.2	12.7	33.3	0.2	100
Happiness	24.3	37.8	11.6	25.1	1.2	100
Mini-videos	11.5	47.4	12.9	25.4	2.8	100
Logic	24.1	36.8	8.8	28.7	1.5	100
Ibervirtual	18.4	47.4	10.7	21.4	2.0	100
NPOs	23.3	34.7	9.7	31.3	1.1	100
Chemistry	31.3	26.0	2.7	38.7	1.3	100
Total	19	35.2	7.7	36.3	1.8	100

Summarising, concerning learners' profile, enrolment information and results from the initial survey say that there is a majority of women, with a high level of education and either unemployed or employed. Most of the

enrolled learners are in Spain (more than 90%). Other learners are in Mexico, Colombia, Argentina, or European countries.

Previous Experience of MOOCs

Of the enrolled students who participated in the initial questionnaire, 70.5% stated that this was their first MOOC experience with the UNED open courses, while 8.3% had had only one previous experience. As little as 3% come to these courses with prior experience involving three or more courses of this sort. Therefore, it is fair to say that for the majority this opportunity represents their only point of reference regarding the MOOCs experience.

In terms of previous experience in COMA/MOOC courses, 9% have had this in different UNED platforms. However, 7% of the total sample have already tried the UNED-COMA courses themselves. This is followed by 4% for MiriadaX and just under 4% for Coursera.

Motivation and Reasons for Enrolment

Bearing in mind that an average of 2.5 reasons for embarking on the UNED MOOC courses analysed was identified by respondents, the most common of these are interest in course content, subject, and expected usefulness of this subject for professional development. The first of these reasons is given by almost 72% of participants in the initial survey; while the second is given by 60.6%. It should be borne in mind that a third (33.8%) give the two reasons together. In fact, between the two they account for 51% of the total collected answers. This is shown in Table 5.

Table 5

Reasons for Enrolment

	Answers	Percentage of cases
	Percentage	
I am interested in the subject/topic of the course	28.3%	71.8%
I find that the course methodology suits me	12.0%	30.4%
I am interested in obtaining a certificate	10.3%	26.1%
The course is useful for my professional development	23.9%	60.6%
For me, the prestige of the UNED is a reason to take a course in this institution	11.1%	28.3%
I am interested in accessing specific contents of the course	5.6%	14.1%

I am interested in interacting with other students with whom I share interests	3.2%	8.2%
I am interested in having access to expert teachers in the subject	5.6%	14.3%
Total (n=24412)	100.0%	253.8%

*Note. a. Dichotomy group tabulated at value 1.

Looking beyond the subject of each specific course, it should be noted that 30% of participants in the questionnaire have selected the fact that the course methodology suited them as a reason for taking part in this experience. This is relatively independent of what is meant by the concept of methodology in this case: Distance learning? Free? Short courses? Participation and collaboration among peers? That is to say, there is something specific in this approach to teaching that attracts a significant number of those who have enrolled.

Given the importance of this specific reason, we will concentrate on it now. Thus, an analysis using binary logistic regression, inasmuch as this demonstrates the direct relationship with the dependent variable, putting the other variables in the model to one side and taking reason as the dependent variable, shows us the statistical significance of variables such as gender. Focusing on the latter, the probability that women indicate this option is 1.2 times more likely than it is for men. Age, however, although significant in the sense that the probability of selecting this reason increases with increasing age, is a factor of little importance. With regard to activity, it is the self-employed students who, compared with those involved in other activities, appear to be more motivated by the methodology of these courses. And, looking at the level of education, the probability of selecting this reason is significantly higher among those who have completed higher education, as would be expected. Thus, those with a university degree or equivalent, or who are studying for this, are more than twice as likely to select this option as respondents who have completed basic or primary education. Further detail and clarification is provided by Table 6, which shows the percentage of those who choose this as a reason within each of the different levels of education, independently of the regression analysis.⁴

Table 6

*Level of Education (Completed or in Progress) by Reason for Taking this Course Cross-Tabulation: I Find That the Course Methodology Suits Me**

Level of education (completed or in progress)	[I find that the course methodology suits me]		Total
	Reason for taking this course		
	Non selected	Yes	
No studies	87.0%	13.0%	100.0%
Basic /primary education	81.4%	18.6%	100.0%

⁴ The result of regression analysis is in Appendix 1.

Secondary education	75.8%	24.2%	100.0%
High school	73.1%	26.9%	100.0%
Vocational training	75.6%	24.4%	100.0%
University level	67.6%	32.4%	100.0%
Postgraduate studies	63.6%	36.4%	100.0%
Total (n=24412)	69.8%	30.2%	100.0%

- Asymptotic significance (two tails) of Pearson's Chi-Square<.000

Finally, we would draw attention to the 28% who have selected the prestige of the UNED as a reason.

Expectations

What do the people enrolled in the UNED MOOCs expect from them? What are their expectations? The majority of the answers focus on obtaining the credential. In a credentialist society it is the certificate that counts, to the extent that four out of five people enrolled in the courses point to the credential as the objective for taking the course (Table 7).

Table 7

Expectations on Taking This Course

	Percentage
My intention is to consult the materials but I don't expect to complete the course	1.2%
I expect to do some of the activities but I don't think I will complete the entire course	2.4%
I expect to finish the entire course but I don't intend to request any certificate	18.2%
I expect to complete the course and request the corresponding credential and/or certificate	78.3%
Total (n=24412)	100.0%

This pursuit of the credential accounts for as many as 92% of those enrolled in the MOOC on "School tutoring," 88% of those in the course "ICT for teaching and learning" and 87% of those in "Entrepreneurship and Social innovation." Where this expectation has least relative weight is in the "Corporate Social Responsibility" course, where it has not been selected by anyone, although in this case the sample base is

very low. The next course where this aspect has relatively low importance is “Logic and uses,” with 67% selecting it.

However, in contrast with these high expectations regarding completion of courses and requesting the corresponding certificate, the average course completion rate stands at 13.71% of those who enrol, and the application for certificates at 19.31% of those who complete the course, as reflected in Table 8. This difference between expectations and completion rates in MOOCs has been previously reported; as Reich (2014) stated, “the majority of students who intended to complete a course—in some cases the overwhelming majority of students— were not successful in doing so.” (para. 22)

Learners' Behaviours and Rates

With regard to the behaviour of students, the most relevant data regarding enrolment, commencement, completion, and requesting of the certificate for each course are given in Table 8.

Table 8

Enrolment, Commencement, Completion and Certification Rates by MOOC

MOOC	Learners enrolled	Learners who have started each course		Learners who have completed each course (from enrolled)		Learners who have paid for a digital credential or certificate		
						Total	% from enrolled	% from completed
Start with English	13651	11.546	84.58%	2254	16.51%	132	0.97%	5.86%
Professional English	8352	6.396	76.58%	608	7.28%	197	2.36%	32.40%
Accounting	3375	2.411	71.44%	508	15.05%	147	4.36%	28.94%
ICT	2337	1.653	70.73%	280	11.98%	82	3.51%	29.29%
Human resources	2106	1.518	72.08%	387	18.38%	106	5.03%	27.39%
Tutoring	1532	1.138	74.28%	287	18.73%	105	6.85%	36.59%
Great works	1284	1.007	78.43%	235	18.30%	58	4.52%	24.68%
Skills	1274	833	65.38%	224	17.58%	34	2.67%	15.18%
Basics of circuits	1261	1.132	89.77%	74	5.87%	13	1.03%	17.57%
Entrepreneurship	978	551	56.34%	161	16.46%	37	3.78%	22.98%
Responsibility	976	668	68.44%	160	16.39%	63	6.45%	39.38%
Happiness	665	358	53.83%	74	11.13%	23	3.46%	31.08%
Mini-videos	664	459	69.13%	72	10.84%	21	3.16%	29.17%
Logic	650	481	74.00%	44	6.77%	6	0.92%	13.64%

Ibervirtual	623	450	72.23%	80	12.84%	18	2.89%	22.50%
NPOs	523	381	72.85%	99	18.93%	26	4.97%	26.26%
Chemistry	515	436	84.66%	41	7.96%	11	2.14%	26.83%
Total	40766	31418	77.07%	5588	13.71%	1079	2.65%	19.31%

About dropout rates, the average of students who start the course but don't finish it is higher than 80%. Completion rate is 13.71% (considering whole enrolment) and 17.79% if we consider only those we started the course. Despite completion rates are low, they are higher than those reported in other studies, such as a rate between 2% and 10% (Reich, 2014), 12.6% (Jordan & Weller, 2013, as cited in Weller, 2014) or average as low as 5% (Jordan, 2014). The high dropout rate and low completion rate have been identified by Schuwer et al. (2015) as a threat of the MOOC movement at the micro level.

Learners' Evaluation and Satisfaction

In this final section on the final evaluations of the MOOCs we must begin by stating that 94% of those who responded have completed the course. Therefore, an overwhelming majority of the satisfaction ratings set out below are from people who have completed the courses.

The rating for what might be considered general aspects of the course is quite similar, being around eight. The most highly rated aspects are the operation of the virtual platform, the organisation and structure of the courses, and their length. The lowest rated aspect is course contents (Table 9).

Table 9

Evaluation of MOOC Elements in the Final Survey (from 1 to 10)

	Mean	Standard deviation
The virtual platform worked properly (n=1668)	8.12	2.364
The course was well organised / structured (n=1701)	8.11	1.919
The course length was adequate (n=1.693)	8.08	1.789
The course met my previous expectations (n=1706)	7.72	1.967
The course methodology was motivating and appropriate (n=1705)	7.72	2.111
The course contents were adequate and sufficient (n=1707)	7.69	1.989

The variability in the evaluation of the dimensions of the course is higher when the specific elements that have been used are addressed, as shown in Table 10. Videos, tests, and self-assessments are the most highly used dimensions or materials, the fact that the first of these is close to an average rating of nine (8.94) being

noteworthy. However, the different forms of personal support were the lowest used elements, neither the support of the curator (4.87), the lowest rated of all, nor that of the facilitator (5.23), nor that of peers (5.01) having been convincing. Or at least it seems that more was expected of them. This is probably logical in the case of unfamiliarity with this kind of course and its comparison with “normal” courses.

Table 10

Degree of Use of MOOCs Tools (from 1 to 10)

	n	Mean	Standard deviation
Videos	1707	8.94	1.618
Complementary Material	1692	8.40	1.952
Tests, exams	1599	8.62	1.942
Self-assessments	1589	8.58	2.038
Peer-activities	1315	6.27	3.393
Support from facilitator	1205	5.23	3.392
Support from tutor-curator	1143	4.87	3.339
Support from peers	1216	5.01	3.306

Students were asked about their perception of the degree of usefulness of each of these tools for the implementation of the course. The result of the responses are shown in Table 11.

Table 11

Degree of Need and Usefulness of MOOCs Tools for Learning and Progress (From 1 to 10)

	n	Mean	Standard deviation
Videos	1689	8.83	1.667
Complementary Material	1669	8.63	1.774
Tests, exams	1578	8.39	1.978
Self-assessments	1569	8.38	1.998
Peer-activities	1284	6.96	2.763
Support from facilitator	1133	7.16	2.741

Support from tutor-curator	1070	7.01	2.776
Support from peers	1153	6.82	2.794

Thus we see that tools that have been used and appear to be highly rated (Table 10) are also considered very useful for learning and course development (Table 11). This is the case for the videos, supplementary materials, tests, and evaluations. Meanwhile, aspects that obtained a lower rating have been considered useful as support tools. This is the case for the support of the facilitator and curator. On a third level, the evaluation of activities by peers and peer support itself (Figure 5) received a relatively low rating, and its usefulness was less highly valued than the previously mentioned aspects. These results are in agreement with those obtained in the analysis of 10 courses in another platform that offers MOOCs in Spanish, Miriadax, as reported by González and Carabantes (2017). The use and satisfaction with various MOOC tools are aligned if we consider these two studies.

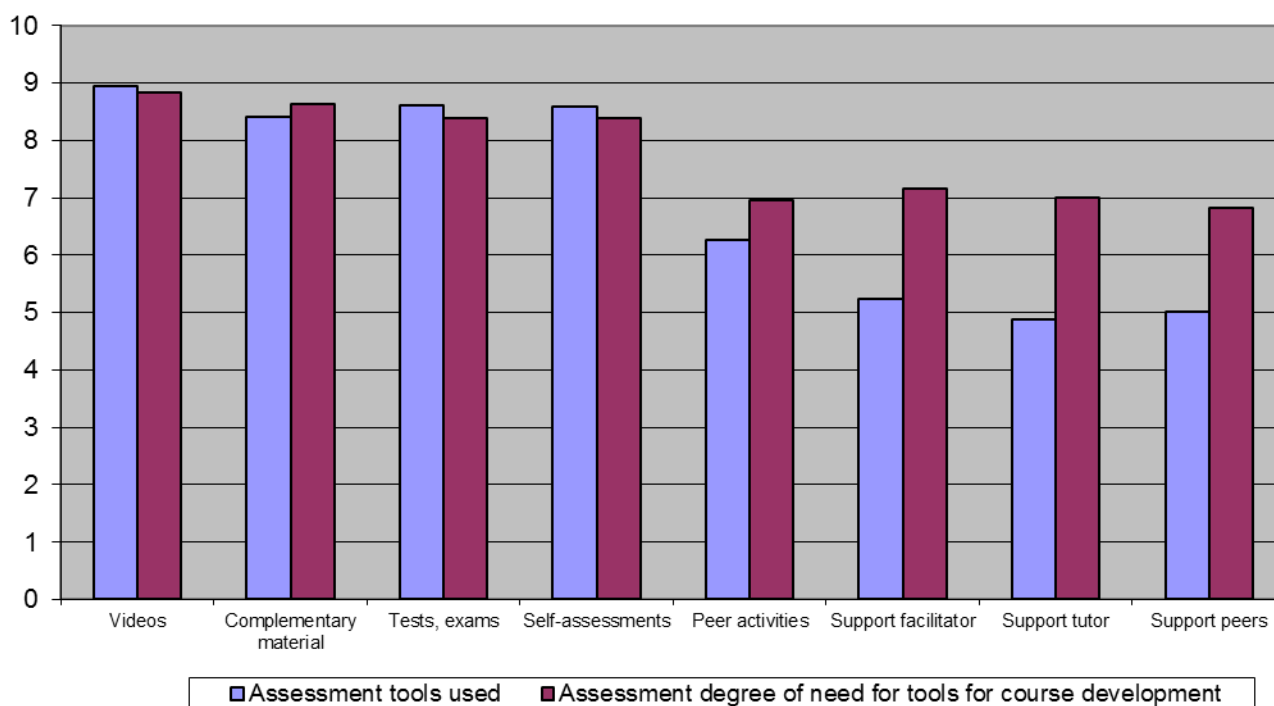


Figure 5. Assessment tools used and the degree of need for tools for course development (0-10).

In any event, the general experience seems to have been quite satisfactory, bearing in mind that, for example, the likelihood of recommending the course taken scored an average of 8.34, which can be interpreted as a high probability. Perhaps most important of all is the fact that the phrase “I would like to take more courses of this type at the UNED” was rated at 9.05. This indicates a high level of satisfaction (Table 12).

Table 12

Final General Evaluation (From 1 to 10)

	n	Mean	Standard deviation
I would recommend this course to other people interested in the topic	1722	8.34	2.098
This course has allowed me to find out about the training on offer at UNED (continuing education, official degrees, etc.)	1656	8.13	2.248
I would like to take more courses of this type (MOOC) at UNED	1693	9.05	1.585
After this MOOC, I would like to take another type of course at UNED (official studies, continuing education, etc.)	1563	8.14	2.312

Do these courses serve to promote the institution and the educational opportunities it offers, considering that this is one of the functions that might be assigned to the MOOCs? In the light of what is shown by the last row of Table 12, the table provides a very positive answer to this question, since 8.14 is the rating for the degree of agreement with the statement: “After completing this course, I would like to take another type of course at the UNED.” Its advertising function appears to have been successful. That is to say, it serves as a point of entry –a sort of trial– for the UNED, as is also underlined by the average rating of 8.13 of the sentence: “The completion of this course has allowed me to find out about the training on offer at the UNED.”

A minimal analysis of the behaviour of this dimension tells us that it has very little relation with age, with a low correlation coefficient of almost zero, with a greater weight among males (8.29) than among women (8.09), and, perhaps most important, with the highest value being reached among those with average levels of education, as shown in Table 13. Moreover, controlling the other socio-demographic variables available (sex and age), it can be said that there is a slight tendency for the rating of this aspect –the probability of taking other courses at the UNED– to decrease as level of education rises. This is something that Table 13 itself suggests.

Table 13

Future Expectations to take another course at UNED (official studies, continuing education, etc.) from 1 to 10 by Level of Education (completed or in progress)

	Mean	n	Standard deviation
Basic /primary education	8.88	17	2.472
Secondary education	9.36	25	1.287
High school	8.38	99	2.165

Vocational training	8.55	168	1.932
University level	8.11	927	2.290
Postgraduate studies (master or doctorate)	7.78	309	2.541

Performing a factor analysis of the principal components (Appendices 2 and 3), focusing the analysis on the first two components, tells us that the assessment of these MOOC courses is structured around two axes. The first axis relates primarily to the general aspects that have been assessed: “I would recommend this course to others interested in the subject,” “The course is well organised/structured,” “I have found the methodology of the course motivating and appropriate,” “The course matched my expectations,” or “I think that the course contents have been suitable and sufficient.” The second axis involves more specific aspects, especially related to the perception of the support received, highlighting this as a relatively key dimension when it comes to assessment, almost like a demand. Thus, in this axis the assessment of the role that the support of peers, facilitator, and curator played in the course has special weight.

Still bearing in mind these two axes, what is their relationship with fostering an interest in taking other courses at the UNED? Through the correlations in the matrix of components (Appendix 2), this relationship can be seen. That is to say, the correlation with the first axis, or general aspects, has a fairly high correlation (0.659, being $P < 0.01$); while in the second axis it has much less weight. Meanwhile, the correlation of the variable that denotes interest in taking other courses at the UNED and variables that reflect the assessment of the support (facilitator, curator, and peers) received during the course is low, not reaching 0.3 under any circumstances. Also, if we take into account, not so much the evaluation of these tools in the course taken but the evaluation of their usefulness in this type of course, we can see that the correlation with the variable representing interest in taking other courses in the UNED is still low, reaching a peak of 0.321 for the support of the curator.

Conclusions

The main results have been presented in the previous section. Below is a summary of those aspects that are of particular interest for finalising the details of the next series of MOOCs and for their evaluation.

At the institutional level, the results of the analysis demonstrate the existence of a high level of interest in this type of course, as well as high expectations and the demand for more similar courses. As a way of attracting potential students, we must recognise and take advantage of MOOCs as a point of entry to the UNED, bearing in mind that it is the first contact with the institution for most of those who enrol in these courses. Linking these courses with other UNED academic courses (lifelong learning, regulated studies, etc.) could meet the demand of the students and might result in the sustainability of the project. In this sense, UNED regulated the approval of new MOOCs according to some criteria, among them the relation with other educational offer in the institution (Gil-Jaurena, 2015). It would be useful to continue the evaluation, analysis, and research on MOOCs offered by the UNED. In particular, aspects such as the difference between the expectations and the actual rates of completion of courses or the predominantly well-educated profile of the users are striking and require specific studies.

At a pedagogical level, although in general the methodology and materials in the MOOCs have been positively valued, we must rethink the personal support roles (curator, facilitator), which have been the least highly used and rated by the learners. Independent studies about each MOOC considering their pedagogical specificities (more video-based, more social interaction-based, etc.) would lead to refining the analysis and providing valuable recommendations for teachers, instructional designers, and the institution itself.

Another important issue relates to the identification and better knowledge of learners in different MOOCs or knowledge areas: who they are, which motivations and expectations they present when they approach MOOCs, which use they make of the resources, what other needs they show, etc. Besides the profile, information about the learning paths that students follow is also of great interest in order to improve the learning experience and reduce attrition rates. A more complex and accurate learning analytics system would be recommended. Clustering (Khalil, Kastl, & Ebner, 2016) is an example of analysis we would use to reveal patterns and study the correlation between learners' behaviours, engagement, and completion rates. In this regard, a reconsideration of the automated measures from a pedagogical perspective is needed, in line with the position held by DeBoer, Ho, Stump, and Breslow (2014). Finally, a deeper analysis of the dimensions that influence learners' evaluation and satisfaction with MOOCs would be of interest in order to design and offer effective MOOCs and other online courses in the near future.

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Appendix 1

Result of Logistic Regression Analysis About Selection of Methodology as a Reason for Enrolment: Independent Variables Standardised Coefficient: Initial Survey

Variable (reference category)	Sig.	Exp(B)
Gender (male)	.000	1.255

Actividad (retired)	.000	
Student	.000	.661
Employee	.266	.923
Self-employed	.982	1.002
Unemployed	.000	.715
Studies (no studies)	.000	
Basic /primary education	.373	1.968
Secondary education	.157	2.895
High school	.110	3.307
Vocational training	.165	2.828
University level	.059	4.113
Postgraduate studies (master or doctorate)	.032	4.998
Age	.001	1.005
Constant	.002	.100

Appendix 2

Component Matrix: Final Survey

	Component			
	1	2	3	4
The course met my previous expectations	.798	-.218	-.332	.059
The course contents were adequate and sufficient	.781	-.193	-.347	.071
The course methodology was motivating and appropriate	.799	-.197	-.250	.096
The course length was adequate	.658	-.139	-.157	.140
The course was well organised / structured	.809	-.268	-.253	.058
The virtual platform worked properly	.586	-.279	-.229	.013
Videos	.602	-.319	.288	.197

Evaluation of the UNED MOOCs Implementation: Demographics, Learners' Opinions and Completion Rates
 Gil-Jaurena, Callejo, and Agudo

Complementary Material	.584	-.098	.448	.260
Tests, exams	.614	-.200	.503	.255
Self-assessments	.637	-.217	.435	.230
Peer-activities	.521	.429	.040	.231
Support from facilitator	.440	.728	-.142	.372
Support from tutor-curator	.444	.722	-.169	.360
Support from peers	.382	.752	-.085	.298
The following tolls are useful for learning and progress in the MOOC:				
Videos	.736	-.328	.094	-.058
Complementary Material	.757	-.256	.248	-.064
Tests, exams	.744	-.170	.273	-.150
Self-assessments	.777	-.128	.255	-.166
Peer-activities	.645	.421	.148	-.241
Support from facilitator	.654	.540	.146	-.369
Support from tutor-curator	.660	.539	.138	-.369
Support from peers	.564	.606	.156	-.355
I would recommend this course to other people interested in the topic	.830	-.233	-.279	-.043
Thanks to this MOOC I have known about UNED's educational offer (continuing education, official degrees, etc.)	.595	-.003	-.230	-.046
I would like to make more courses of this sort (MOOC) at UNED	.659	-.267	-.264	-.184
After this MOOC, I would like to make other courses at UNED (official studies, continuing education, etc.)	.528	.037	-.339	-.194

*Note. Extraction method: principal component analysis

a. 4 extracted components.

Appendix 3

Percentage of Explained Variance in Principal Component Factor Analysis: Final Survey

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% variance	cumulative %	Total	% variance	cumulative %
1	11.237	43.220	43.220	11.237	43.220	43.220
2	3.764	14.477	57.698	3.764	14.477	57.698
3	1.829	7.035	64.733	1.829	7.035	64.733
4	1.265	4.864	69.597	1.265	4.864	69.597
5	.959	3.689	73.286			
6	.812	3.123	76.409			
7	.682	2.625	79.033			
8	.667	2.564	81.597			
9	.597	2.296	83.894			
10	.559	2.151	86.044			
11	.503	1.936	87.980			
12	.474	1.823	89.803			
13	.378	1.455	91.258			
14	.334	1.285	92.543			
15	.291	1.119	93.662			
16	.271	1.041	94.703			
17	.231	.887	95.590			
18	.209	.805	96.395			
19	.199	.766	97.161			
20	.167	.641	97.802			
21	.149	.574	98.376			
22	.128	.492	98.868			
23	.112	.432	99.299			

Evaluation of the UNED MOOCs Implementation: Demographics, Learners' Opinions and Completion Rates
Gil-Jaurena, Callejo, and Agudo

24	.099	.381	99.681		
25	.054	.208	99.889		
26	.029	.111	100.000		

*Note. Extraction method: principal component analysis.



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Designing Authentic Learning Activities to Train Pre-Service Teachers About Teaching Online



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Abstract

Online learning is increasingly being used in K-12 learning environments. A concomitant trend is found towards learning becoming *authentic* as students learn with tasks that are connected to real-world occupations. In this study, 48 pre-service teachers use an online environment to engage in authentic practice as they developed online learning experiences for their future students. Using a design-based research methodology, the researchers were involved in planning, designing, implementing, and evaluating the higher education class across two macro cycles. An authentic learning framework was utilized in the development of the class. Findings explicate the design of the course and how it aligned to the authentic learning framework. It appears that web-based tools were beneficial as the pre-service teachers designed their own K-12 online classes. Findings show that the pre-service teachers' comfort increased when using the using online web building applications in the authentic environment. Furthermore, a high level of engagement in reflective and collaborative learning was uncovered during the activities. This research acts as a springboard for educators who are interested in designing online higher education courses incorporating authentic learning experiences.

Keywords: authentic learning, Web 2.0, teacher education, online teaching

Introduction

Teacher training programs have consistently been challenged by their incompetency in preparing pre-service teachers for the ever-changing reality of modern classrooms (Blackwell, Futrell, & Imig, 2003; Cusworth & Whiting, 1994). Traditional methods of teaching, such as lecturing in large-lecture halls, often fail to keep students' attention and engagement (El-Ghareeb & Riad, 2011). It appears that a dichotomy exists between how pre-service teachers are prepared to teach in classrooms and what teaching is like in the real world. Thus, pre-service teachers may be trained to answer test questions, but find it difficult to solve real problems when teaching in the classroom (Herrington & Oliver, 2000; Gulikers, Bastiaens, & Kirschner, 2004). To best prepare pre-service teachers for real world problem

solving and application, authentic learning that uses a situated learning approach has been deemed an effective method (Snape & Fox-Turnbull, 2013). As students gain opportunities to learn through a contextualized approach, there has also been a concomitant positive trend towards students taking advantage of online learning.

Online learning is the action of delivering course materials and instruction to learners by using Internet technology (Demiray, 2011). Online learning has pervaded both formal and informal K-12 learning. The International Association of K-12 Online Learning reported that in 2010 there were 1,816,400 students enrolled in online courses and this number does not include 200,000 students attending full-time online schools (International Association for K-12 Online Learning [iNACOL], 2013). The association note that in 2013-2014 there were 310,000 students attending full-time online schools and that K-12 online learning is growing at an estimated annual pace of 30% annually (iNACOL, 2013). However, research indicates that many teacher training programs still use traditional methods (Kennedy & Archambault, 2012a; Kennedy & Archambault, 2012b). The reality that younger generations' lives are daily enhanced by Internet technologies and the increase in the number of students enrolling in online courses yield a need for alternative and more effective teaching methods and tools to be used (Liu & Cavanaugh, 2011).

In teacher education programs, online instruction has emerged as an effective way to prepare pre-service teachers for future teaching in online environments (Archambault, Debruler, & Freidhoff, 2014). Researchers stressed the importance of understanding the alternative online teaching methods as necessities to achieve authentic learning and better prepare pre-service teachers in online environments (Archambault, Debruler, & Freidhoff, 2014; Bjekic, Krneta & Milosevic, 2010; Latham & Carr, 2012b). To better understand authentic learning in online environments, the purpose of this study was to elucidate a design process for creating authentic learning activities for pre-service teachers in an online environment. This study includes an examination of pre-service teachers' perceptions of their online learning experiences and the technologies used. The findings of the study also reveal pedagogical implications about how to design and facilitate authentic learning for teacher education subjects in online environments.

Theoretical Frameworks for Designing Authentic Learning

The Notion of Authenticity

The notion of authenticity in education has been extensively discussed and analyzed through empirical and theoretical works. Researchers (viz., Latham, & Carr, 2012a, Slavkin, 2004; Turnbull, 2002) postulated that its earliest theoretical strings were derived from the term authentic assessments with regards to constructivist and situated learning. Authenticity is a students' perception that tasks are connect to their lives (Behizadeh & Fink 2015). It is associated with authentic learning outcomes that involve the evaluation of constructivist learning, disciplined enquiry, higher order thinking and problem solving (Latham & Carr, 2012b).

Both social constructivist learning and situated learning theories stress the social and physical contexts in which learning occurs. These theories hold that learning resides in the learners' social relationships which are unintentionally situated within the authentic activity, context, and culture (Amory, 2014; Lave & Wenger, 1991). To have a full grasp of concepts, learners must apply those

concepts in authentic social and physical environments through participating in communities of practice (Amory, 2014; Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991). The process of situating learning in a certain context is necessary as the process is modelled and transferred to other activities in which meanings are negotiated and therefore constructed by learners. The social and situated component of learning becomes a critical element for learning to occur.

A Framework for Authentic Learning

With growing interest in designing authentic learning environments, multiple frameworks have developed to understand authentic learning (viz., Newmann & Wehlage, 1993; Slavkin, 2004). Drawing from researchers' different perspectives and contexts, the conceptualization of authentic learning may vary to some extent (Kreber, Klampfleitner, McCune, Bayne, & Knottenbelt, 2007). For example, Newmann and Wehlage (1993) conceptualized five components of authentic learning from pedagogy and instruction perspectives. They contend that authentic learning entails (a) focusing on higher-order thinking as opposed to rote memorization of factual information, (b) involvement in deeper knowledge construction including problem-solving and understanding of complex meaning, (c) connectedness to the larger real-world social context, (d) engagement in substantive conversation, such as discussion and sharing of ideas and dialogue, and (e) inclusion of social support for all students to achieve high expectations.

In Slavkin's (2004) book, educators provided six requirements to achieve authentic learning: (a) teachers must be able to help students accurately review experiences, (b) skills may be difficult to apply to new settings, (c) authentic pedagogy needs complex and authentic tasks, (d) responsibility for learning is shared between teacher and student, (e) there are multiple ways to look at material, and (f) both teacher and student must be involved in ensuring learning occurs and information is applied practically (p. 9).

In reviewing several frameworks of authentic learning, a checklist of 10 characteristics of authentic activities developed by Herrington, Oliver, and Reeves (2003) was selected for this study. Their framework, as adopted, is a holistic and detailed framework to understand what authentic learning means and presents a checklist of guidelines for designing authentic learning activities (Hossainy, Zare, Hormozi, Shaghaghi, & Kaveh, 2012; Teräs, Teräs, & Herrington, 2012). The 10 characteristics described in the framework are:

1. Authentic activities have real-world relevance
2. Authentic activities are ill-defined, requiring students to define the tasks and sub-tasks needed to complete the activity.
3. Authentic activities comprise complex tasks to be investigated by students over a sustained period of time.
4. Authentic activities provide the opportunity for students to examine the task from different perspectives, using a variety of resources.
5. Authentic activities provide the opportunity to collaborate.
6. Authentic activities provide the opportunity to reflect.

7. Authentic activities can be integrated and applied across different subject areas and lead beyond domain-specific outcomes.
8. Authentic activities are seamlessly integrated with assessment.
9. Authentic activities create polished products valuable in their own right rather than as preparation for something else.
10. Authentic activities allow competing solutions and diversity of outcome. (Herrington et al., 2003, p. 61)

Study Purpose

In this study, the instructional design framework for authentic learning (Herrington, et al., 2003) was used to develop an online course for pre-service teachers. The authentic activity designed for this class was to have the pre-service teachers design an online course for their own students that also incorporated authentic activities. Furthermore, as authentic activities are motivating to learners (Martens, Gulikers, & Bastiaens, 2004) it was anticipated that these activities would have the pre-service teachers motivated to learn in the class. The three research questions that guided this study are:

1. How was Herrington et al.'s (2003) framework used to integrate authentic activities into the design of an online course for pre-service teachers?
2. What were the pre-service teachers' perceptions of the online authentic learning experiences?
3. How did technology facilitate the authentic online learning process?

Methods

Design-Based Research

In this study, we followed a design-based research methodology (Wang & Hannafin, 2005), which is a pragmatic research approach that involves the planning, designing, implementation, and evaluating of a teaching intervention aiming at delivering outcomes that are constructed in real-world contexts (Middleton, Gorard, Taylor, & Bannan-Ritland, 2008; Wang & Hannafin, 2005). This design-based research approach is of critical value to improving curriculum development, renovating instructional strategies, and reassessing learning. Through incorporating the authentic learning activities as a teaching intervention, the aim was to improve course design. This design-based research methodology involves constant reflection and revision. This study involved two macro cycles.

Participants

A total of 48 undergraduate pre-service teachers took part in this study. The first macro cycle had 22 students and the second macro cycle had 26 students. The participants were all enrolled in a teacher education program at a large Midwestern university in the United States. Since the two cycles took place in the same course of a difference session, general characteristics of participants in each session were comparable in terms of age, grade level, and major of study. There were 28 males and 20 females

of ages 18 to 22 years. They were younger generation college students born in the 1990s. These students are considered Millennials who are relatively technology-savvy and have many areas of their lives connected to the online world (Florida, Kaimal, Oblinger, & Blessing, 2003).

According to data from the pre-survey, participants in this study were self-reported to have a medium level of technological capability. Approximately half of the participants were comfortable with using web technologies in their learning. The responses showed that 14 of 48 participants were familiar with some web design programs, such as Google Sites, Front Page, and Weebly. More than half of the participants (27 of 48) have used some forms of textual, graphic, and video tools to create content for the web. A majority of them (45 of 48) recognized some benefits of online learning in current K-12 education. Participants believed that online learning could be effective as a supplement to traditional classroom learning in K-12, but they also pointed out that it should not be a completely replacement for classroom education.

Table 1

Participants' Prior Experience of Using Online Applications

Items	Mean (cycle1)	SD (cycle1)	Mean (cycle2)	SD (cycle2)	Mean (total)	SD (total)
1. What is your comfort level in using web-based technology?	2.5	.95	2.5	.95	2.5	.95
2. How often do you engage in learning a new online application?	3.6	.94	3.04	1.22	3.28	1.13
3. How familiar are you with using free and/or open source web building applications?	3.65	1.18	4.04	1.19	3.87	1.19

1= very comfortable/very often/very familiar, 5= Not comfortable/Not often/Not familiar

Instructional Context

The undergraduate course in which the five instructional activities were implemented for a college-level hybrid course designed for pre-service teachers seeking licensure to teach in K-12. There were two sessions of the same course involved in this study. The major purpose of this course was to acquaint pre-service teachers with technology applications commonly found in educational settings. Each week the pre-service teachers were to use one technology application taught that week to create an instructional artefact. The class met three times face-to-face throughout a 15-week semester and the remaining course work was completed online.

Procedures

The study took place in two sessions of the same course taught by two different instructors in Spring 2013. The first instructor implemented the instructional activities in the first half of the semester, while the second instructor implemented those activities with modifications suggested from the first instructor in the second half of the semester. This study was made up of two macro cycles. The first

macro cycle was in the first half of the semester and the second macro cycle was in the last half of the semester. Each macro cycle had shorter mini cycles that were ongoing. In other words, each teaching episode (each weekly class) had changes that were implemented immediately after each episode so the students benefited immediately from those changes.

At the beginning of the first macrocycle, a standardized pre-survey was used to gather information on the pre-service teacher's prior experience and perceptions of online teaching. This was conducted to better understand the learners' needs and characteristics prior to the start of class to support in the design of the authentic learning activities. To introduce the pre-service teachers to the authentic learning task, they were told that they had a student in class that was unable to attend the face-to-face class for one month due to a medical condition. The pre-service teachers were told to use Weebly, a web-based drag-and-drop website builder, to build a month-long online course for that student. Learning activities had to include four weeks of instruction supporting either math, science, English, recreation, and/or computer literacy activities. The learning activities should be enhanced by various technical web applications.

Participants were given two weeks to learn Weebly using web-based tutorials and videos, then they created the online course over a period of three weeks. Upon completion of the website, participants were instructed to review two peers' websites and use a screen-capturing technology to provide comments to other participants. Finally, the pre-service teachers wrote a blog and responded to a post-survey about their experiences and opinions about the class they had taken. Students were given prompts to reflect on the authentic activities in the blogging platform. The second macrocycle followed the same structure of activity implementation, with pre- and post-class surveys being distributed before and after the authentic learning activities. Due to the voluntary nature of data collection, we only received 38 post-class survey responses in total.

Data Collection and Analysis

Data were collected from a pre-class survey, a post-class survey, and student blogs. These data were collected and analysed throughout the two macro cycles. The pre-class survey aimed to investigate participants' prior experience and perception of online teaching as well as technology integration. The survey entailed three Likert-scale questions asking to collect data on the participants' comfort level, familiarity, and frequency of using web-based technology on a scale of 1 to 5, ranging from 1 = high level of usage to 5 = low level of usage. The post-class survey had two parts. The first part consisted of five open-ended questions asking participants their perceptions on their learning experiences with a focus on whether they acknowledged the benefits of different elements in the authentic learning design and the possibilities of online teaching. Three Likert-scale questions were used to discover participants' overall perception of their online learning experience and their prospective incorporation of content. The second section of the survey focused on the use of technology, especially in the peer review activity. Open-ended questions were also asked to provide more interpretive data to the quantitative ratings.

Two of the researchers coded using 10 *a priori* codes (Stemler, 2001) developed by Harrington et al. (2003) to investigate the participant responses and then met to discuss inter-rater consistency. Initial discrepancies were discussed until consensus was achieved. Quantitative data was measured by calculating the means and standard deviations of participant ratings on their perception of each

activity in the survey. The after-class blog posts were analysed to further identify the perceived benefits and challenges of incorporating authentic online learning activities.

Findings

The purpose of this study was to answer the three research questions and the findings are organized accordingly. As a reminder to the reader, the findings of design-based research focus on the design of the learning activities that the pre-service teachers engaged in. Therefore, the findings, especially for research question one describe the learning activities, any changes that need to be made to the instructional design, and how effective those approaches were in meeting the learning objectives.

RQ 1: How Did the Authentic Learning Framework Integrate Into the Instructional Design of Learning Tasks?

As changes were made to the instructional design in the macro cycles, RQ 1 show the changes that were made at the completion of macro cycle 2 to better integrate with Herrington et al.'s authentic learning characteristics. Herrington et al.'s (2003) authentic learning characteristics advanced a practicable framework for the instructional design and guided development of several learning tasks of real-world relevance that would add to participant's professional experience. All participants used Weebly to construct their own authentic learning context, which was the online course within their specified area of K-12 instruction. The course was designed to have the instructors encourage the pre-service teachers to look beyond traditional pedagogic methods of teaching and curriculum development and more toward ideas for leveraging the web to supplement classroom instruction. A sample of the final project tasks and how they align to the authentic learning characteristics are articulated below:

Authentic activities have real-world relevance. The pre-service teachers developed an online course for a student who did not have access to face-to-face classroom instruction due to illness. This is one real-world reason that teachers may have to provide to their future students. From the pre-service teacher responses, it appears that they understood that although they may not wish to apply for online teaching positions, that even in traditional face-to-face classrooms they may need to have this skill to do this for some students in their future classes. From surveys it also appears that the pre-service teachers were highly motivated to engage in these tasks as they saw the real-world benefit to their future careers.

Authentic activities are ill-defined, requiring participants to define the tasks and sub-tasks needed to complete the activity. From the blog posts and survey it appears that allowing the participants to be flexible in the creation of both learning environment and instructional content is a reflection of the authentic learning characteristics defined by Herrington et al. (2003). Given that the project scenario lends responsibility to the participants to assume the role of creative educator providing an online learning environment, it was necessary to give the pre-service teachers full encouragement to move beyond individual specializations and contentment, thus exposing them to a new world of digital possibilities.

Authentic activities are comprised of complex tasks to be investigated by participants over a sustained period of time. Over the period of five weeks, project participants were responsible for adding content and revising educational content to fit within their online learning sites. The first week involved learning Weebly and researching accessible file formats that

could either be linked or uploaded as stand-alone items. Another week included themed lesson plans such as *American History*, at which time participants were required to structure an online lesson plan using a selection of fact-based digital slides or instructional videos that focused on a historical event. Each lesson would be followed by an assessment delivered through the online learning site. The participants' blog responses and open-ended comments showed the pre-service teachers understanding of this process building over time. For example, one participant commented, "My concerns before the project was how much time it was going to take, and making great lesson plans for my student. After the project I was just relieved to see that my hard work paid off and I believe I created a really good site."

Authentic activities provide the opportunity for participants to examine the task from different perspectives, using a variety of resources. The researchers allowed plenty of opportunities for participants to examine the task and provided a wide variety of resources to guide the pre-service teachers towards success. Oftentimes educators may have to explore a variety of tools to assure that they fit within the context of the lesson or learning environment. The pre-service teachers were also provided with multiple types of modelling, including worksheets, guidelines, exemplar websites, and demonstrations of how to work with specific types of technologies through video conferencing and online tutorials. Participants reported in the blogs and the survey responses that approaching the task from different angles and attaining a wide variety of resources prepared them better for future teaching practice. As one participant noted, "In preparing this eLearning site it really made me feel like a teacher. It was great practice for something I could very well be doing in the future."

Authentic activities provide the opportunity to collaborate. Throughout the project sequence, the pre-service teacher participants were given several opportunities to collaborate in groups to discuss each other's website. First, they were grouped into different units of three to five people with similar interest and disciplinary background. Later, participants were encouraged to use varying technologies to facilitate the collaboration process, such as wikis, Twitter, and blogs hosted by the instructors. From the surveys, a great number of participants revealed that they enjoyed the peer assessment activity where they were allowed to provide rich feedback and insights to each other and help their peers to improve their websites. When providing feedback for one another, it also offered an opportunity for them to see their own work from a different lens. For example, one student commented, "the [peers'] comments allowed me to see some constructive criticism about my website from someone else's perspective." The pre-service teachers also reported that they adopted the peer feedback and used it to make enhancements to their own sites accordingly, prior to submitting their final version.

Authentic activities provide the opportunity to reflect. Participants were given multiple opportunities to reflect upon what was learned and articulate their rationale for content decisions. Throughout the process of creating the online learning site, participants were required to update their blogs on a weekly basis with information pertaining to the course or project in general. A hosted wiki page was created so that participants could add their site link for open review by both class members and the course instructor. In doing this, participants benefited from direct comments from the instructor and even gained insights from viewing their classmates' sites. Specific problems and issues of the website were easily identified, brought about, and later addressed subsequently through this periodic review afforded by blogs and wikis. For example, some pre-service teachers

pointed out in the surveys that the superiority of using hyperlinked buttons instead of posting an extended list of pure text-based links. They also commented that the blogging activity provided them ample opportunities to think more in-depth of all the activities as a whole and the comments they received from peer review activity helped them perceive their own work from a different perspective.

Authentic activities can be integrated and applied across different subject areas and lead beyond domain-specific outcomes. The assignment was designed to promote learning outcomes from varying disciplines and domains and to enhance pre-service teachers' engagement through involving them in diverse roles and practicing different expertise. The pre-service teachers were also required to submit a project description, which enunciates the division of work according to each group member's specialization and expertise. The peer review activity again switched participant' roles from a collaborator to a reviewer, enabling them to use their own knowledge and expertise to provide peer feedback for one another. As one participant elaborated, "I think that the peer review comments helped me improve my online learning site. I didn't really think about some of the things that they mentioned beforehand so it was nice to see what others thought from their point of view. Also when making a website you don't really see things as confusing since you created it, but hearing other people's opinions really helps."

Authentic activities are seamlessly integrated with assessment. Both formative and summative assessments were integrated into multiple authentic activities in the online learning assignment. Throughout the website design and development process, instructors provided periodical check-ups and maintained continuous monitoring of the pre-service teachers' website progress using varying types of technologies. Formative assessment in the form of informal feedback conversations, praise, and constructive criticisms frequently occurred on multiple technology platforms, such as on the Twitter microblogging platform, Blackboard learning management system, as well as email announcements and asynchronous communication. Instructors provided immediate feedback through these technologies once issues and questions were spotted. When pre-service teachers reached the final stage in which the final website was turned in electronically, instructors gave grades and comments using the pre-designed rubrics as the final round of summative assessment. Our survey responses and blogs data revealed that the pre-service teachers benefited tremendously from the both instructor-provided feedback and the peer review activity.

Authentic activities create polished products valuable in their own right rather than as preparation for something else. The pre-service teachers were informed at the beginning of the class and then continually reminded that their assignment had to be a piece of polished work for their prospective job seeking purposes. Competency in using the prescribed technologies and evaluation of participant choices would serve as the assessment, as well as the completed online learning website. Their final work had to be submitted in an electronic portfolio system and evaluated by external evaluators. This would assure that real-world examples of technology integration in educational content could be presented to potential employers, thus serving as a testament of the pre-service teachers' technical abilities. As one participant noted in the survey, "I really enjoyed this assignment. I thought it was helpful for me to see how much hard work and planning it takes to put together lesson plans." Another participant commented that the assignment aligned extremely well with a real life situation and he could see himself using the website he created for a future class.

Authentic activities allow competing solutions and diversity of outcome. The assignment promoted learning outcomes from both cognitive and affective learning dimensions. From cognitive learning perspective, the project provided ample opportunities for the pre-service teachers to comprehend the notion of online teaching, apply different learning theories and models into designing the online learning website, practice the skills of using various educational technologies, and evaluate their peer projects' from different angles. The pre-service teachers' metacognitive learning was also enhanced through continuous reflection using blogs, wikis, and the summative peer review. Participants' affective learning outcomes expected from the authentic activities include an increased motivation and appreciation of online teaching as a newly-emerging teaching method. When participants were asked "Did learning to build an eLearning support site make you more comfortable with the possibility of teaching online in the future?" 30 out of 38 expressed a positive response.

RQ 2: What Were the Pre-Service Teachers' Perceptions of Their Learning Experiences?

Overall, the pre-service teachers' responses to the survey revealed their positive learning experience during these authentic activities in this assignment as most participants agreed that this experience increased their comfort level in creating an online learning environment with authentic tasks for a K-12 audience or other group setting. From the surveys and blogs this section articulates the themes that were revealed from analysing the post class surveys and blogs.

Real-life relevance. Real-life relevance emerged as a key theme when the pre-service teachers were asked about the perceived merits and drawbacks of this project. The project scenario was strategically posed to evoke a meaningful activity that simulates a potential real-life situation of which each would have to provide a remedy. When asked about their feelings toward the project scenario and how well it aligned to a real-world situation in a K-12 setting, the general consensus was positive. For example, one pre-service teacher commented on the future value in saying "I thought the real-life scenario was really helpful because it made the assignment more practical and made me want to invest more in the project because I could see how I may be in a similar situation at some point in the future."

Constructive learning. The pre-service teacher responses to the question "What did you like most about building the online learning content?" revealed that they favoured the constructive learning opportunities supported by the authentic learning activities. About half of the participants commented that they enjoyed being able to construct their own website that represented their own knowledge and skill construction. As one participant explained, "I liked the aspect of constructing your own material and lesson plan all online rather than just in person." Another noted "I always enjoyed adding content and coming up with ways to incorporate things into the website. The authentic learning project, building an online learning website, enabled us to engage in a fun, active, social process that involves deep levels of constructive learning." Participants also acknowledged that because they were given full control of the design process, they were more motivated and autonomous in creating the website. As one participant commented, "I was able to create the site the way that I wanted to and had imagined the website layout to look like. I had full control, and to be honest, it was fun making your own website."

Collaborative learning. Collaborative learning was mainly enhanced through the peer reviewing activities. Overall, participants perceived a high value of feedback received from their peers. Peer feedback not only contained useful suggestions to improve the content materials of their websites, but also concerned the visual design and multimedia integration. In the open-ended questions, five did point out the feedback they received was rather superficial. As participants stated, "there were really not many suggestions for improvement." Table 2 show the participant ratings on how they perceived feedback from their peers.

Table 2

Participant Ratings on Perceptions of Feedback Received From the Peer Review Activity

Items	Mean	SD
1. The feedback from my peer reviewers helped me to improve the content materials of my site.	3.81	0.66
2. The feedback from my peer reviewers helped me to improve the visual design of my site.	3.78	0.67
3. The feedback from my peer reviewers helped me to improve multimedia integration of my site.	3.78	0.79
4. In the peer review activity, my peer reviewers used supportive languages.	4.19	0.57
5. In the peer review activity, my peer reviewers provided constructive feedback.	4.22	0.63
6. In the peer review activity, my peer reviewers provided me useful suggestions.	4.19	0.62

1 = strongly disagree; 2 =disagree; 3 = neutral; 4 = agree; 5 = strongly agree

Use of technology. The pre-service teachers also reported that the technologies used in this project helped to enhance their technical competencies, while improving upon methods to create educational content in the future. One participant stated, "I really enjoyed learning how to create a website and add content that fits into how I would like to teach English one day." In addition, one of the respondents shared his enthusiasm for learning a new web development tool by stating, "I think that it was a good learning experience and when I was finished I felt really accomplished. I think I will try to incorporate this tool in the future." It appears that the participants were not just learning how to use technology applications, but how to use the authentic ways to build pedagogically sound activities through learning technologies.

Perceptions of online teaching. When pre-service teachers were asked about their future online teaching possibilities, there remained a favourable response for the likelihood of developing an online learning website in the future (Mean=3.78; SD=.97) and even suggesting an online support environment to a friend or colleague (Mean=3.76; SD=.98). Responses from open-ended questions also support this result. A majority of participants noted their awareness of future online teaching possibilities and their newly developed competencies of building an educational support site, advanced through this assignment. For example, one participant commented, "I am not the most tech savvy person so the thought of teaching online used to scare me. However, now that I know how to do

so much more and feel much more confident in my abilities, I would be willing to teach online without hesitation."

Other participants still preferred face-to-face classes as one participant responded, "I think it made me more comfortable in terms of using the online programs, but I wouldn't consider using it because I feel it takes away from the crucial element of face-to-face human interaction." The inclusion of the online learning component enriched the learning experience, thus bringing forth an awareness of a potential future possibility with creating online content and teaching online. However, to reach pre-service teachers' maximal comfort level and competence of online teaching, much professional training and development is needed along the way.

RQ 3: How did Technology Facilitate the Authentic Learning Process?

Selective combinations of web-based technologies were used to both facilitate and enhance the authentic learning process for the pre-service teachers. The researchers' goal of aligning the proper technology to the instructional design was critical. Blackboard was used for course management, but several Web 2.0 applications were leveraged to enhance collaboration and instructor and participant feedback.

A class wiki page was developed using Wikispaces, a website that allows a community of developers to contribute and edit content. For this project, it provided a platform that afforded multiple participants the opportunity to present their site in an open format for classmates to review and comment on. Additionally, each participant was required to journal their activities in a weekly blog, of which could be viewed by everyone, including people outside of the course. During this project, WordPress, a free online blogging application, was used as the platform for publishing the blog. In doing such, each participant was able to discuss their difficulties during the creation of the website and other tasks, as well as their triumphs when overcoming each challenge.

Technologies were also used extensively for providing peer feedback on the online learning websites. Table 3 presents the pre-service teacher's responses to the peer reviewer's comments and supplemental technologies used for their feedback. It was found that the comments and suggestions provided through support of these digital technologies were useful and assisted with the improvement and completion of the project. The pre-service teachers reported that they were highly engaged in the process of providing and receiving feedback owing to the technology integration.

Table 3

The Pre-Service Teachers' Ratings of the Technology Integration in the Peer Review Activity

Questions	Mean	SD
1. The technologies used in the peer review activity made me concentrate on the review task.	3.89	0.74
2. The technologies used in the peer review activity engaged me in the process of providing and receiving feedback.	4.08	0.80
3. The technologies used in the peer review activity made the task fun and enjoyable.	3.84	0.90

1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree

Discussion

The analyses of participant responses to their experiences in developing an online learning site, in concurrence with integrating Web 2.0 technology for collaboration and feedback yielded evidence that meaningful authentic learning activities are beneficial in the context of pre-service teacher training. Prior to the course project, participants were knowledgeable of the benefits afforded to K-12 education through online learning, but were deficient in using Web development tools and other collaboration technologies for the purpose of teaching and learning. Incorporating Weebly into the authentic learning experience augmented the pre-service teachers' ability to plan and implement a real-world online learning environment, which could also be used to supplement a face-to-face course. Empowering pre-service teachers' to be creative in choosing learning resources for their online learning site and not restricting their choices to venture outside of instructor requirements added further bearing to the essence of authentic learning principles posed by Herrington et al. (2003).

Web 2.0 technologies were used for peer collaboration and feedback as part of the activities. The use of a personal blog, Wikispace, and Voicethread activities, were perceived as useful and supportive components for receiving feedback on the site progress. However, some participants did feel as though their peer comments lacked the critical feedback necessary to compel them to make significant changes to their site. In these instances, the peer comments were not detailed enough, or they were unsure of what was actually being critiqued on their project. Designing a peer assessment activity with broader review objectives may assist participants in giving the appropriate level of feedback within the needed areas. There may also be a need for the instructor to allocate more time in assuring that feedback tools are used in a proper manner, which concurs with prior studies emphasizing the importance of instructional guidance in Web 2.0-supported learning (Holotescu & Grosseck, 2009; Luo & Gao, 2012). Another challenge perceived by the pre-service teachers included balancing the amount of content they would place on the online learning site. While the instructor's goal was to give them freedom in creating and adding a variety of educational content to their website with minimal restrictions, some participants concluded that the nominal requirements felt overwhelming to manage and too time consuming. These inferences may have been due to the pre-service teacher's dearth of experience in developing curriculum at the time. The course section did consist of varying academic levels. Categorizing course participants by academic level, or even commingling teams with an advanced level participant acting as group mentor, may help with balancing out the development of relevant learning activities that would be suitable for a K-12 audience.

The instructor's intent to build an awareness of web building and digital collaboration tools, as well as expose pre-service teachers to the potential of online learning support in K-12 environments was accomplished through authentic learning activities. By aligning the instructional design to the 10 characteristics of authentic learning, the participants benefited from a meaningful experience that could be directly transferred to professional practice within a classroom or virtual learning environment. Reviewing the participant blog entries and post-survey feedback allowed the instructors to recognize the passion and comfort for digital environments some participants gained during and after the project. Though there were no definitive decisions to use online learning as their primary method for teaching and learning in the future, the project was effective in presenting it as an alternative and an augmentation to their technology skills. Future projects could place more emphasis on exposing pre-service teachers to learning management systems and digital online collaboration

tools in which they will recognize the potential of using technology within the capacity of an online educator.

Conclusion

This study examined the design and evaluation of authentic learning activities in a teacher education learning context. The instructional activities were designed to include authentic learning activities that would provide meaningful experiences for pre-service teachers to convey into professional practice, following Herrington et al.'s (2003) 10 authentic learning characteristics.

Using a design-based research methodology, an online course was designed and the findings explain how that course aligns to Herrington et al.'s (2003) 10 authentic learning characteristics. The findings show that the pre-service teachers perceived the online learning authentic learning activities to be a good introduction to learning how to structure an online learning site, a technical skill in which they would consider using in the future. Their post-activity responses also presented evidence of comfort for using online web building applications as well as prospective desire for online teaching. The study also demonstrated the usefulness of Web 2.0 tools for supporting peer feedback activities and also providing constructive comments. Overall, the pre-service teachers did perceive the Web 2.0 technology supported peer and instructor feedback and that the collaboration tools were also enjoyable to use.

This study, however, is not without limitations. As the study is primarily relied on self-report data, some objective dimensions of pre-service teacher learning, such as performance, were not measured and evaluated. As the study was implemented in one particular setting, generalizations of results and implications from this study were limited. Future research in a different setting or with a disparate participant group may provide further insights on the impact of authentic learning design.

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Does Successful Use of Digital Learning Materials Predict Teachers' Intention to Use Them Again in the Future?

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Abstract

Do perceptions of success in using digital learning materials (DLMs) *regularly* (i.e., several times a week) strengthen (or weaken) teachers' behavioural intentions to use DLMs again? And which psychological factors have a relationship with the intention to use DLMs again? These questions are important in light of stimulating teacher's use of DLMs. To answer this question, teacher "flows" were analysed using crosstabs and multinomial logistic regression. These flows visualize how teachers go from a certain degree of perceived success to a certain strength of behavioural intention. Second, Hayes (2013) process method and structured equation modeling (SEM) techniques were applied to determine the mediating role of attitude, perceived norm, and perceived behavioural control of perceived success on the behavioural intention. The results suggested that the teachers' strength in behavioural intention was in accordance with their perceived success for the case that their self-prediction was positive but that this strength became weaker when teachers' self-prediction was negative. Attitude and perceived norm mediated the effects only when self-prediction was positive whereas perceived behaviour control did this in both cases. Also, there was a direct effect between perceived success and behavioural intention. It is important that teachers get a chance to experience success with the use of DLMs, enabled either by school leaders (regarding in-service teachers) or by teacher training institutions (regarding pre-service teachers). Only then we will see teachers' willingness to use DLMs on a *regular* basis to grow.

Keywords: self-prediction to use digital learning materials, teachers' use of digital learning materials, willingness to use digital learning materials

Introduction

The Wikiwijs initiative launched by the Dutch Ministry of Education, Culture and Science in 2009 aimed to encourage teachers' use of digital learning materials (DLMs) in their educational practices. Previous experience with information and communication (ICT) tools showed that, although the availability of ICT tools in most schools has increased significantly in recent years, this has not lead to more use of these tools (Tondeur, Valcke, & Van Braak, 2008). Furthermore, ICT is still not part of everyday

teaching routines in most schools (Vrasidas, 2015) despite the recognition on many levels (teachers, school leaders, politics) of its importance for learning in the 21st century. In addition, these outcomes are cause for worry for education as well as science. Researchers who want to investigate the effects of the use of DLMs in relation to learning outcomes of students or other related topics only investigate a specific group of teachers. After all, almost all teachers must integrate ICT in their daily teaching practises before valid results can be reported.

The research question addressed was whether perceptions of successful use of DLMs would strengthen (or weaken) teachers' behavioural intentions to use DLMs again during classes on a *regular* basis, that is, several times a week in the coming school year. Indeed, previous research has shown that perceived success of past behaviour is an important predictor of performing the same behaviour in the future provided that all conditions have remained the same (Ouellette & Wood, 1998). In our study we specifically focused on the effect of perceived success of using DLMs *regularly* during classes in the past school year and whether this perceived success would correspond with the strength of teachers' behavioural intention to *regularly* use DLMs during classes in the coming school year. In addition, we also wanted to see whether teachers who reported to have had no plans at all to use DLMs during classes now have developed the intention to do so on a *regular* basis.

In this article, we first elaborate on the Reasoned Action Approach (RAA) of Fishbein and Ajzen (2010) as this was the framework we used throughout our study. We proceed by discussing two analytical methods that were applied in our study, and finally, the results, discussion, and conclusion are presented.

Theoretical Framework

For answering the research question, whether perceived success is affecting teachers' behavioural intention to use DLMs *regularly* in the coming year, the Reasoned Action Approach (RAA) of Fishbein and Ajzen (2010) was used. The central variable in RAA is the behavioural intention that reflects the willingness (or reluctance) to show a particular desired behaviour. In our study, the behavioural intention is the *regular* use (i.e., several times a week) of DLMs by teachers in their lessons in the coming year. Fishbein and Ajzen (2010) indicated that the behavioural intention is a predictor of the actual behaviour; however, the relationship between behavioural intention and actual behaviour is not perfect. Two groups of factors moderate this relationship between behavioural intention and actual behaviour. The first group is formed by individual factors (e.g., the knowledge and skills turned out to be insufficient to perform the behaviour) and the second group is formed by the environmental factors that may prevent the behaviour to be performed (e.g., a broken computer or bad internet connection). The two groups of factors are summarized as actual behavioural control in RAA. Actual behavioural control is the counterpart of perceived behavioural control, which is a direct determinant of behavioural intention. Perceived behavioural control (or self-efficacy, see Bandura, 1986), is the belief that the behaviour can be performed because one trusts in her or his own capacity to do so. This conviction is based in one's belief of possessing the necessary knowledge and skills and the belief that one can exert sufficient control to cope with unexpected problems. Fishbein and Ajzen (2010) designated these beliefs as the capacity and autonomy dimension, respectively, of perceived behavioural control. As the gap is narrowing between perceived behavioural control and actual behavioural control, the relationship between behavioural intention and actual behaviour becomes stronger.

Next to perceived behavioural control, attitude and perceived norm are the other two direct determinants of behavioural intention. Attitude is the extent to which one takes a favourable or unfavourable position in relation to the desired behaviour. In other words, teachers may have formed a more or less favourable position over the *regular* use of DLMs in the classroom. Perceived norm is to be regarded as the pressure exerted by the social environment to exhibit certain behaviour. This social pressure is the result of the belief that significant others may have certain opinions on whether or not to perform a particular behaviour. As the perceived norm becomes stronger, whilst attitude and perceived behavioural control remain constant, the more likely it will be that the behavioural intention also gets stronger. In other words, when a school leader sets the norm of *regular* using of DLMs in class, this will contribute quite strongly to the perceived social pressure and thus to the behavioural intention to actually do this. Figure 1 shows the RAA model. In this figure, the grey areas indicate the variables involved in this study. Although not indicated in the figure, with “use of DLMs” is meant the “*regular* use of DLMs,” that is, several times a week in the coming school year.

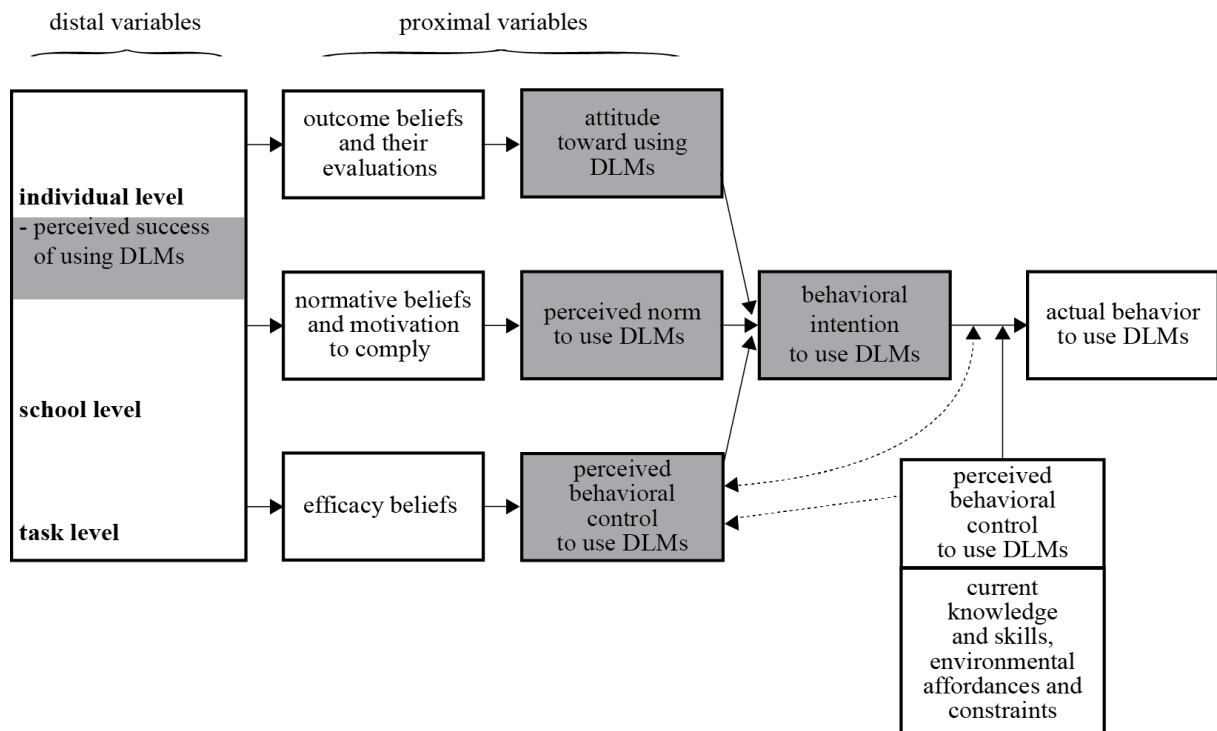


Figure 1. The Reasoned Action Approach applied to teachers' use of DLMs.

Figure 1 also shows that attitude, perceived norm, and perceived behavioural control are in turn formed by successively outcome expectations and their evaluations, normative beliefs, and motivation to comply, and control beliefs regarding the performance of the behaviour. As the current study does not consider these beliefs, we do not describe them here. All the variables so far are usually designated as proximal variables, as they are the closest variables that can influence the behavioural intention to perform or not to perform a certain behaviour (see Figure 1). In contrast to the proximal variables, distal variables are variables that influence the behavioural intention in an indirect way, that is, via the proximal variables. Distal variables exercise their influence at the individual level, the school level, or at the task level. In our study, the only distal variable we considered was perceived success of actual using DLMs *regularly* in the past school year, which is a variable at the individual level. Perceived

success is measured in the eyes of the teacher, in other words: teachers' overall assessment of their own success in using actual DLMS. Perceived success may vary from teacher to teacher. Generally, perceived success of previously performed behaviour affects the three proximal variables in the following ways:

- Attitude: outcome expectations proved to be true or false and their evaluations may be positively or negatively changed through the experience. For instance, teachers may have experienced that using DLMS in the lessons made these classes more interesting and the students more enthusiastic. At the same time, the teacher may have also experienced that the extra time invested in lesson preparation was not as high as expected.
- Perceived norm: experiences may strengthen or weaken motivation to comply with the normative beliefs of significant others. For instance, teachers may become more motivated to comply with the opinion of the school director that teachers should use DLMS *regularly* for a number of reasons, possibly for the same reasons that may have changed the teachers' attitude. If teachers experienced that using DLMS made classes more interesting and that the extra preparation time was acceptable, teachers may find it less of a problem to satisfy the school director's opinion as the use of DLMS regularly may become something they would do anyway.
- Perceived behavioural control: the behaviour could be demonstrated to be carried out, or not, in problematic circumstances. The teacher noted that problems occurred less frequently than was initially thought and that the problems were dissolved more easily than expected (c.f., Hagger, Chatzisarantis, & Biddle, 2001).

Therefore, in this study we expected that the effect of perceived success in using DLMS on behavioural intention is mediated by attitude, perceived norm, and perceived behavioural control.

Research Question and Hypotheses

The main research question was formulated as follows:

Do perceptions of success in using of DLMS *regularly* (i.e., several times a week) during classes in the past year strengthen (or weaken) teachers' behavioural intentions to use DLMS again on the same *regular* basis in the coming year?

From this research question the following hypotheses were derived:

- H1a Teachers who were "successful to very successful" in using DLMS *regularly* during classes in the past year will have a "strong intention" to use DLMS again on a *regular* basis.
- H1b Teachers who had "no to moderate success" in using DLMS *regularly* during classes in the past year will have a "no to a weak intention" or a "moderate intention" to use DLMS again on a *regular* basis.
- H1c Teachers who had "no intention at all" to use DLMS *regularly* during classes in the past year will have a "no to a weak intention" to use DLMS on a *regular* basis.

- H2a The influence of perceived success on the behavioural intention to use DLMs *regularly* during classes in the coming year is mediated by the attitude to do so.
- H2b The influence of perceived success on the behavioural intention to use DLMs *regularly* during classes in the coming year is mediated by the perceived norm to do so.
- H2c The influence of perceived success on the behavioural intention to use DLMs *regularly* during classes in the coming year is mediated by the perceived behavioural control to do so.

To test these hypotheses, the variable self-prediction to actually exhibit the desired behaviour was used in the study. Self-prediction was used as a discriminatory factor in the population to distinguish the group of teachers that predict that they are going to use DLMs on a *regular* basis from the group of teachers that predict that they are not going to use DLMs on a *regular* basis. It is important that self-prediction should not be confused with behavioural intention. Armitage and Conner (2001) indicated that there is a conceptual difference between behavioural intentions and self-prediction: there is a difference between what a person's intention is to do and what someone actually thinks she or he is going to do. They argued this reasoning as follows:

(S)elf-predictions should provide better predictions of behaviour as they are likely to include a consideration of those factors which may facilitate or inhibit performance of a behaviour, as well as a consideration of the likely choice of other competing behaviours. Sheppard et al.'s meta-analysis supported this view: measures of self-predictions were found to have stronger relationships with behaviour (mean $r = .57$) than did behavioural intentions (mean $r = .49$), although attitude and subjective norm accounted for more of the variance in intentions (mean $R = .73$) than self-predictions (mean $R = .61$) (p. 477).

Self-prediction is usually measured by items such as “how likely is it that you are going to perform [behaviour x]?” and behavioural intentions by items such as “do you plan to perform [behaviour x]?”.

Method

Participants

A large number of teachers from all levels of the Dutch education ($N = 1587$) have completed an online questionnaire administered by TNS / NIPO in the Spring of 2012. Table 1 displays the distribution of teachers to the variables school sector, gender, and age.

Table 1

Teachers Distributed Over School Sector, Gender, and Age (N= 1587)

School sector	Gender		Age M (SD)
	man	woman	
Primary	120 (16.3%)	614 (83.7%)	41,9 (12.4)
VET (lower)	142 (60.7%)	92 (39.3%)	45,8 (12.1)
Secondary	134 (50.6%)	131 (49.4%)	42,8 (12.6)
VET (middle)	86 (54.4%)	72 (46.9%)	46,9 (12.2)
Higher education	105 (53.6%)	91 (46.4%)	41,1 (14.1)
<i>Total</i>	587 (37.0%)	1000 (63.0%)	43.3 (12.6)

Measuring Instruments

The questionnaire consisted of a number of measuring instruments in order to investigate the various aspects related to teachers' intended use of DLMs. As no standard validated measurement instrument for each of the variables was available, the researchers constructed measurement instruments for all the variables according to the instructions and guidelines of Fishbein and Ajzen (2010).

Self-prediction for the *regular* use of DLMs during classes was measured with one item: "Do you think that you will use digital learning materials in your lessons / lectures on a *regular* basis in the coming year?" Only a *yes* or *no* answer could be given on this question.

Perceived success was also measured with one item: "To what extent were you actually successful in your intentions to use digital learning materials in your lessons / lectures on a *regular* basis in the past year?" A 7-point Likert scale was used with answer categories: 1 = "completely unsuccessful" to 7 = "completely successful." If teachers did not intend to use DLMs in the past year, they had the option to answer "I had no intention to use digital learning materials."

The behavioural intention was measured using four items (e.g., "I intend to *regularly* use digital learning materials during classes in the coming year"). All items of behavioural intention used a 7-point Likert scale with answer categories: 1 = "absolutely disagree" to 7 = "strongly agree." The four items were in line with the standard items that are commonly used to measure behavioural intention and they were also recommended by Fishbein and Ajzen (2010, also see Ajzen, 1991).

Attitude was not directly measured in this study. Instead, a proxy for attitude was used. Teachers who predicted to *regularly* use DLMs during classes in the coming year could indicate from a structured list of 22 items regarding the potential benefits of DLMs usage which item was applicable to them. These benefits addressed things like, DLMs provide clearer lessons, give more insight, and work better. Similarly, teachers who predict not to *regularly* use DLMs during classes in the coming year could indicate which item was applicable to them from a structured list of 21 items regarding the potential disadvantages of DLMs usage. These disadvantages included, no added value, not necessary, and not useful. The number of advantages and the number of disadvantages that teachers consider to be applicable to them were used to calculate a rating for attitude.

Perceived norm is measured by one item: "All things considered, to what extent do you experience social pressure of your school leader, team leaders, colleagues, parents, and so on to *regularly* use digital learning materials during classes in the coming year?" A 7-point Likert scale was used. The response categories were: 1 = "absolutely no pressure" to 7 = "extraordinary pressure."

Finally, perceived behavioural control was measured with 13 items on two dimensions: capacity and autonomy (see Fishbein & Ajzen, 2010). The capacity dimension comprised six items (e.g., "I think I will manage to use digital learning materials on a *regular* basis"). The autonomy dimension consisted of seven items (e.g., "In most cases it is up to me to determine whether I am going to use digital learning materials or not and whether I am going to do this on a regular basis"). All perceived behaviour control items used a 7-point Likert scale with answer categories: 1 = "absolutely disagree" to 7 = "strongly agree."

Analysis

Table 2 list for each variable the mean (M) and standard deviation (SD) as well as the correlations between these variables.

Table 2

Descriptive Data of the Used Variables (N = 1587).

Variable	Number of items	M	SD	Range	Pearson's r				
					1	2a	2b	3	4
1 Behavioural intention	4	5.03	1.30	1-7	.94 [†]				
2a Attitude (self-prediction = 'yes')	1	1.29	1.13	0-6	.45**				
2b Attitude (self-prediction = 'no')	1	0.29	0.60	0-4	-.47**				
3 Perceived norm	1	2.54	1.50	1-7	.05*	.04			
4 Perceived behavioural control	14	65.00	10.93	22-91	.63**	-.09*			
5 Previous success	1	4.62	2.00	0-7	.59**	.33**	-.11**		.89 [†]
						-.29**			
						.39**			
						-.39**		-.01	.57**

** $p < .01$ * $p < .05$ (two sided)

[†] Cronbachs' alpha

Note 1: Depending on self-prediction, teachers' attitude will have positive or negative wording. Therefore, the analyses were carried out separately for self-prediction = "yes" and self-prediction = "no."

To test the hypotheses, two analytical methods were applied. The first analytical method used cross tabs / multinomial logistic regression for analyzing teachers flows. That is, the relationship between teachers 1) who had perceived some degree of success of actual using DLMS *regularly* during classes in the past year or 2) who had no intention at all in the past year to use DLMS, and how they flow into three ordered categories of different strengths of the behavioural intention to use DLMS *regularly* in the coming year. To this end, we constructed a category of teachers who were "not to moderate successful" of actual using DLMS and another category of those who were "successful to very successful" of this. Teachers who had no intention at all of using DLMS formed a third category. The three ordered categories of different strengths of the behavioural intention were respectively "no to weak intention," "moderate intention," and "strong intention." All categories were constructed by recoding the original data.

The second analytical method used the process method of Hayes (2013) and SEM techniques to analyse the influence of perceived success in the past year on the behavioural intention to use DLMS *regularly* again in the coming year. It was investigated whether perceived success indirectly effected (through the proximal variables attitude, perceived norm, and perceived behavioural control) and / or directly affected behavioural intention. Past research suggests that there could be a direct effect (i.e., the previous use of DLMS had a direct effect on behavioural intention, see Kreijns, Van Acker, Vermeulen, & van Buuren, 2013). It is noted that the teachers who have had no intention at all to use DLMS in the past school year could not be included in this analysis.

This latter implied that for both of the two analytical methods, a distinction has to be made in the population of teachers who predicted that they will use DLMS *regularly* during classes: (self-prediction = "yes"; $n_{yes} = 1221$ for the first analytical method and $n_{yes} = 1173$ for the second method); and the population of teachers who predicted that they will not use DLMS (self-prediction = "no"; $n_{no} = 336$ for the first analytical method and $n_{no} = 262$ for the second method).

First Analytical Method

As pointed out above, we have constructed three categories of teachers based on their previous success in the past year and on the fact that they had no intention at all to use DLMs:

1. The category “had no intention” consisted of teachers who had indicated having no intention at all to use DLMs in the past year ($N_s(1) = 152$).
2. The category “not to moderate success” consisted of teachers who had scored a 1 (= completely failed) to 5 (= somewhat successful) ($N_s(2) = 783$).
3. The category “successful to very successful” included teachers who had scored a 6 (= successful) or a 7 (= completely successful) ($N_s(3) = 652$).

We also constructed three categories for the behavioural intention to use DLMs *regularly* in the coming year:

1. The category “no to weak intentions” included the scores between 1 and 4.3 ($\approx \frac{1}{3}$ of the volume). The number of teachers who fell into this category was referred to as $N_i(1)$.
2. The category “moderate intentions” included the scores between 4.4 and 5.75 ($\approx \frac{1}{3}$ of the volume). The number of teachers who fell into this category was referred to as $N_i(2)$.
3. The category “strong intentions” included the scores between 5.8 and 7 ($\approx \frac{1}{3}$ of the volume). The number of teachers who fell into this category was referred to as $N_i(3)$.

Depending on the Unit of Analysis (UoA) and the analysis techniques used, different teacher flows could be determined. For the analyses, both the individual teacher and the teacher group as UoA was used. When the individual teacher was the UoA, multinomial logistic regression was used; and when the teacher group was the UoA, crosstabs was used. The resulting teacher flows are reported in Table 3. From this figure, and for the case of a positive self-prediction (i.e., teachers predict that they are going to use DLMs on a regular basis), we clearly see that the teachers' flows using crosstabs were above expectations except for the group teachers who were successful or very successful. The group teachers who initially had no intention to use DLMs showed a moderate intention to use DLMs *regularly* in the coming year, whilst it was expected that this group would have a no to weak intention. The group of teachers who had no or moderate success, showed a strong behavioural intention to use DLMs *regularly* in the coming year, whilst it was expected that this group would have a no to weak intention or a moderate intention. For the case of a negative self-prediction (i.e., teachers predict that they are not going to use DLMs on a regular basis in the coming year), all teacher flows were according to our expectation.

For the individual teacher as the UoA, multinomial logistic regression in SPSS version 20 was performed to study the influence of perceived success (i.e., “had no intention,” “not to moderate success,” and “successful to very successful” in the past year) and whether or not the teacher predicted to use DLMs *regularly* during classes in the coming year (i.e., “yes” or “no”) on teachers' behavioural intention to have a “no to weak,” “moderate,” or “strong” behavioural intention. Self-prediction to use DLMs *regularly* in the coming year was a covariate categorical variable. The full model was statistically significant: $\chi^2(6, 1587) = 752.50, p < .001$. In other words, the model was capable to significantly distinguish teachers who expressed having a “no to weak,” “moderate,” or “strong” behavioural

intention from each other on the basis of perceived success and self-prediction with a statistically explained variance of about .40 (Cox & Snell Pseudo R-Square = .38 and Nagelkerke Pseudo R-Square = .43).

Table 3

Overview of Teachers Flows

UoA (analysis)	No to weak intention		Moderate intention		Strong intention	
	Group (crosstabs)	Individual (multinomial logistic regression)	Group (crosstabs)	Individual (multinomial logistic regression)	Group (crosstabs)	Individual (multinomial logistic regression)
Self-prediction = 'yes'						
'Had no intentions'	0	26	48	14	0	8
'Not to moderate success'	0	156	0	293	559	110
'Successful to very successful'	0	40	0	188	614	386
Self-prediction = 'no'						
'Had no intentions'	104	98	0	6	0	0
'Not to moderate success'	0	149	224	66	0	9
'Successful to very successful'	0	13	0	16	38	9

To gain more insight, Figure 2a and Figure 2b were constructed to visualize the teachers flows (UoA is the individual teacher).

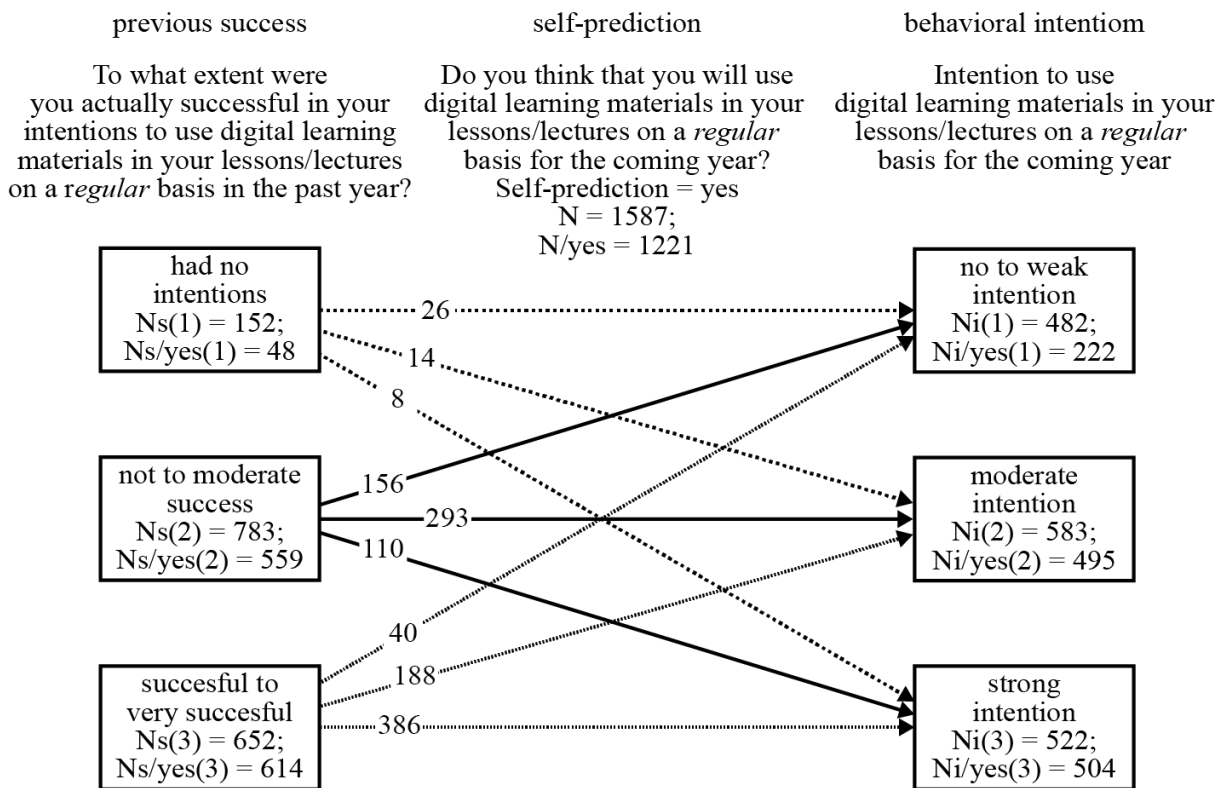


Figure 2a. Teachers flows for the population of teachers who predicted that they will use DLMs regularly during classes.

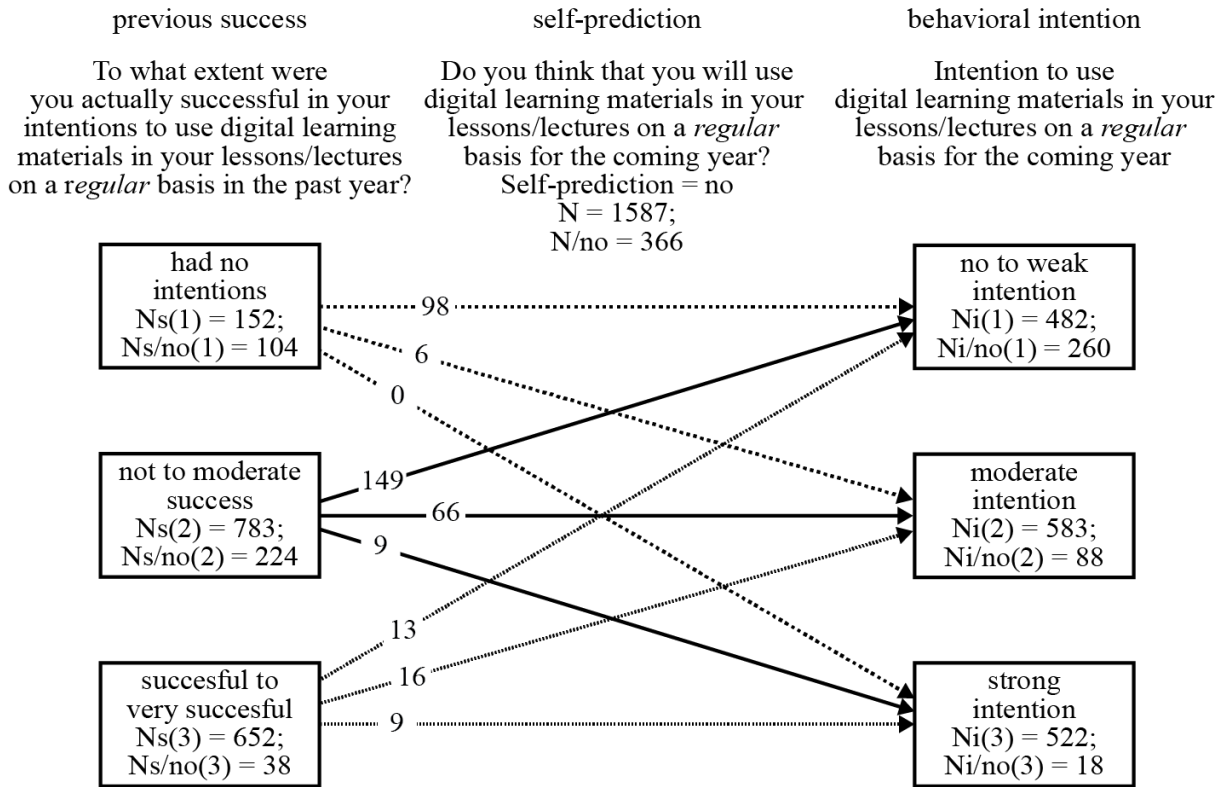


Figure 2b. Teachers flows for the population of teachers who predicted that they will not use DLMs *regularly* during classes.

From the teacher population who predicted that they will use DLMs *regularly* during classes in the coming year, the majority of teachers in each category proved—as was expected—to flow into the corresponding categories (i.e., “had no intention” flowed into “no to weak intention,” “no to moderate success” flowed into “moderate intention,” and “successful to very successful” flowed into “strong intention”). However, other flows were—as was not expected—also be possible. For example, it was surprising that from this population of teachers, some of the teachers who fell in the category “successful to very successful” flowed into the category “moderate intention” (188 of the 614 teachers) and into the category “no to weak intention” (40 of the 614 teachers). Likewise, it was surprising that teachers who fell in the category “had no intention” and, thus, had no experience of success in using DLMs whatsoever nevertheless decided to express a “strong intention” (8 of the 48 teachers) to use DLMs *regularly* in the coming year.

In line with our expectations, from the teacher population who predicted that they will not use DLMs *regularly* during classes in the coming year, the majority of teachers in each category developed a corresponding “no to weak intention” or a “moderate intention” to use DLMs *regularly* in the coming year. But here too there were unexpected flows. Teachers who were “successful to very successful” surprisingly flowed into the category “no to weak intention” (13 of the 38 teachers).

The reasons for all of these unexpected flows were further explored in the next analyses (see the next section).

Second Analytical Method

To determine the direct and indirect (via the proximal variables attitude, perceived norm, and perceived behavioural control) effects of success on the behavioural intention, we followed the Hayes process method (2013, also see Preacher & Hayes, 2008) and used the associated PROCESS macro package SPSS (Hayes, 2012). In this analysis, the original categories for previous success and behavioural intention, and not the three constructed categories from the first analytical method, were used. Consequently, the population of teachers who “had no intention” to use DLMs *regularly* in the past year ($N_{s(1)} = 152$) were not included in the analysis. This exclusion affected the composition of the sample. For the sake of completeness, the following tables (Table 4 and Table 5) give the background data of the remaining $N = 1587 - 152 = 1435$ displayed. Comparison of the two tables with the backgrounds of the teachers shows hardly any differences in values and standard deviations. However, the average age is slightly higher in the smaller sample.

Table 4

Teachers Distributed Over School Sector, Gender, and Age (N= 1435)

School sector	Gender		Age M (SD)
	Man	Woman	
Primary	115 (17.0%)	560 (83.0%)	44,9 (12.5)
VET (lower)	137 (63.1%)	80 (36.9%)	46.4 (12.0)
Secondary	122 (51.0%)	117 (49.0%)	42,8 (12.6)
VET (middle)	77 (54.6%)	64 (45.4%)	47.0 (12.0)
Higher education	88 (54.0%)	75 (46.0%)	44.5 (14.0)
<i>Total</i>	<i>539 (37.6%)</i>	<i>896 (62.4%)</i>	<i>43.5 (12.6)</i>

As can be seen in Table 5 the values for the mean (*M*), standard deviation (*SD*) of the variables, the correlation between the variables, and Cronbach's alpha values for internal consistency proved to be of minimal difference between the samples (compare Table 2 with Table 5).

Table 5

Descriptive Data of the Used Variables (N = 1435).

Variable	Number of items	M	SD	Range	Pearson's r			
					1	2a	3	4
1 Behavioural intention	4	5.20	1.16	1-7	.93 [†]			
2a Attitude (self-prediction = 'yes')	1	1.39	1.12	0-6	.40**			
2b Attitude (self-prediction = 'no')	1	0.23	0.54	0-4	-.40**			
3 Perceived norm	1	2.60	1.50	1-7	-.01 *	.01		
4 Perceived behavioural control	14	65.75	10.68	22-91	.63**	-.05		
5 Previous success	1	5.11	1.39	1-7	.59**	.29**	-.15**	.89 [†]
						-.24**		
						.36**	-.04	.58**
						-.37**		

** $p < .01$ * $p < .05$ (two sided)

[†] Cronbach's alpha

Note. Depending on self-prediction, teachers' attitude has a positive or negative wording. Therefore, the analyses were carried out separately for self-prediction = “yes” and self-prediction = “no.”

The Hayes (2013) process method for mediation tests the following four relationships:

1. Whether there is a significant direct relationship between the mediator (i.e., attitude, perceived norm, or perceived behavioural control) and the dependent variable (i.e., behavioural intention).

2. Whether there is a significant direct relationship between the independent variable (i.e., previous success) and the mediator.
3. Whether there is a significant indirect effect of the independent variable on the dependent variable via the mediator.
4. Whether the direct effect of the independent variable on the dependent variable remains significant after controlling for the mediation effect (in other words, whether there is full or partial mediation and, thus, whether a direct effect is present next to the indirect effect).

The analysis was performed twice: for the population of teachers who predicted that they will use DLMs *regularly* during classes in the coming year and for the population of teachers who predicted to not do so.

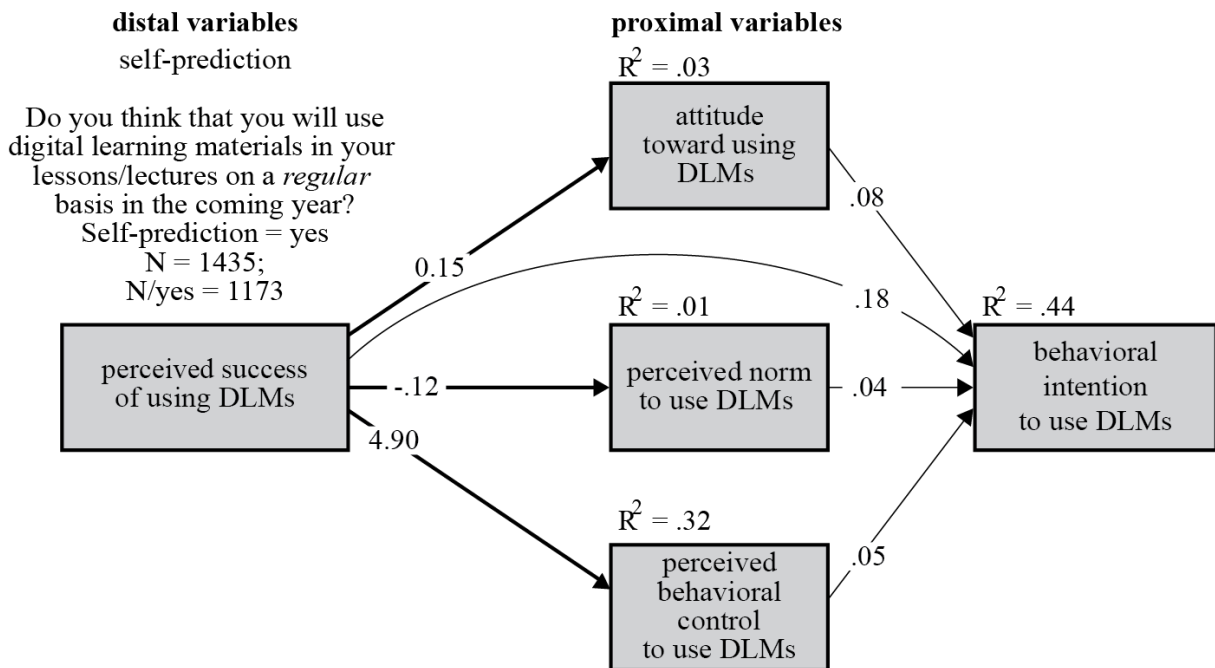


Figure 3a. Results of the mediation analysis of the model for the case that self-prediction = “yes.” The displayed (unstandardized) path coefficients are significant at $p < .001$ level. Non-significant paths are shown grey in the figure. Thick black lines reflect the indirect effect of the distal variable via the three mediators.

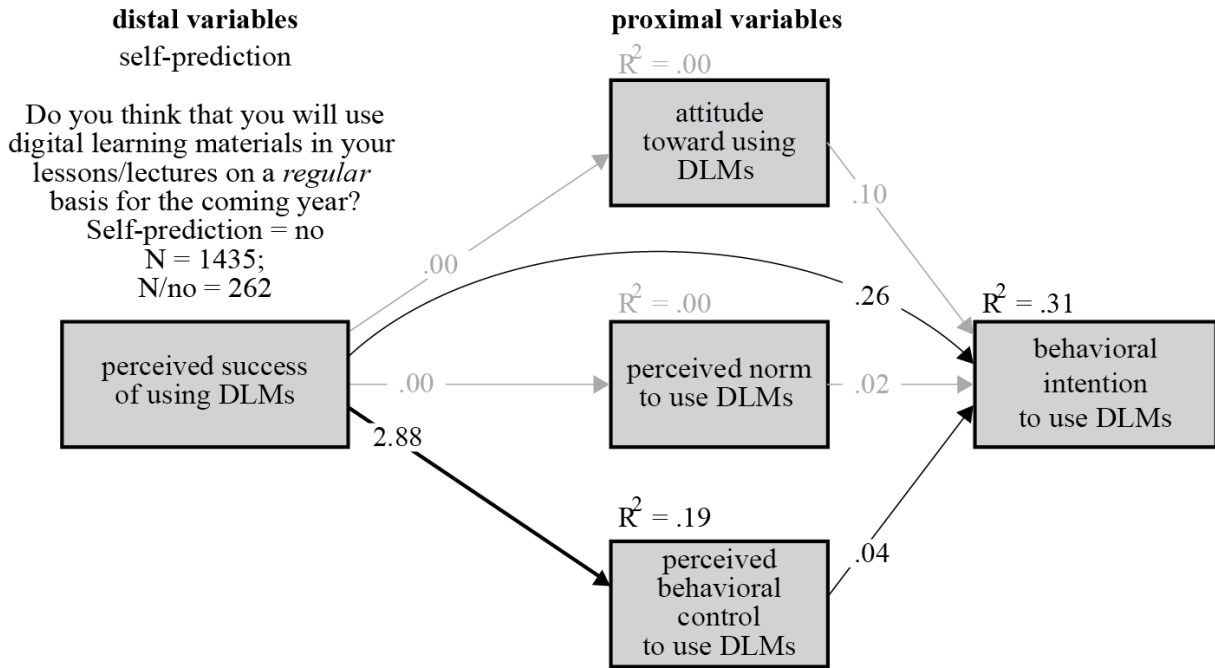


Figure 3b. Results of the mediation analysis of the model for the case that self-prediction = “no”). The displayed (unstandardized) path coefficients are significant at $p < .001$ level. Non-significant paths are shown grey in the figure. Thick black lines reflect the indirect effect of the distal variable via the three mediators.

Table 6

Tests for Determining the Significance of the Indirect Effects of the Independent Variable Success. *B* Indicates the Strength of the (Unstandardized) Indirect Effect

Distal variables	Mediator	B	Confidence interval	
			Lower limit	Upper limit
Self-prediction = 'yes'				
Success in the past year				
	total	.24*	.21	.28
	attitude	.01*	.01	.02
	perceived norm	-.00	-.01	-.00
	perceived behaviour control	.24*	.20	.27
Self-prediction = 'no'				
Success in the past year				
	total	.12*	.07	.17
	attitude	.00	-.00	.01
	perceived norm	.00	-.01	.01
	perceived behaviour control	.11*	.07	.17

*Note. Significant unstandardized path coefficient B.

To determine the fit of the two models in Figure 3a and Figure 3b, Structural Equation Modelling (SEM) was used with AMOS 5. Fit indices showed a reasonable fit of the models: for the population of teachers who predicted that they will use DLMs *regularly* was the CFI = .971 and RMSEA = .10 (CI: .07 – .13) and for the population of teachers who predicted that they will not use DLMs *regularly* was the CFI = .972 and RMSEA = .04 (CI: .0 – .11).

An overview of the unstandardized path coefficients resulting from the Hayes (2013) analysis and the SEM analysis are shown in Table 7 for comparison of the values of both mediation analyses. The difference between the values from both analyses do not differ greatly.

Table 7

Comparison of the Values of the Unstandardized Path Coefficients from the Hayes Analysis and the SEM Analysis

from → to		Hayes analysis		SEM analysis	
		Path coefficient	Significance	Path coefficient	Significance
Self-prediction = 'yes'					
previous success	→ attitude	.15	✓	.16	✓
previous success	→ perceived norm	-.13	✓	-.12	✓
previous success	→ perceived behaviour control	4.90	✓	4.91	✓
previous success	→ intention	.18	✓	.18	✓
attitude	→ intention	.08	✓	.08	✓
perceived norm	→ intention	.04	✓	.04	✓
perceived behaviour control	→ intention	.05	✓	.05	✓
Self-prediction = 'no'					
previous success	→ attitude	.00		.00	
previous success	→ perceived norm	.00		.00	
previous success	→ perceived behaviour control	2.88	✓	2.88	✓
previous success	→ intention	.26	✓	.26	✓
attitude	→ intention	.10		.10	
perceived norm	→ intention	.02		.02	
perceived behaviour control	→ intention	.04	✓	.04	✓

Conclusions and Discussion

The main research question addressed in this study was: “Do perceptions of success in using DLMs *regularly* (i.e., several times a week) during classes in the past year, strengthen (or weaken) teachers' behavioural intentions to use DLMs again on a *regular* basis in the coming year?” To answer this research question, *teachers' flows* were first analysed using crosstabs / multinomial logistic regression. These flows designated the relationship between teachers 1) who had perceived some degree of success of actual using DLMs *regularly* during classes in the past year or 2) who had no intention at all in the past year to use DLMs, and how they flow into three ordered categories of different strengths of the behavioural intention to use DLMs *regularly* in the coming year. The unit of analysis was either the group of teachers (the analysis used crosstabs) or the individual teacher (the analysis used multinomial logistic regression). The variable self-prediction was used to distinguish the group of teachers that predicted that they are going to use DLMs on a *regular* basis from the group of teachers that predicted they were not going to use DLMs on a *regular* basis in the coming year. The results indicated that teachers who had experienced various degrees of success using DLMs in the past school year showed stronger (for the crosstabs analysis) or corresponding (for the multinomial logistic regression) behavioural intentions to use DLMs *regularly* again for the case that their self-prediction was positive. This also applied to teachers who had no intention at all to use DLM *regularly* in the past year; they now had a moderate (for the crosstabs analysis) or a no to weak intention (for the multinomial logistic regression) to use DLMs *regularly* in the coming year. For the case that the self-prediction was negative, teachers had accordingly a much weaker intention to use DLMs *regularly* again in the coming year.

That is, for the crosstabs analysis, the teacher flows were in accordance with the expectations, and for the multinomial logistic regression, these flows were weaker than expected. Furthermore, the multinomial logistic regression, but not the crosstabs, showed for both cases (self-prediction is “yes” and “no”) deviating behavioural intentions of what was expected, but these were in the minority. As a result, it was concluded that hypotheses H1a, H1b, and H1c were confirmed.

After the determination of the *teachers flows*, the effect of perceived success on the behavioural intention to use DLMS *regularly* again in the coming year was investigated using the Reasoned Action Approach. It was also investigated whether this effect was mediated by attitude, perceived norm, and perceived behavioural control, and whether a direct effect could be determined. The analyses with the Hayes (2013) process method indicated that for the case where the self-prediction was positive, both attitude and perceived norm mediated the effect of the perceived success on the behavioural intention but that these effects diminished when self-prediction was negative. The results of the SEM analysis confirmed this conclusion. With respect to attitude, this result was somewhat surprising. Indeed, previous research (e.g., Kreijns, Van Acker, Vermeulen, & van Buuren, 2013)) has indicated that attitude is a crucial variable in the formation of a behavioural intention under different conditions. We believe that our choice for using a proxy for attitude did underrepresent the attitude construct and this caused the surprising results. With respect to perceived norm, the result was less surprising, as much research (e.g., Kreijns, Vermeulen, Van Acker, & van Buuren, 2014) has shown an unimportant role of perceived norm when it comes to the forming of a behavioural intention. A direct effect was also seen for both cases of a positive and negative self-prediction. The results of the SEM analysis further indicated that perceived success explained .44 and .31 of the variance in behavioural intention for respectively a positive and negative self-prediction. Based on these results, it was concluded that the hypotheses H2a, and H2b, were confirmed for the case of a positive self-prediction but not for the case of a negative self-prediction. Hypotheses H2c was confirmed for both cases of self-prediction.

In conclusion, although individual teachers did not show a stronger intention when teachers perceived success in using DLMS regularly in the past school year, they did, however, maintain a behavioural intention that was in accordance with the degree of perceived success for the case of a positive self-prediction. But in the case of a negative self-prediction teacher, results showed a weaker behavioural intention to use DLMS again on a regular basis. However, there were teachers who showed a behavioural intention that was unexpected.

The current research has some limitations. Using a proxy for attitude was possibly underrepresenting the attitude construct. Our future research, therefore, will use the common way to measure attitude; Fishbein & Ajzen (2010) suggested to use bipolar scales for measuring attitude. Another limitation concerns the population of teachers: only Dutch teachers participated in the research. Teachers' use of ICT, and in particular, DLMS is not a case that only matters the Dutch situation but it is a concern that is shared with all other countries over the world. Moreover, situations may differ from country to country (Kozma, 2003). Finally, the current research was cross-sectional, and consequently, it is not possible to determine the causal sequence. Longitudinal research in the future should give more insight in the causality in the relationships between perceived success, self-prediction, and behavioural intention.

For the educational practice, this research stipulated the importance of teachers to get a chance to experience success with the use of DLMS during their lessons. School leaders, therefore, should support and encourage the use of DLMS by teachers and take care of their ICT professional development.

Professional development programmes should guide the experiences with DLMs in such a way that success experience is more guaranteed. For example, scaffolding the teachers' use of DLMs from simple to more complex. School leaders should also be aware that teachers experimenting and using DLMs will not become demotivated due to an insufficient and unreliable ICT infrastructure; unsuccessful experiences lead to no or weak intentions. Furthermore, school leaders should take care that there is a balance in the workload of teachers, so that competing task demands will not severely limit teachers' decisions to use DLMs in the near future, which is reflected in their self-prediction. Even the most motivated and skilful teachers may not use DLMs if there are too many other tasks that have to be done under time pressure. By encouraging DLMs use in a supporting environment more perceived success can be expected, with the consequence of more DLMs use and again more perceived success. Getting this process started, however, is a carefully designed process which actually begins at the teacher training institutions. These institutions are responsible that DLM use become part of the teachers' repertoire.

Only when all these considerations are taken into account, will we see teachers' willingness to use DLMs on a *regular* basis grow.

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Professional Online Presence and Learning Networks: Educating for Ethical Use of Social Media



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Abstract

In a teacher education context, this study considers the use of social media for building a professional online presence and learning network. This article provides an overview of uses of social media in teacher education, presents a case study of key processes in relation to professional online presence and learning networks, and highlights issues and challenges for wider consideration. Specific practical illustrations are provided, relating experiences when starting out with social media, integrating coursework challenges for student teachers, and considering feedback and future planning. Social media is used in teacher education for sharing content, discussing, and collaborating. There are challenges and risks with social media in an academic context. Students require differentiated scaffolding depending on their expertise and confidence. In terms of social implications, professionals are warned to safeguard online reputation, while making proactive use of social media to enhance learning networks.

Keyword: teacher education, social media, professional online presence, learning networks, open and distributed learning

Introduction

Recent years have seen increasing use of social media in higher education, with scholarship emerging around the ubiquity of social media as a fast trend (Johnson, Adams Becker, Estrada, & Freeman, 2014). As in the general population, there is a growing proportion of academics engaging with social media as a regular professional pursuit. The trend is for increasing uptake of tools and platforms like Twitter, Blogging, and other digital media across professional contexts and for teaching purposes (Fox & Bird, 2017; Lupton, 2014).

In teacher education, leveraging the power of social media for social learning is increasingly recognized as a key skill for teachers (Johnson et al., 2014). Of course, this is more a set of dispositions, competencies, and literacies than a skill as such, and the complex set of understandings must be underpinned by awareness of ethical and social responsibilities. This paper illuminates some of the finer points regarding leverage of social media for professional learning in teacher education. As teacher educators gradually immerse themselves in the possibilities, teacher education students are also beginning to explore educative potential. For example, a New Zealand study by Wright (2010) explored how Twitter could help teacher education students to develop reflective practices while on teaching practicum placements in schools.

In teacher education, uses of social media include the production and sharing of content, discussion and interaction with content, and collaborative connection with other social media users (Johnson et al., 2014). Each of these uses is briefly discussed in turn.

Firstly, the production and sharing of content occurs where users are encouraged to use social media to both understand and communicate ideas (Gesser, 2013), promoting openness by making research and resources available outside of the academy (Chayko, 2014; Lupton, 2014; McCarty, 2011). It is rare now to attend a conference in teacher education without a corresponding Twitter hashtag and a series of interest groups emerging. In a similar vein, social media can function as a “backchannel” for communication within or between classes, so that students and teachers continue to share alongside formal channels (Greenhow & Gleason, 2012).

Secondly, discussion and interaction with content can be asynchronous or in real time, enabling collective thinking (Johnson et al., 2014), engagement in social commentary (Lupton, 2014), and ultimately knowledge construction via networking (Selwyn, 2011). As such, learning through social media is underpinned by a sociocultural conceptualization whereby interaction and development of new understandings are inextricably linked and contextualized (Vygotsky, 1978). Individual and collective transformations of knowledge occur through dialogic exchanges between people (Delahunty, Verenikina, & Jones, 2013; Vygotsky, 1978).

Thirdly, collaborative connections with other users are possible as social media can enable collaboration across institutions and with field experts (Johnson et al., 2014). The potential for collective work is widened due to the public nature of many networks, creating opportunities to interact with and learn from individuals who may not easily meet in person (Couros & Jarrett, 2012). Importantly, networks enable questions to be promptly answered (Richardson & Mancabelli, 2011). For some, social media is about building relationships (Greenhow & Gleason, 2012; McCarty, 2011; Nolan, 2013), giving and receiving support (Lupton, 2014), and mitigating feelings of isolation (Wright, 2010). For many, social networks constitute personal/professional learning environments and communities of practice (Lim, Agostinho, Harper, & Chicaro, 2014).

Conceptually, the use of social media also can be understood as a shift to connectivist learning (Siemens, 2005), prompted by creation of new knowledge, the primacy of connection, and the growth in the

abundance and complexity of knowledge (Siemens, 2009). Connectivism emphasises the ways learning is distributed in a network, acknowledging the diversity of networks and the strengths of ties, as well as ongoing rapid change (Siemens, 2005, 2009).

In these ways, social media can be employed as a backchannel, an ongoing discussion and a personal learning network. Overall, social media can enable teacher education participants to be “connected, collective and creative,” as Selwyn (2011, p.2) suggests. However, as is always the case with digital technologies, the affordances are not necessarily realized and learning is by no means guaranteed. After all, not all uses of social media are educational or of sufficient quality to contribute to knowledge building. Furthermore, not all uses of social media are ethical or socially responsible. Risky, inappropriate, damaging, and even illegal episodes on social media have led to promotion of “eprofessionalism,” particularly in fields like health sciences (Chester, Kienhuis, Pisani, Shahwan-Akl, & White, 2013). This is a reminder to members of professional groups, including graduates joining professions, to be mindful of the need to take great care with the use of social media in order to safeguard their own credibility, and the confidentiality of clients.

In academic and professional contexts, stumbling blocks and issues with social media include the time consuming nature of establishing and maintaining social media contacts (Lupton, 2014; Richardson & Mancabelli, 2011). For many educators, there are concerns about separating public and private life, and a wish to preserve privacy (Lupton, 2014; Johnson et al., 2014; Fox & Bird, 2017). Similarly, there is uncertainty about the boundaries between personal and professional use of social media (Chester et al., 2013; Lupton, 2014), which can easily become indistinct (Fox & Bird, 2017). Academics are troubled by issues around online safety and security (Johnson et al., 2014), including fear of becoming a target of attack (Lupton, 2014). A complex set of concerns revolve around integrity in terms of the risk of offending one’s audience, while academics may also be at pains to be taken seriously by colleagues who might regard social media as inappropriate or trivial (Lupton, 2014). There is also a fear of losing control over intellectual property. These uncertainties and fears are exacerbated in many cases by a lack of clear policy structures around the use of social media in academic and professional contexts (Chester et al., 2013; Johnson et al., 2014). As a result, teacher educators and students alike can be reluctant to use social media for educational purposes, and may confine their use to private and recreational functions (Selwyn, 2011). While resistance may be due to a lack of awareness of the educative affordances of social media, it can also be a deliberate choice in order to avoid the pitfalls mentioned, and it cannot be assumed that students or staff will necessarily extend their use of social media in ways that are supportive of learning and teaching. In order to do so, tertiary students, academic staff, and emerging professionals need to develop an awareness of how to harness the affordances of social media in ethical and socially responsible ways, proactively safeguarding against the very real dangers, and challenging outdated notions to fully understand the new opportunities, alongside the new risks and complexities (Osborne & Connelly, 2015; Fox & Bird, 2017).

Ethical use of social media means adhering to professional standards, even outside of work contexts. Since social media involves public expression, standards apply regardless of whether an individual is

working at the time of posting. Key ethical principles to apply to the use of social media include confidentiality, a professional expectation of those who work with clients and who owe loyalty to companies and institutions. A related principle is the obligation of responsible care, where professionalism entails doing good and minimizing harm. This in turn is related to justice, in terms of fairness, and respect for human rights. Breaches of these ethical principles could be regarded as breaches of a professional's moral commitment to clients, society, and the profession. Hence, socially responsible use is a reminder that what an individual does with social media does not occur in a vacuum and is likely to affect or influence others by virtue of the social character of the communications. Fundamentally, there is an expectation that professionals will apply sound judgment to all communications and dealings, on and off social media (O'Neill, 2015). Of course this is far from being a clear-cut matter, hence the need for clarification of policy, codification of principles for ethical decision-making, and ongoing discussions and development among representative professional bodies and those responsible for educating professionals.

Looking to the future, there are implications for student learning, professional expectations, policy, research, and practice in teacher education. Social media mirrors real-life learning, now and in the future. It is essential that students learn to manage social media processes for the sake of lifelong learning, since "Students will need to participate in these learning networks to stay on top of their fields of interest and to advance their careers" (Richardson & Mancabelli, 2011, p. 135). For these reasons, educators need to lead by modeling transparency, network literacy, sharing, and participation, underpinned by ethical and social responsibility. Increasingly, these functions are a professional expectation across every discipline and field of expertise (Chester et al., 2013; Nolan, 2013; Osborne & Connelly, 2015).

Professionals in the twenty-first century use social media to promote their professional selves (Fox & Bird, 2017), and to network in pursuit of lifelong learning and professional development (Greener, 2015). It therefore stands to reason that professional preparation should incorporate use of social media for professional online presence and learning networks. Such preparation needs to go beyond the reactive limitations of early professional notions of protecting oneself by using a pseudonym online (Tunick, Mednick, & Conroy, 2011). Rather than avoiding or hiding one's identity online, a more proactive approach is to cultivate and promote a professional online persona (Barbour & Marshall, 2012).

To further research, Greenhow and Gleason (2012) highlight the importance of looking at participant perspectives on social media experiences, and call for studies of teachers' purposes for social media integration. Davis, Deil-Amen, Rios-Aguilar and González Canché (2012) suggest there is a need to look at less traditional students, distance students, and those who are older and more isolated from campus community. Further research in the Asia-Pacific region is also needed (Lim et al., 2014).

Finally, in terms of practice, this paper contends that teacher educators have a professional responsibility to challenge teachers to adapt and optimize the learning opportunities afforded by social media.

POPLN: Professional Online Presence and Learning Networks

Fundamentally, a key premise of this paper is that teacher educators must look to make professional use of social media, before turning their attention to social media for student learning. In essence, this paper highlights two aspects of social media in teacher education: *Professional Online Presence* and *Learning Networks*.

The first element, Professional Online Presence, involves cultivation of a social media profile and footprint that is in keeping with one's goals as an educator. This involves ethical behaviour and formation of a professional identity, in the sense of presenting self, described by Goffman (1959). For example, in relation to social media behaviour, it is vital that educators are mindful of netiquette and "visible in positive ways" (Nussbaum-Beach & Hall, 2012, p.89), carefully managing online reputation. In terms of teaching practice, social media is an avenue for continuing and expanding beyond the walls of the classroom or Learning Management System (Gesser, 2013). In this day and age, "Connected educators google well" (Nussbaum-Beach & Hall, 2012, p.88), and it is readily apparent which professionals have harnessed the power of social media for teaching and learning. Professional online presence is after all, a deliberate stance, and one that is ethically and intelligently cultivated in the service of educational endeavour.

Secondly, Learning Networks are an opportunity to join and sustain a community of professionals, to engage in adaptive help seeking and to adopt a proactive stance in relation to professional learning. Social media affords educators the opportunity to regularly "trade information, share resources, ask and answer questions, and debate and discuss educational issues of the day" (Couros & Jarrett, 2012, p. 149).

Educators and students alike engage in adaptive help seeking when they know how and when to seek information, feedback, support, and assistance, and turn to their networks as part of a cycle of self-regulated learning (Newman, 2002; Steed & Poskitt, 2010). Via connected learning communities, educators and students can become "do-it-yourself" learners, selecting mentors and orchestrating their own learning (Nussbaum-Beach & Hall, 2012, p.11). Teachers need to take control of professional learning, looking beyond pre-packaged courses provided by others. It is often said that effective teachers must be learners, and it stands to reason that effective learners are self-directed and entrusted with choices and control over personalized programmes of learning. Effective teachers and learners must have an open mindset and be prepared to learn in new environments.

A Case Study: Key Experiences and Discoveries

The University of Waikato in New Zealand offers several blended teacher education programmes in New Zealand, including a ground-breaking and award winning undergraduate Mixed Media Programme (MMP); a graduate Masters of Teaching and Learning (MTL) degree; and a refresher course for inservice teachers (TRC). Across these programmes student/teachers are encouraged to extend their use of social media for professional purposes. Starting with Twitter, and branching out to Facebook, Pinterest, Blogs, and ePortfolios, students have connected and reflected, meeting in real time, sharing and reviewing

resources, tracking news, and engaging with the wider profession. This paper documents some of the processes involved and feedback received, as well as ideas for the future. Documentation of these processes, in an ethnographic sense, is likely to be useful to tertiary and teacher educators starting out with social media, as there are few written accounts of how lecturers appropriate social technologies for learning activities (Hamid, Waycott, Kurnia, & Chang, 2014; Lim et al., 2014). In what follows, data was generated via journaling of the processes throughout the period of study (2013-2015). Students contributed via voluntary forum posts, anonymous feedback, and assigned reflective work. All quotes are used with student permission.

Starting Out With Professional Use of Social Media

In 2013, the first steps invited student-teachers to take part in a social media challenge involving establishment of a professional social-networking presence, via Twitter.

Teacher education students established Twitter accounts, started following teachers and educational authorities, and joined communities of professionals to discuss educational issues (e.g., #edchatnz, @TeachHub). Students often lurked in Twitter, following and reading, before gradually beginning to retweet and to post links to teaching resources. The most confident students seemed to be influenced at an early stage by a particular hashtag, group or individual. For example, one student discussed the social media challenge in person with his school leader and was inspired to follow the senior colleague and to build his network from that point. Twitter was a popular choice, branching out from Facebook which was generally already a social favourite for the students. A few tentatively established blogs, struggling with uncertainty about “what to blog” but gradually finding their voices. Some established eportfolios and shared these for feedback. Students critiqued the usability of the social media tools and exchanged advice on how to overcome hurdles relating to confidence and technicalities (who to follow, what to post, how to add a tab to the eportfolio). As the semester progressed, students persevered and followed a wider range of international educators, read more widely in the blogosphere, and independently located then shared online resources like tutorials. Pinterest and Scoopit entered the range of possibilities. A class hashtag was established. Those who identified a specialist interest to blog about were able to sustain their blogging adventures.

Student feedback from the class of 2013 indicated a wish to formalize the social media challenge in some way, via summative assessment for course credit, and closer integration with the assigned work in the course. Students valued the activity but found it time consuming, and wanted license to spend more study time on the social media challenge.

POPLN 2014

In response to the success of the social media challenge in 2013 and student feedback and suggestions relating to the development of the task, a more comprehensive approach was trialed in 2014, entitled *Professional Online Presence and Learning Networks* or the POPLN challenge.

To initiate POPLN, students were assigned background reading about professional uses of social media in education. These included media reports highlighting the dangers of social media for teachers who have faced disciplinary action for transgressions; the aforementioned guidelines from the teachers' union and regulatory bodies and a range of examples of social media tools along with explanatory YouTube clips, tutorials, and professional users in education.

Students were prompted to consider the following:

- Cybersafety: Your online identity and how to safeguard your professional reputation, integrity, and privacy;
- Being proactive: Establishing a professional online presence;
- Lifelong learning: Using the Internet to build a personal/professional learning network; and
- Challenges: Expanding your repertoire of social networking tools for professional purposes.

With these considerations and goals in mind, the essence of the POPLN challenge directed students to:

Select a tool to begin with, any free online social networking tool will do.

- find the tool online,
- establish a profile,
- explore the uses for professional networking and learning,
- find out how others use it,
- reflect on the potential for future learning and help seeking,
- share some of your thoughts in our Moodle forum, and
- respond to peers in our Moodle forum.

In response to students' preference for the task to be more integral to the assigned work, the 2014 class were required to write a proposal and interim progress report within the first month of semester, outlining choice of tool/s and intentions in cultivating a professional online presence and learning network. Students were encouraged to share postings, quoting evidence of their own social media presence, and self-evaluating their learning to date. Mid-course, students were required to participate in a forum in which they shared a learning experience connected with the POPLN challenge, and exchanged advice on how to optimise the learning potential of the available social media tools.

At the end of semester, students were required to produce a final report, reflecting on their journey with POPLN and use of social media tools, and incorporating critical analysis of the affordances and limitations of their chosen tool for learning and professional networking. At this stage, students were also prompted to set goals for ongoing professional learning through social media. Alongside these assigned coursework elements, an optional asynchronous forum remained open for the duration of the semester so that students could discuss POPLN progress, issues, share developments, and ask questions. In addition, a class hashtag was again established, but this time a Twitter widget was embedded in the Moodle course to enable students to track the class tweets within the course.

Throughout the POPLN challenge, students used the progress forum to pose questions, share links, and signal their own presence (e.g., by posting their Twitter handles or links to new blog posts). Students exchanged feedback, commenting on each other's efforts and reports of progress, and encouraging their peers. Common challenges articulated by the students during the challenge included feeling exposed and vulnerable at the start, so that the first tweet was a hurdle. Moving beyond lurking in Twitter took the students through a progression that typically involved retweeting before posting original links and commentary. After taking the first steps, the next challenge involved maintaining momentum and sustaining purposeful patterns of contribution. Learning to use hashtags was cited as a challenge for some students, along with the struggle to become familiar with strange terminology like "handle" (Twitter) and "pins" (Pinterest). A common concern was dealing with overload, due to the vast array of social media options and the volume of postings, pins, and tweets involved. Some of the students reported overload stemming from managing multiple social media accounts. In the realm of professional blogging, copyright became a concern for one student who wanted to use images from a children's book on her blog. This initiated an authentic inquiry for the student involved, as she looked into the protocols, identified the copyright holder, and negotiated permissions. Another key breakthrough in learning terms came as students became discerning about who to follow, and importantly determined who NOT to follow on social media, in terms of corporate entities and individual commentators who detracted from the professional focus of learning as a student teacher. Overall, students said they liked the open-ended style of POPLN and the choice involved in the design of the challenge, selecting their own tools and setting their own goals for social media use. In particular, students reported enjoyment in connecting with each other and with a wider "community of practice."

As Cameron reflected,

The main benefit for me has been extending my community of practice beyond the colleagues of my own school. To be able to follow and communicate with teachers and educational organizations with similar class levels, curriculum foci, interests and concerns enriches and supports one's own practice, but there is also an array of new initiatives, perspectives and research that I might never have known about in my very familiar and comfortable small town, small school bubble. I look forward to continuing to build my connections through the rest of my study and back into the classroom.

2015: Feedback and Future Planning

Subsequent to the 2014 POPLN challenge, extending the use of Twitter to provide a hashtag for each class, and engaging in synchronous ‘tweetmeets’ with new classes to discuss coursework, students have experimented with Tweetchat and Storify to collate and manage coursework related conversations. New cohorts of students have engaged and responded to the POPLN challenge, and have diversified to experiment further with visual tools like Pinterest. As Angela reflected in relation to Pinterest,

It has been a great tool to collect resources related to teaching. For example, I have been interested in modern learning environments so using Pinterest, I was able to find images that helped me gain an understanding and insight to what this might look like.

In the meantime, students’ use of Twitter evolved and became more sophisticated, as articulated by Josie, who discerned several dimensions to her use of the tool,

Twitter has opened up professional learning possibilities in many ways. Firstly, through ‘following’ specific education-based individuals as well as organizations, I have been able to stay updated regarding movements relating to educational policy and research through the comments or ‘posts’ others have made through Twitter. I have also found this medium useful with regard to resources. There are many organizations that actively use Twitter to share their great ideas for classroom activities, and positive experiences they have had using particular resources. CORE Education and the Science Learning Hub are examples of some Twitter users who post tips for their followers to use. Another dimension of awareness I have encountered through the use of social media is the ability, when actively looking, to stay updated about the latest and greatest in terms of educational opportunities. There have been summits, conferences and professional learning sessions that have been ‘tweeted’ about, and I have come to know about these events solely through reading Twitter. I have visited many websites and blog pages as a direct result of tweets that I have read. Being connected in this way has brought me to academic readings, topical debates and page after page of classroom activity sites.

Students still reported that their biggest challenge was finding the confidence to post. Surmounting this hurdle was also the most significant breakthrough, and with it came the realisation of the power of social media for collaboration and discovery.

As Angela related,

My breakthrough moment would definitely have to be joining the “What is School” educational chat. I was able to connect with educators from around the world for one hour to discuss educational technology. It was a great experience that allowed me to gain insight on the perspectives of other educators and discuss issues and strategies with using technology in the classroom.

For example, during the “what is school” chat one person stated that, “Closed minds are the biggest roadblock. Just seeing tech and not the possibilities” (Drager, 2014) and in regards to strategies, Lang (2014) shared, “Technology should be used as a transformational tool for innovation and creativity, not an

add-on.” A common theme was that technology should be used to enhance collaboration, discovery, and a sense of empowerment.

Empowerment is similarly a feature of the student feedback arising from the social media challenge, indicating that students have valued the opportunity to explore and to increase awareness of social media affordances for learning. Some students have struggled with the open-ended and unstructured design of the social media challenge, despite checkpoints and advice, expressing a need for firmer guidance in relation to learning steps and a more explicit scaffold. For example, Anne confided that she was “suffering from information overload”, and needed to shift her strategy from “trawling around ... to be more purposeful and focus on assignment needs. I am following twitter, Pinterest and LinkedIn (and links from fellow students) but not yet contributing anything really significant.”

Anne’s experience was shared by a significant proportion of students in the class, and suggested a need for stepping students through a clearer progression of mini-challenges, at least in the initial stages of the POPLN challenge. For example, a clear goal each week – to move students beyond trawling and following, and onto creation of content and purposeful collaboration. Overall, 25% of the class admitted to struggling at some point in the POPLN challenge, and echoed Anne’s experiences above. The students’ concerns revolved around two areas:

1. Understanding the purpose of social media use as a professional, as distinct from personal use, and how to focus this use by knowing where to start and how to narrow down the overwhelming range of options.
2. Time management – managing distraction and remembering to make time for a self paced task.

In essence, both of these challenging areas can be summed up as Focus. Students need help to focus the purpose of their social media use, and to focus their use of time.

The challenge for teachers is to differentiate the scaffolding for students, to provide clear, focused goals and boundaries for those who need a tighter structure, while promoting experimentation and innovation by advanced users.

In some cases, students reported an about-turn in their thinking about social media, admitting to previously dismissing the likes of Twitter as trivial and of no significance for learning purposes. For example, Nathan commented,

My thinking has completely changed as far as social media goes. Before doing this paper my thoughts about twitter were that it was a tool that enabled people to blurt out their thoughts to the world. Now I see it as a platform for social interaction, sharing, and learning.

Throughout 2015 and 2016, students have continued to use Twitter in particular for sharing resources and ideas of wider interest to colleagues, and for seeking help with study-related issues. Prioritising Twitter has been a way to focus student efforts on one tool to start with, with Twitter the tool of choice due to the

way it lends itself to following professionals and separating personal/professional use (Fox & Bird, 2017). Wider experimentation with synchronous tweetchats across the profession has occurred, with students joining in and reporting to others. In a similar vein, national professional groups within Facebook have become popular, enabling students to virtually join the profession prior to graduation. In order to extend these conversations, an alumni hashtag has been established to promote and collate ongoing interactions with new professionals.

Reflecting on the use of social media in the past four years gives rise to three particular intentions for the year ahead:

Firstly, it is apparent that a degree of differential scaffolding is needed for students, to support those who are at different stages in their experience and comfort with social media. With this in mind, a tiered approach to tasks is proposed (Table 1) in order to balance the desire for structure for those who need it, alongside the successful open-ended character of the challenge overall.

Table 1

Structuring Challenges to Suit Level of Expertise

Level of expertise:	Examples of challenges:
Beginners	First tweets, establish core following, begin to reflect on impact and potential.
Intermediate	Expanding contributions, gaining followers, joining synchronous tweetchats.
Advanced	Diversifying platforms, hosting a tweetchat, blogging guidelines for others to promote professional learning through social media.

Secondly, it is intended that further concrete evidence of student learning through social media will be generated, via entry and exit surveys of students prior to commencing the POPLN challenge and at the end of semester. Students will be asked to provide evidence of social media use and demonstrable learning outcomes stemming from the use of social media tools and processes.

Finally, as mentioned, the longitudinal impact of social media will be investigated by arranging to monitor a group of students after graduation. This will enable exploration of whether and how emerging professionals continue to use social media for learning, and the factors that lead to this continuity.

While the experimentation with social media for professional learning is only beginning, there have been substantial benefits noted, alongside several issues and challenges to acknowledge.

Issues and Challenges

Considering the aforementioned experiences, there are a number of emergent issues and challenges, briefly summarized next.

Skepticism and Dismissal

Teacher education encourages critical thinking, questioning, and reflective practice. However, when faced with social media, educators sometimes respond with the kind of cynicism that detracts from open-mindedness (Greener, 2015). This reflects the lack of credibility cited as a concern by Lupton's (2014) academics. Furthermore, as Selwyn (2011) suggests, not all students will readily leap at the chance to use social media in an educational and professional context.

Professional commentary and the track record explored with students is persuasive. There remains, nevertheless, a need to generate data on the effects of POPLN after students graduate as teachers and to that end, a longitudinal study is planned to follow up the cohorts of 2013-2016 to ascertain whether and how they continue professional learning through social media. Having used social media for learning during one's degree, do graduates continue to harness social media for ongoing professional learning? How are learning networks cultivated and expanded?

Teachers as Learners

Teachers (including student teachers) are often looking for ideas that are directly applicable to their own classrooms and students – they want immediate practical application. Sometimes, teachers leap ahead to try things out with students before they have invested in their own professional learning. It has been a challenge to have teachers take a step back and to put their own learning first. For example, after an initial introduction to POPLN, student teachers have asked, “how can I implement this as a primary teacher?” and “I can't wait to use social media with my students but how will the school react?”

Student teachers are cautioned not to rush to use social media with students, but instead to take time to try out the tools and social media environment, for professional learning, in order to become more familiar with the risks and possibilities. This is not to suggest that POPLN is irrelevant to the classroom, since after all, teachers as learners will gain many ideas via social media that can and do have immediate classroom application. At the same time, professional learning through social media enables insight into issues of ethics, privacy, copyright, netiquette, time management, and digital literacy, all of which inform teaching practice.

Safety, Privacy, and Integrity

There are so many horror stories about mismanagement of online identity and loss of professional integrity due to over sharing. A professor recently remarked that it is safer to stay away from the Internet as far as possible, to keep a low profile, and avoid creating a digital footprint.

In this day and age, avoidance of a digital footprint is unrealistic, as anyone who “Googles” themselves will learn. It is dangerous to leave management of one’s online identity to chance, or to other people (Barbour & Marshall, 2012; Osborne & Connelly, 2015). Rather, as fully functioning citizens, it is the responsibility of each individual to proactively protect and project online identities that are in keeping with our best selves. This is not a simple matter of image management, in a shallow form, but rather a plea to use the Internet in ways that are safe, protective of privacy and human rights, ethically astute, critical, discerning (Brookfield, 2015), and in keeping with one’s professional roles and social responsibilities (Fox & Bird, 2017).

Future Research

A cross-disciplinary approach to future research could involve case studies of social media from diverse faculties and institutions, to extend the study to multiple case studies.

In terms of practice, this might extend to encouraging students to incorporate social media within assignments across courses, as a means of data collection, research and writing assistance, collegial discussion, and dissemination of work.

In conclusion, this paper has chronicled some of the University of Waikato’s experiences with social media in teacher education during recent years, focusing on the establishment of a professional online presence and learning network. This paper has suggested practical approaches to integrating social media teacher education as a series of coursework tasks. While there are challenges related to attitudes, learning dispositions, and safety risks, the highlights are significant. Not least among these is the importance of disrupting assumptions, opening minds, and raising awareness of new possibilities with social media in teacher education and across tertiary disciplines. Developing critical, discerning and learning-oriented uses of social media is a crucial part of preparing emerging professionals for ongoing networking in ethical and socially responsible ways.

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A Grounded Theory of Professional Learning in an Authentic Online Professional Development Program



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Abstract

Online professional development (OPD) programs have become increasingly popular. However, participating in professional development does not always lead to profound professional learning. Previous research endeavours have often focussed on measuring user acceptance or on comparing the effectiveness of OPD with a face-to-face delivery, but there is little knowledge of how the process of professional learning actually occurs in OPD. This study explores how professional learning takes place in an OPD program designed according to the principles of authentic e-learning, and how the learning design and technologies used impact on the professional learning experienced by the participants. The context of the study is an international OPD program in vaccine management developed and offered by World Health Organization. A grounded theory approach was employed to develop a theorised model of the professional learning process in an authentic online learning environment. The findings show that professional learning was facilitated in a dynamic web of interactions rather than by covering content: the learner is at the centre of the process, actively engaged in authentic tasks in collaboration with peers, while mentors and content play a supporting role. Technology facilitates and enables the web of interactions. The learning process was found to bear resemblance to the type of professional learning that occurs in authentic workplace settings, which implies that the authentic e-learning principles provide a helpful learning design framework for OPD.

Keywords: online professional development, professional learning, authentic e-learning, learning design, grounded theory, vaccine management

Introduction

While professional development programs are increasingly often offered online, little is known of how professional learning actually takes place in online professional development (OPD) programs and what elements of the learning design and learning environment support or hinder it. This study examines how professional learning occurs in an OPD program designed and implemented according to the pedagogical model of authentic e-learning (Herrington, Reeves & Oliver, 2010) and how the elements of the learning design and the use of technology affect the professional learning experience of the participants. The context of the study is an international OPD program in vaccine management, offered by the World Health Organization (WHO). A theoretical model of the professional learning process in an authentic online learning environment is developed using a grounded theory approach (Strauss & Corbin, 1998). While the model can be used to inform the design, implementation, and facilitation of online professional learning programs, we believe it will potentially be helpful for other online learning contexts designed for adult learners as well.

Professional Development and Professional Learning

In this study, we define *professional development* (PD) as activities that are intended to engage professionals in new learning about their professional practice (Knapp, 2003), whereas *professional learning* (PL) is an intrinsic phenomenon. Participating in professional development activities may or may not lead to professional learning. Ruohotie (2002) describes professional learning as a continuous process that builds throughout the entire professional career or the individual. As a result, as Webster-Wright (2010) summarises, “PL cannot be mandated, coerced or controlled, but can be supported, facilitated and shaped” (p. 12). This observation is a starting point for the study presented in this paper and provides a key motivation for the research task. In order to better understand the value of OPD, it is important to first understand how PL in fact occurs during the type of PD endeavour in question.

Whereas many OPD programs are based on online content delivery, examples of more pedagogically driven designs can also be found. For example, Ching and Hursh (2014) report on an OPD program that led to wide-scale innovation adoption and change in professional practice. This was seen to be a result of the learning design that built on the social constructivist belief that people construct knowledge collaboratively and learn best when creating purposeful artefacts for an authentic audience (Ching & Hursh, 2014). The findings align with earlier research on PD and adult learning. Learner involvement, building upon experience, situated content, and problem-centered context have been suggested to be key principles of adult learning (Knowles, 1990). In line with these principles, effective professional development is believed to be social, active and practice-driven (Webster-Wright, 2010).

However, instead of the above identifiers, the advantages of OPD are often primarily associated with accessibility and flexibility regarding time and space (Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2009); Carey, Kleiman, Russell, & Venable, 2009). While these perceived advantages often serve as the default ground for OPD research, they tend to make assumptions of the pedagogical foundations of e-learning that are seldom defined or questioned. OPD is often assumed as content delivery in the form of self-study materials and assignments, sometimes mandated by the employer. For example, Vu, Cao, Vu, and Cepero (2014) examined factors that lead to learner success in OPD, and found self-direction, compliance to employer expectations and disciplined study routine as the most important characteristics. Kyalo and Hopkins (2013) studied the acceptance of OPD amongst medical professionals and found that while the majority appreciated the flexibility and the self-paced nature of the studies, less than third of the participants regarded the OPD program as a successful professional

learning experience. The difficulty to remain motivated and self-directed was identified as a challenge. Moreover, OPD was found theoretical and unsuitable for practical subjects (Kyalo & Hopkins, 2013).

Neither of these examples describes the learning design of the OPD offerings in question but seems to automatically assign OPD with content-driven self-study. Baran and Cagiltay's (2006) study examining teachers' expectations and experiences with OPD make these assumptions more explicit. Their rather discouraging observation was that the participants found the OPD experience decontextualized, theoretical, and downright boring. The only advantage was the flexibility of time and space. The participants were not eager to undertake another OPD course unless it was interactive and highly practical, and provided opportunities to problem-solve and learn from colleagues (Baran & Cagiltay, 2006). Interactivity and collegial sharing have often been particularly difficult to achieve in OPD; Liu (2012) identifies their absence as one of the most obvious shortcomings in OPD. The issue is sometimes tackled by adding a discussion board in the online learning environment; however, these often remain underutilised. This was the case also in an OPD program evaluated by McConnell and Monroe (2012), and as a result, the design was reverted to a static website focussing on content delivery and individual assignments.

Ignoring the dimension of learning design has led to weaknesses in the evaluation of e-learning, including OPD. The effectiveness of e-learning is typically evaluated in comparison with a face-to-face delivery, reducing social interactions into quantitatively defined variables and assuming these can be controlled or randomised (Phillips, McNaught, & Kennedy, 2012; Reeves, 2006). In such endeavours, the pedagogical and education-philosophical underpinnings of either mode are typically not defined or considered in the research design. The measurements take the form of test results or participant satisfaction surveys (e.g., Lahti, Kontio, Pitkänen, & Välimäki, 2014; McConnell & Monroe, 2012), or user acceptance questionnaires (e.g., Kyalo & Hopkins, 2013; Alsofyani, Bin Aris, Eynon, & Norazman, 2012). However, the research results remain of little applicability when "online" is presented as a pedagogical strategy in its own right, while it, in reality, is a channel through which a variety of different pedagogical designs can be employed.

Authentic professional learning. Some researchers have taken a different approach to professional development research, shifting the focus from the characteristics of the PD program to the learning process of the professionals. Vermunt and Endedijk (2011) have studied teachers' professional development and argue that most of the literature in the area is prescriptive and neglects to explore how teachers learn naturally. Similarly, Webster-Wright (2010) believes that professional development research would benefit from a better understanding of how professional learning takes place in natural work settings. She used phenomenological analysis to reveal how health care professionals keep learning in working life and developed this understanding further into a framework of "authentic professional learning" (Webster-Wright, 2010).

The present study builds on this thinking and seeks to combine the two approaches by investigating how professional learning actually takes place in an OPD program. Acknowledging that "online" is not a pedagogical design or a universal variable in its own right, we next move on to describe the learning design of the OPD program in question.

Authentic e-Learning as a Design Framework for Professional Development

We believe it is not possible to arrive in a theoretical framework of professional learning in an OPD program without considering the learning design of the program in question. Different approaches to teaching are known to lead to different learning strategies and experiences (Prosser & Trigwell, 1999). The OPD program that forms the context of this study has been designed and implemented according to the principles of authentic e-learning (Herrington, Reeves & Oliver, 2010). Authentic e-learning is a pedagogical framework that has originally been developed and studied in a higher education context. The goal of the framework was to apply a “model of instructional design based on the theory of situated learning to the design of multimedia learning environment for university students” (Herrington & Oliver, 2000, p.25). The authentic e-learning framework has been widely studied in different educational contexts, including pre-service teacher education (e.g., Amiel & Herrington, 2012; Valtonen, Kukkonen, Kontkanen, Sormunen, Dillon, & Sointu, 2015), higher education (e.g., Bozalek et al., 2013), teacher professional development (e.g., Teräs, 2013; Parker, Maor, & Herrington, 2013), vocational education (Pu, Wu, Chiu, & Huang, 2016), and foreign language learning (Ozverir, Herrington, & Osam, 2016). However, applications of authentic e-learning in industry and organisations are still scarce. Most examples involve linking students with industry through projects, placements, or authentic practices (e.g., Collis, Foth, & Schroeter, 2009; Pu et al., 2016). This study makes a contribution to the research of authentic e-learning by applying the model in a professional development context and presenting a theoretical model of how exactly professional learning might take place in an authentic e-learning based program.

The authentic e-learning framework provides learning design guidelines for translating the pedagogical ideas of situated learning (Lave & Wenger, 1991) into practice in online education. Being based on the notion that learning occurs best when it is embedded in context, activity, and culture, situated learning is a natural match for professional development and training purposes (e.g., Machles, 2003). One of the claims for authentic learning is that it is able to bridge the gap between formal education and the expectations of society and working life better than traditional methods based on the delivery of abstract and decontextualized content (Herrington et al., 2010). It moves away from traditional university course activities, such as lectures, readings, and examinations to an approach where the focus of the course is in an authentic project. Such an approach is well suited for professional development – perhaps even more easily than in a higher education context where the constraints of traditional academic practices are often hindering the development of authentic e-learning courses (Herrington et al., 2010).

The role of technology in an authentic e-learning environment differs significantly from the commonly seen practice of using technology as an information delivery channel, where content is delivered to students by technology, students use technology to complete assignments to indicate that they have processed the content, and the teacher uses technology to assess the adequacy of the student’s response, or the response is assessed automatically. Herrington et al. (2010) refer to this as learning from technology. By contrast, learning with technology uses technology as cognitive tools that learners use for constructing knowledge, solving problems, collaborating, and articulating their knowledge to others. The latter is assumed in authentic e-learning.

The authentic e-learning framework consists of nine elements that align closely with success factors identified in earlier professional development research, as well as with central adult learning theories. These elements are described in the following.

1) **Authentic context** which is not created merely by providing real world examples, but Herrington et al. (2010) define it as “need(ing) to be all-embracing, to provide the purpose and motivation for learning, and to provide a sustained and complex learning environment that can be explored at length” (p.19). An authentic context must reflect the way the knowledge will be used in real life; therefore, it must also preserve the complexity of the real life setting.

2) **Authentic tasks** are the core of an authentic learning design. In addition to having strong real-life relevance, they are as ill-defined and complex as real world problems tend to be. Authentic tasks are long-term efforts and result in a polished product. The importance of such tasks in professional development has been known for a long time: Ling and MacKenzie (2001) found that successful professional development is a long-term process that offers opportunities for practical implementation. The same has later been confirmed in other studies (Lawless & Pellegrino, 2007; Garcia & Roblin, 2008). These observations support Knowles’ (1990) notion that adult learners require situation-relevant content and prefer to work within a problem-centered context.

3) **Access to expert performances and the modeling of processes** is an idea that originates from apprenticeship learning. In the context of professional development this means that the learners have the opportunity to observe how experts solve problems as well as learn with and from their colleagues. The idea of apprenticeship is also found behind Lave and Wenger’s (1991) influential and widely studied ideas of situated learning, legitimate peripheral participation and communities of practice.

4) **Promoting multiple roles and perspectives** ensures that learners are exposed to controversies, debates, and discussion, as well as to various sources of information rather than a single textbook or teacher’s lecture notes. The benefits of learning environments that promote dialogue and collegial sharing have been identified in different OPD studies worldwide. For example, Garcia and Roblin (2008) and Löffström and Nevgi (2007) have found that sharing of viewpoints and experiences enhances the work performance of professionals.

5) **Collaborative construction of knowledge** is a key characteristic of authentic learning and a widely stated success factor of professional development. Collegial sharing (Ling & MacKenzie, 2001), interdisciplinary teamwork (Garcia & Roblin, 2008), as well as interaction and collaboration between participants (Liu, 2012) have all been recognized as key ingredients in effective professional development.

6) **Reflection** in authentic learning can be promoted by requiring participants to make decisions regarding completing tasks, by presenting materials in a non-linear fashion that allows free navigation and acting upon reflection, and by offering opportunities to compare one’s thoughts to the ideas of other learners, experts, and mentors. The role of reflection in adult learning is long recognized (Schön, 1983) and it has also been identified as a feature of quality professional learning (Lawless & Pellegrino, 2007; Garcia & Roblin, 2003).

7) **Articulation** is encouraged when the tasks require the participants to discuss their growing understanding, negotiate meaning, and publicly present and defend arguments. In accordance with this principle, Garcia and Roblin (2007) found that promoting articulation through weblogs in OPD enhanced reflection, the development of metacognitive abilities, creativity, and interaction between colleagues.

8) An authentic e-learning course “provides for **coaching** at critical times, and **scaffolding** of support, where the teacher provides the skills, strategies, and links that the students are unable to provide to complete the task” (Herrington et al., 2010, p. 35). Similarly, Ling and MacKenzie (2001) maintain that successful professional learning is well supported.

9) **Authentic assessment** is not separated from the learning process, but is seamlessly integrated in the activities. Moreover, authentic assessment requires that learners be provided with the opportunity to be effective performers with the skills and knowledge they have acquired.

Research Context

The participants of the study consist of experts in immunisation, vaccine management, and pharmaceuticals that completed an OPD course in Vaccine Vial Monitor (VVM) based vaccine management offered by the WHO and EPELA (Extensio et Progressio, Authentic e-Learning) (http://epela.net/epela_web/evvm.html). The participants of the OPD program consisted of both men and women from different organisations all around the world, mostly from different African and Asian countries. The OPD program took place fully online and the participants never met each other or the mentors physically. VVM is a label containing a heat-sensitive material, which is placed on a vaccine vial to register cumulative heat exposure over time. The VVM label indicates whether the administered vaccines have been damaged by heat or not, consequently helping to reduce vaccine wastage, identify cold chain problems and manage vaccine stocks. The eVVM OPD course aims to develop sound vaccine management skills using VVMs. Instead of delivering the course content in the form of readings and lectures, the OPD program invites participants to interact and learn within an authentic online learning environment that simulates a vaccine cold chain. The course spans over nine weeks, during which the participants travel virtually from one level to another in the supply chain, assuming the relevant professional roles in situations ranging from international arrival of the vaccines to storage and a plan of action to adopt VVM policies for national use. On each level, participants engage in authentic tasks, solving similar problems as they would in a real-world situation and producing outcomes that can actually be used in the field for authentic working purposes. They work in teams, reflect on their learning both individually and collaboratively, and receive continuous feedback from mentors and peers. As a result, the participants develop and apply advanced decision-making and planning skills. The course does introduce short expert videos and reference materials about the subject matter, but the most important learning opportunities are enabled via authentic tasks. Self, peer, and mentor review are important aspects of assessment. Following five weeks of virtual visits, participants are introduced to a real client so that together with their peers as consultants they analyse a real world cold chain challenge and make recommendations to the client. Figure 1 illustrates the course flow and the activities of the participants and mentors during the course.

**A Grounded Theory of Professional Learning in an Authentic Online Professional Development Program
Teräs and Kartoglu**

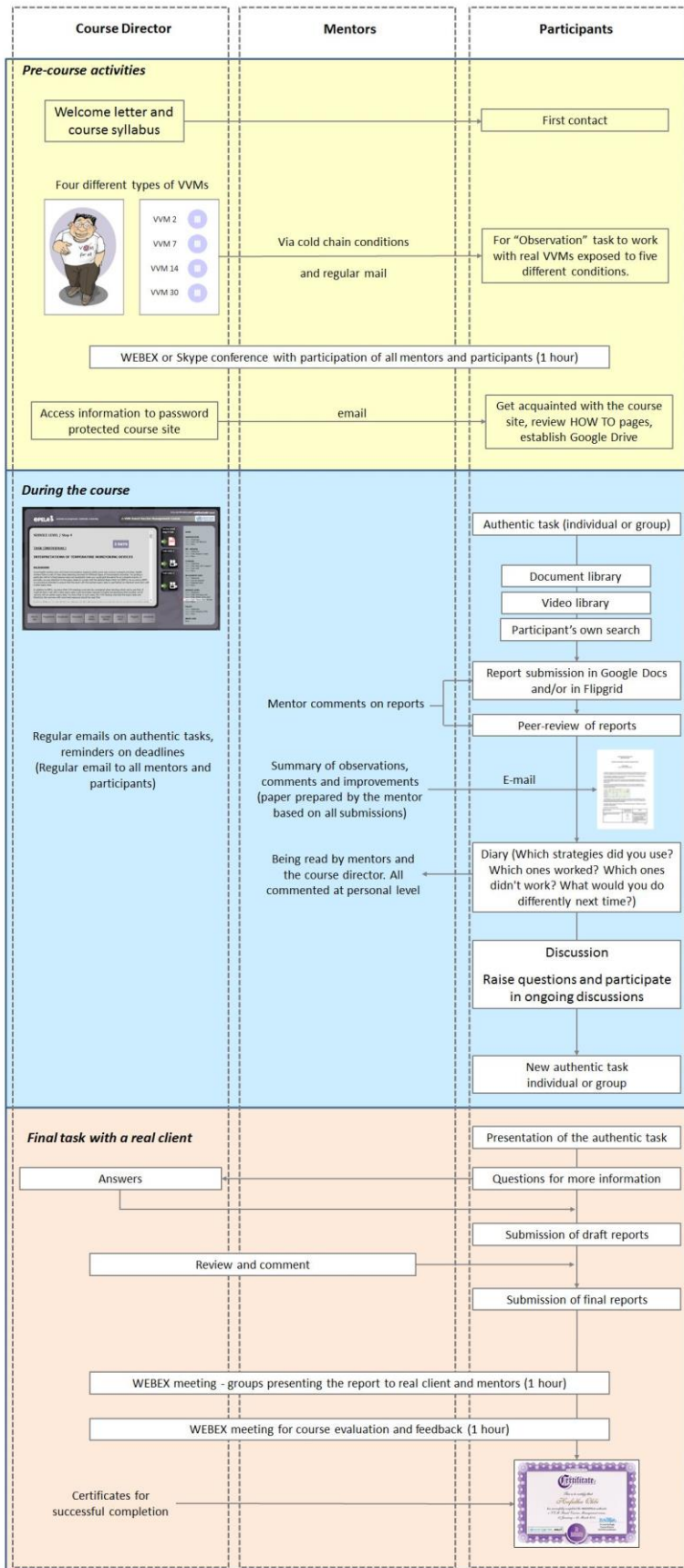


Figure 1. The flow of the eVVM online professional development course.

The process illustrated in the figure above takes place in the online learning environment of the course, utilising a variety of technologies for different purposes. The learning environment has been designed to integrate the authentic learning principles. In addition to the online technologies, the participants receive a set of real physical VVM cards for observation. Table 1 illustrates how the nine principles of authentic learning were used in the course and how the technologies supported this.

Table 1

Authentic Learning Principles and Technologies in the VVM OPD Course

Authentic learning principle	How the principle was used	Technologies
Authentic context.	The vaccine supply chain is represented through virtual visits implemented with 360° videos and authentic documentation. Authentic practices and approaches are employed in all learning tasks.	<ul style="list-style-type: none"> • EPELA environment, which integrates virtual steps of the vaccine supply chain with the authentic tasks, resources and tools. • VVM cards that the participants observe and experiment with.
Authentic tasks.	All tasks are designed based on actual real life problems that are complex and ambiguous. The tasks are completed over an extended period of time. All tasks are designed based on real-world problems notified to WHO.	<ul style="list-style-type: none"> • Google Drive provides participants access to shared folders for submission of task reports and peer review. • WebEx is used as a conference platform for the final task for groups to present their work to the real client. • VVM cards. • Skype, WhatsApp and Facebook used for communication when working on these tasks.
Access to expert performances and modelling of processes.	Expert videos, access to mentors, sharing of participant expertise through collaborative tasks.	<ul style="list-style-type: none"> • Video and document libraries provide authentic resources such as expert videos and scientific papers.
Multiple perspectives.	Versatile materials (video & document library) presented in a non-linear fashion.	<ul style="list-style-type: none"> • Video and document libraries. • Discussion forums for sharing perspectives, asking questions, and discussing experiences in different contexts.
Collaborative construction of knowledge.	Participants access and comment on each other's work. Individuals and groups create reports and recommendations as well as mind maps, flow charts and decision trees for processes – these documents are now in use in the field.	<p>Several tools are used for this purpose throughout the course:</p> <ul style="list-style-type: none"> • Skype • Discussion forums • Google Drive
Reflection.	Participants keep a diary to reflect on authentic tasks, their learning and approaches to solve problems. Diary entries are made following completion of the tasks, peer review and mentor comments,	<ul style="list-style-type: none"> • Online diaries. • Scavenger hunt blog where participants are given a list of situations to observe and photograph in their own working contexts and post them in

	enabling critical reflection on action.	the blog along with a story of each situation.
Articulation.	Diaries, Flipgrid videos and course director's one-on-one interactions with participants about their diary entries provide articulation opportunities.	Several tools support articulation: <ul style="list-style-type: none"> • Diaries • Flipgrid • Discussion forums • WebEx
Scaffolding and coaching.	Mentors are readily reachable via Skype, email and other means. In each authentic task, mentors provide prompt constructive feedback.	<ul style="list-style-type: none"> • Discussion forums. • Skype for both group and individual mentoring. • Email. • Google Drive for feedback and comments on participants' work.
<i>Authentic assessment.</i>	Authentic assessment is embedded within the authentic tasks. Products resulting from these tasks include reports, presentations, peer reviews and learning diaries. These are used to assess the learning of each individual.	<ul style="list-style-type: none"> • Diaries. • Discussion forums. • Google Drive. • WebEx.

Methodology

A grounded theory approach was employed for the research task. Grounded theory seeks to determine how the actors respond to different conditions and the consequences of their actions (Corbin & Strauss, 1990). The purpose of grounded theory is thus to develop a theoretical explanation for a process or an action through the process of constant comparison (Strauss & Corbin, 1998). This theoretical explanation is grounded in and generated from the qualitative data produced by the participants. As Strauss and Corbin (1998) emphasise, a theory goes beyond a set of findings in that it offers an explanation about phenomena. In the case of the present study, the aim was to explain the occurrence of professional learning, grounding that explanation on the actual experience of the participants to the eVVM course.

Collection and Analysis of Data

The data was collected through semi-structured interviews with seven participants who completed the eVVM course, as well as through observations in the online learning environment. The interviews were conducted via Skype and they were recorded and transcribed. The length of the interviews varied from 30 minutes to one hour. The interview questions invited the interviewees to reflect on and describe their learning experience and discuss the impact the course had on their professional growth.

The analysis followed the coding procedures described by Strauss and Corbin (1998). In grounded theory, data collection and analysis are interrelated processes (Corbin & Strauss, 1990): the analysis starts with the first bits of data and directs the next steps in data collection. In this study, the first bits of data were collected through observations in the online learning environment. These observations guided the interviews and informed the formation of interview questions. As the interviews were being completed, they were first listened to again and transcribed, after which the transcripts were read through repeatedly. This initial process allowed the researcher to immerse in the data, become more familiar with it, and identify initial points of interest. This stage was followed by the process of open coding, which involves identifying concepts in the data. Conceptual labels are given to incidents, events, and happenings, in order to be able to analyse them as potential indicators of phenomena. Concepts are

thus the basic units of grounded theory analysis (Corbin & Strauss, 1990). An effort was made to generate codes that would capture what essentially was going on with regard to professional learning. At the same time, memoing was used to record questions, interpretations, and thoughts that rose from the data, to facilitate a detailed, in-depth analysis that would result in an adequate code. The process of memoing is an integral part of grounded theory as it provides a system for the researcher to keep track of all categories, properties, questions, and hypotheses that result from the analysis process (Corbin & Strauss, 1990).

The concepts identified were labelled in the transcripts and organised into categories with the help of concept mapping and constant comparison of data, codes, and emerging categories. Corbin and Strauss (1990) refer to categories as the “cornerstones of a developing theory” (p. 7) as they allow for the theory to be integrated. As a result of the process, the coded concepts represent abstractions derived from the responses of many participants. Table 2 illustrates an example of how codes were organised into categories. For example, some of the interviewees talked about how they had enjoyed the group work activities, whereas some others mentioned how they had been able to learn from their colleagues who knew more than they did about a certain issue. Although these concepts are not exactly the same, they both describe experiences that may be categorised as “appreciating collaborative learning.”

Table 2

Example of Codes and Categories

Open codes	Categories
Enjoying group work	Appreciating collaborative learning
Appreciating small, rotating groups	
Learning from a more knowledgeable colleague	
Group member not responding to emails	Challenges with collaboration
Group member not contributing to the task	
Juggling between commitments	
Testing scenarios with peers	Collaborating beyond course requirements
Comparing professional contexts	
Continuing to stay in touch	

After the process of open coding, the next stage of axial coding involves relating categories to their subcategories and testing their relationships against data (Corbin & Strauss, 1990). Through axial coding, the number of codes is reduced and connections and relationships among them are uncovered (Strauss & Corbin, 1998; Moghaddam, 2006). For example, the subcategories of *appreciating collaborative learning*, *challenges with collaboration*, and *collaborating beyond course requirements* were grouped together under the axial code “experiencing collaborative learning.” The final stage of the analysis is the process of selective coding. In this stage, a central category is chosen and other categories are related to it (Strauss & Corbin, 1998, Moghaddam, 2006). A central category must be one that all other major categories relate to, either as actions, conditions, or consequences. It must also appear in the data so frequently that, in almost all cases, there will be indicators pointing to that concept. (Corbin & Strauss, 1990). The central category that emerged from the data in this process was “professional learning as interactions.” During the process of selective coding, the categories were integrated and developed into a theoretical scheme (Strauss & Corbin, 1998). This was facilitated by reviewing and sorting memos, diagramming, and revisiting all the interviews to compare the scheme against the raw data. A theorised framework was then formed by connecting the dots and identifying the factors that enable or hinder these interactions.

Research Findings

As Corbin and Strauss (1990) point out, the interrelatedness of data collection and analysis in the grounded theory process allows for the research process to capture all relevant aspects of a topic as soon as they are encountered. In this study, one of the first points of interest to catch the attention during the early stages of the research process was that all participants were already experienced in e-learning. Some had completed a considerable number of OPD courses. However, they emphasised that the eVVM course was different from their previous experiences because of the authentic learning approach.

This was definitely very problem based learning. A lot of MOOCs have been done very well, but there’s still a lot of aspects that deal with a lot more theoretical content, rather than: “you are now a manager of a health unit and you have to deal with these types of problems.” There is a lot of grey area in how you deal with it and how you make decisions. So, that was the difference. It was very hands on (Participant 5).

Secondly, most interviewees described very tangible learning outcomes that impacted directly on their practice, rather than accumulating merely theoretical knowledge. One of the participants reported: “Now that I’ve done it physically, I can explain it,” referring to a recent fieldwork situation where he had been able to apply his new skills with the VVM observation. Other examples included the ability to use some of the authentic products developed during the course in the field. A third early observation was that no one emphasised the “usual” benefits of e-learning associated with flexibility with regard to time and space. Instead, they highlighted the high degree of realism, relevance, and practicality of the course.

The different thing, when I’m comparing the eVVM with the rest of the eLearning courses. ...The realistic task! When I was doing my eVVM course, we had some complex collaborative tasks with colleagues from different countries. So we’re dealing with, you know, actual tasks. (Participant 1)

The first provisional concepts in the study were thus “difference from other OPD programs,” “realistic task,” and “impact on professional practice”. As outlined by Corbin and Strauss (1990), provisional concepts are validated and later included in the theory if they are repeatedly present or significantly absent in the data. The repeated mentions of the benefits of the authentic tasks and, on the other hand, the lack of discussion around the “usual” benefits of e-learning were both considered significant.

Other sub-categories that emerged from the data were organised through the process of axial coding into eight categories: *the learner*, *authentic tasks*, *authentic learning resources*, *collaboration with colleagues*, *scheduling*, *mentoring*, *technology*, and *impact on professional practice*. Through further refining and selective coding, “learning as a web of interactions” emerged as a central category. The eight categories all relate to the central category, either as causal conditions, contextual conditions, consequences, or strategies, explained in further detail in the following section.

Learning as a Web of Interactions

A model of professional learning as a dynamic web of interactions, facilitated by technology, started to form during analysis (see Figure 2). At the centre of the web of interactions is the learner who engages in authentic learning tasks in collaboration with her or his peers, supported by the mentors, and making use of authentic learning resources. Technology facilitates these interactions as a means of communication, as tools for collaboratively preparing the authentic tasks and sharing the products, and as a way of accessing the supporting learning resources. All interactions are reciprocal: each person involved brings in a unique contribution that has an impact on another person’s learning process. In this sense, the process cannot be fully predicted or replicated.

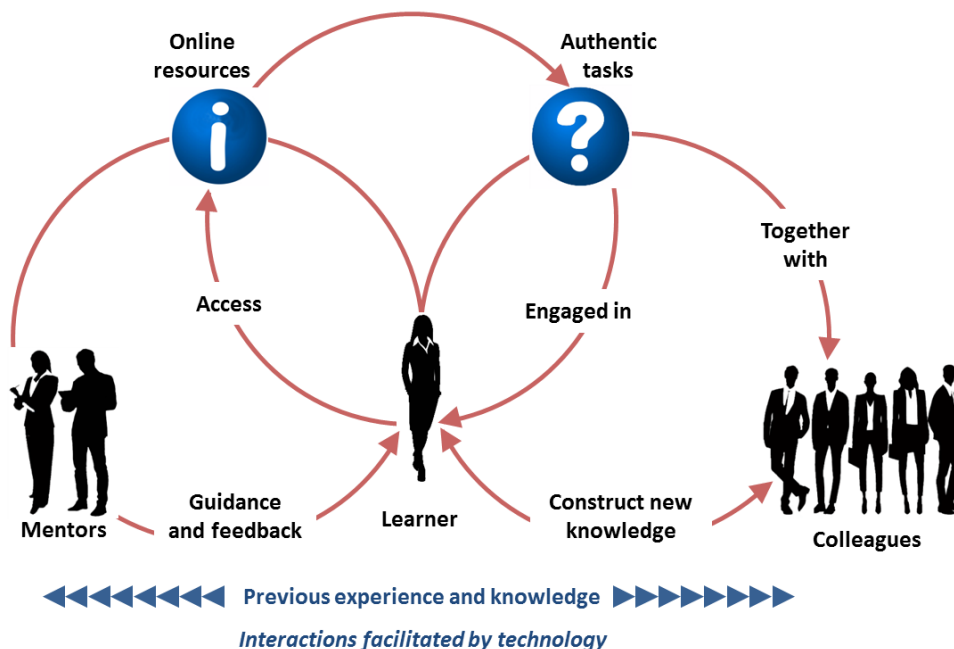


Figure 2. A framework of professional learning in authentic learning based OPD.

The learning interactions illustrated in the framework do not exist in a vacuum, nor do they have their starting and ending points within the scope of the OPD program, as illustrated in the following interview excerpt: “(T)he course is over but there’s a couple of us that are still communicating and digesting...we take a scenario and we kind of change it a little bit, and add our own experiences we used to deal with” (Participant 5).

The interactions were influenced by different forms of prior professional learning, such as existing professional networks, as well as attendance to other professional development programs either prior to or concurrently with the eVVM program. Moreover, the interactions were spontaneously deepened beyond the requirements of the program and continued afterwards in the form of ongoing discussion, strengthened networks, and collegial bonding. It is therefore noted that the learning interactions cannot be fully designed and managed, nor can they always be expected to occur in a similar manner. This is not to say that they cannot be supported and facilitated. Each of the elements in the framework can contain qualities that either promote or hinder the interaction and thus learning. Evidence of both types of qualities was found in the data, as explained in the following section.

Qualities that Promote the Learning Interactions

The first of the eight categories related to the central category is the learner. In the web of interactions, the learner is the active subject and in the centre of the interaction. The most important qualities that either promote or hinder the learning interactions are therefore attached to the learner. The crucial importance of commitment to studies was emphasised in the data. Without commitment from the learner’s side, meaningful learning interactions cannot take place. Commitment should not be regarded an inherent quality that the learner either has or has not, rather, it is something that can be supported and encouraged, as well as smothered and discouraged. Striving for an authentic learning experience is a key measure in encouraging commitment: “(A)ll of the activities were very useful because they were based on a realistic task...it can increase personal commitment in terms of continuing with the course” (Participant 1). This includes ensuring the practical relevance of the professional development program for the target group, as well as employing an appropriate authentic learning design.

The categories of authentic tasks, authentic learning resources, collaboration with colleagues, scheduling, and mentoring all relate to the central category as causal or contextual conditions. Table 3 illustrates the qualities of these categories that promoted or posed challenges to the learning interactions.

Table 3

Elements That Promote/Impede Learning Interactions

Category	Promoting qualities	Challenges
Authentic tasks	<ul style="list-style-type: none"> • Realism and practical nature • Complexity • Collaboration • Intellectual challenge • Meaningful use of digital technology 	<ul style="list-style-type: none"> ▪ Time constraints
Colleagues	<ul style="list-style-type: none"> • Global network • Shared interest 	<ul style="list-style-type: none"> ▪ Unresponsive group member ▪ Drop-out during group work ▪ Work across time-zones ▪ Unavailability of colleagues

A Grounded Theory of Professional Learning in an Authentic Online Professional Development Program
Teräs and Kartoglu

	<ul style="list-style-type: none"> • Ability to share experiences and test scenarios • Ability to see each other's work • Feedback and comments 	
Learning resources	<ul style="list-style-type: none"> • Authentic resources instead of textbook • Just-in-time instead of predefined readings • Clear and systematic presentation • Availability for future reference • Easy navigation 	<ul style="list-style-type: none"> ▪ Bandwidth requirements ▪ Length of documentation ▪ Not downloadable
Scheduling	<ul style="list-style-type: none"> • Tight schedules facilitate concentration • Increased commitment • Flow • Encourage to do one's best 	<ul style="list-style-type: none"> ▪ Juggling between commitments ▪ Hindering activities beyond the required ▪ Difficulty meeting deadlines
Mentors	<ul style="list-style-type: none"> • Availability • Timely feedback • Clarity of instructions • Good course management 	

Authentic tasks and collaborative learning were new to most participants, although all were experienced in OPD. This suggests that the principles of authentic learning are not yet very widely employed in OPD. Despite the newness, these features were appreciated by the participants. When describing the authentic tasks, some emphasised that the tasks were not only relevant and realistic, but they were “real practice.” These statements challenge the traditional way of perceiving e-learning as better suited for theoretical learning: “Instead of just somebody presenting information, you could see how it would work in the field. So it gave us a better depth of understanding and practical application” (Participant 5).

My best learning activity was the case study...because in that one I had to assume I'm the one doing the investigation on ground... how the VVM changed, I didn't have that experience. But now I think I know how I would do that investigation. It was realistic. (Participant 3)

Some of the participants would have appreciated more time to complete the tasks, whereas others found that the deadlines actually increased focus and commitment. Almost all pointed out that they had put in their best effort, which indicates a deep level of engagement with the tasks: “I and my partner we actually did a lot of work on the case study and the presentation as well. We put in our very best” (Participant 2).

All participants appreciated the *collaboration with colleagues*. Each participant brought a unique set of experiences to the course environment. The participants tapped into this resource and at times, discussions evolved beyond course expectations as participants shared experiences, compared professional contexts, and tested scenarios. Some continued to work together after completing the course, establishing lasting professional relationships. Learning from and with others was repeatedly emphasised as a beneficial and meaningful way of professional learning.

On the other hand, the busy *schedules* of the participants made it difficult to stay on track with the group tasks and there were cases where a group member was unresponsive or did not contribute to the task. In such cases, the role of skilful facilitation and good course management was emphasised. All participants were juggling between commitments, and some found it difficult to meet deadlines. On the other hand, others found that the busy schedule increased their commitment to the studies and encouraged them to do their best.

Based on the findings, *learning resources* that promote interaction are authentic, innovative, and relevant. They are based on real environments and scenarios that the participants can identify and relate to. Other important qualities include easiness of navigation, clear presentation, as well as accessibility (adequate length, format, and alternatives for materials that require ample bandwidth). The most important qualities of *mentoring* included availability of the mentors, active communication, clear instructions, good course management (e.g., dealing with group issues), as well as constructive feedback.

The Role of Technology

The category of technology relates to the central category as strategy: technology served as an enabler of the different learning interactions. While the course introduced a very wide range of technologies, no major technology-related challenges emerged from the data. The participants mentioned technology mostly when referring to learning experiences that were enabled by technology, such as organising vaccine vials in a refrigerator in a simulation, participating in a stimulating discussion, or giving presentations in a web-conference. Technology was also mentioned when describing communication with peers and mentors. The role of technology as a vehicle for distributing information gained minor attention compared to the roles of enabling active learning experiences and communication.

Experienced Impact of the Program

The last one of the categories, impact on professional practice, relates to the central category as a consequence. The impact of the eVVM course on professional learning described by the participants fell into three sub-categories: impact on professional practice, impact on self, and impact on the wider community. The impact on professional practice included improved decision-making in vaccine stock management, ability to use the VVM to determine whether a vaccine can be used, as well as developing a robust mental model on how to manage vaccines with VVM. The authentic task played a central role in achieving this impact: “With the observation of the VVM that we did, that actually gave me a kind of visual understanding of the principles in VVM management... now that I’ve done it physically, I can explain it” (Participant 2). The impact on self could be seen as increased self-confidence and trust in one’s ability to perform new tasks, expanded professional network, as well as strengthened professional identity.

The impact on the wider community that followed the professional learning was significant: reduced wastage, improved outreach services, increased accessibility, and coverage of immunization programs, increased storage life of vaccines and reduced damage during transportation: “So you can increase the services, you can increase the accessibility, and even the coverage. So you reach more children” (Participant 1).

Discussion and Implications

This study has examined how professional learning occurs in an authentic e-learning based OPD program. There are three key features in the learning interactions model that may inform OPD development and implementation. Firstly, online professional learning can be practice-oriented and result in changes in the field. The impact in the case presented in this paper was felt on the three levels of professional practice, professional identity, and impact on wider community. Secondly, OPD that has such an impact goes beyond content acquisition and information delivery and provides the participants with opportunities to engage in authentic professional tasks that are similar to what they would perform in the actual field and collaborate with colleagues in solving problems. Thirdly, such a model is heavily learner centred and requires active commitment. Therefore, a robust authentic learning design, meaningful use of technology as cognitive tools, as well as skilful facilitation play a crucial role. Interestingly, the way professional learning took place in the interactions has parallels with the authentic professional learning framework presented by Webster-Wright (2010), implying that

professional learning occurred in a way that resembles the way professionals naturally learn at work. Based on this observation, the authentic e-learning model (Herrington et al., 2010) appears to be a promising learning design framework for OPD.

The learning interactions were not only directly related to the course content and learning tasks, but spontaneously extended beyond course requirements as the participants' discussions moved away from the course platforms towards testing hypotheses, comparing situations in the field, and questioning and suggesting solutions to problems, and continued to do so after the course had ended. This phenomenon supports the observation that the professional learning that took place resembled the way professionals learn in authentic work situations, as opposed to simple information delivery. This is, in fact, not dissimilar to the early stages of a community of practice (Wenger, McDermott, & Snyder, 2002). Like professional learning, communities of practice cannot be forced but they form voluntarily when a group of people find value in interacting. The following description of communities of practice aligns with what some participants experienced:

(T)hey spend time together, they typically share information, insight, and advice. They help each other solve problems. They discuss their situations, their aspirations, and their needs. They ponder common issues, explore ideas, and act as sounding boards. ...They also develop personal relationships and established ways of interacting (Wenger et al., 2002, pp.4-5).

This is not to say that authentic learning is a silver bullet that will automatically result in the formation of a community of practice. As Wenger et al. (2002) point out; communities of practice form on their own as a natural part of organisational life, they cannot be forced with the help of an intentional learning design. They cannot be managed, controlled, and directed. Attempting to force the participants of a PD program to form a community of practice is therefore doomed to be unsuccessful. However, communities of practice can be cultivated by creating an environment where they can thrive: making time and resources available, valuing their learning, and giving them a voice in decisions (Wenger et al., 2002). It does seem that the authentic e-learning design promotes real-life relevance, complexity, and collaboration that are often absent in formal OPD but may be helpful in creating an environment where the unforced creation of a community of practice is possible.

Engagement is another identifier of authentic professional learning. According to Webster-Wright (2010), active engagement in practice is not merely desirable, but essential to the experience of learning as professional. Authentic tasks provide a feasible way of integrating this dimension in OPD. In Webster-Wright's model, engagement requires for the professional to care about the situation. It is therefore crucial that the OPD program is directly relevant to the participants' context and they can see how it impacts on practice. Engagement also involves dealing with uncertainty and working out solutions, often with help from colleagues. In fact, "uncertainty is an important feature of learning" (Webster-Wright, 2010, p. 122). This aligns with authentic e-learning which assumes that the complexity of the real world is retained in the learning environment and reflected in the learning tasks. In this study, these features were seen to foster commitment to learning, which is one of the most important factors that may either support or hinder learning interactions. These findings resonate with earlier research regarding the role of motivation and self-regulation as crucial factors in initiating and fostering commitment. According to Corno and Kanfer (1993), the processes involved in motivation affect decision-making and commitment with respect to an individual's goals. However, as Ruohotie (2002) points out, motivation alone is not sufficient as even a highly motivated person may find it

challenging to follow through her or his intentions. Therefore, conative skills are needed to maintain commitment (Pintrich, 1999). Ruohotie (2002) suggests that these skills can be fostered by learning designs that promote learner autonomy, collaborative learning, and meaningful learning tasks. In the light of the present study, authentic e-learning seems to provide a useful framework for such a design. In designing OPD, it is important to keep in mind that the program must be intrinsically motivating for the practitioners and serve their personal professional learning needs. Merely compliance-driven professional development is unlikely to promote a sense of ownership and commitment in the participants.

The authentic professional learning model emphasises the temporal and social interconnectedness of professional learning (Webster-Wright, 2010). Temporally, learning is not isolated to a single transition situation but is continuous, dynamic, and iterative. This aspect is also an important part of the learning interactions framework suggested in this study: learning interactions do not begin at the beginning of a course, nor do they end when the course does. Socially, learning occurs through dynamic interactions with others. In collaborative learning situations, one learns with others (collaborative problem solving, working together), from others (multiple perspectives, knowledgeable colleagues), as well as about others (empathy, appreciating different viewpoints). Evidence of all three was found in this study.

As Webster-Wright (2010) points out, professional learning is open-ended and requires openness of attitude. This is evident also in the learning interactions model: professional learning does not have a beginning and an end, and it can only occur when the professional cares enough to commit to the learning interactions. Therefore, a model of how professional learning occurs in an authentic e-learning based OPD program will inevitably remain incomplete. The course ends but learning continues, and what each individual takes home will vary. In that sense, attempts to determine very detailed “learning outcomes” may be futile. Rather, authentic learning based OPD provides opportunities to learn professionally through authentic tasks, collaborating with others, reflecting and articulating, accessing latest knowledge and expertise, scaffolded, and coached by capable mentors. These processes facilitate the interactions that spark professional learning.

Conclusion

In this study a grounded theory approach was used to examine how professional learning takes place in an OPD program designed and implemented according to the principles of authentic e-learning, as well as to understand the impact of the authentic learning design on the professional learning experience of the participants. The context of the study was an OPD program in vaccine management offered by the WHO. A key outcome of the study is a theoretical model of learning interactions that may be beneficial for professional development providers, online learning designers, online educators, and online learners. Understanding the mechanisms of online professional learning and the implications for OPD will also provide insight for decision-making and policy development in the relevant sectors.

In the theoretical model that was developed in this study, online professional learning occurs through interactions rather than by consuming content. Enabled by technology, the learner, colleagues, mentors and authentic curriculum all interact with each other in layers, each layer bringing in added value and promoting learning. Curriculum therefore becomes enriched with knowledge from the participants and mentors. It is not a ready-made package that can be delivered and consumed, but rather a dynamic

series of interactions that lead to collaborative construction of new knowledge. The role of technology is to create an interactive learning environment, which enables and facilitates these interactions. The authentic e-learning model provides a helpful pedagogical framework for creating such a learning environment.

Parallels with the authentic professional learning model could be detected in the theoretical model of learning interactions. There was evidence of professional learning taking place with impact on practice, self, and wider community. These findings imply that authentic e-learning based OPD may enable learning that resembles the way professionals learn naturally in the workplace.

Finally, it can be suggested that learning design is a key component in OPD research as it contextualises the findings, improving their applicability, and comparability. It is crucial to realise that e-learning in itself is not a pedagogical dimension, rather, it is just a delivery mode. Further research into OPD learning design would therefore be in place. Holistic approaches, such as design-based research or a phenomenological inquiry could provide further insight into OPD research. More research is also needed in order to further test and validate the theoretical model introduced in this study. The model is based on a well-documented adherence to the pedagogical principles of authentic e-learning. The hypothesis that thus follows is that the theoretical model will work in other OPD contexts using the authentic e-learning design. Testing this hypothesis with other authentic e-learning based OPD offerings is the next step in validating the theoretical model.

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Explanations and Interactives Improve Subjective Experiences in Online Courseware

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Abstract

As online courses become more common, practitioners are in need of clear guidance on how to translate best educational practices into web-based instruction. Moreover, student engagement is a pressing concern in online courses, which often have high levels of dropout. Our goals in this work were to experimentally study routine instructional design choices and to measure the effects of these choices on students' subjective experiences (engagement, mind wandering, and interest) in addition to objective learning outcomes. Using randomized controlled trials, we studied the effect of varying instructional activities (namely, assessment and a step-through interactive) on participants' learning and subjective experiences in a lesson drawn from an online immunology course. Participants were recruited from Amazon Mechanical Turk. Results showed that participants were more likely to drop out when they were in conditions that included assessment. Moreover, assessment with minimal feedback (correct answers only) led to the lowest subjective ratings of any experimental condition. Some of the negative effects of assessment were mitigated by the addition of assessment explanations or a summary interactive. We found no differences between the experimental conditions in learning outcomes, but we did find differences between groups in the accuracy of score predictions. Finally, prior knowledge and self-rated confusion were predictors of post-test scores. Using student behavior data from the same online immunology course, we corroborated the importance of assessment explanations. Our results have a clear implication for course developers: the addition of explanations to assessment questions is a simple way to improve online courses.

Keywords: assessment, feedback, affect, confusion, online course design

Introduction

Many researchers have evaluated different elements of computerized instruction using experimental and observational methods (e.g., Clark & Mayer, 2011; Szpunar, Khan, & Schacter, 2013; Türkay, 2016). Often

these studies were conducted in-person in laboratories rather than online, and few have utilized authentic online course materials. Moreover, the majority of the studies have assessed learning outcomes with an immediate follow-up rather than a more educationally pertinent delayed follow-up test. The current work is guided by experiments performed by Szpunar, Khan, and Schacter (2013) and Szpunar, Jing, and Schacter (2014). The results of these studies support the idea that the interleaving of assessments with short videos enhances learning while reducing mind wandering and overconfidence. In these studies, participants were tested immediately after instruction with the same test items as the study materials. Finally, the assessments in these studies were open response type assessments, which cannot reliably be machine-graded at scale.

To address some of the shortcomings of the studies mentioned above, our goal in this study was to investigate the effectiveness of the types of instructional sequences that are widely available on common online course platforms while utilizing course materials used in real online courses. Moreover, we conducted this study fully online, not in a laboratory setting, to experimentally match the intended delivery modality of these materials. To investigate educationally relevant outcomes, the post-test was administered not as an immediate follow-up, but seven days after instruction. The post-test covered content-matched items but did not directly replicate assessment items that participants encountered in the instruction. We made these design choices in order to study retention and near transfer of the material rather than memorization of the test items and their correct responses. Finally, we varied certain parameters experimentally to examine the influence of instructional choices on students' experiences in and engagement with online courses.

In settings such as massive open online courses (MOOCs) and small private online courses (SPOCs), video is the most common instructional modality (Hansch et al., 2015). Instructors have the option to supplement video instruction with text, assessment, and/or other forms of interaction (simulation, discussion, and interactives, to name a few). These instructional modalities can involve very different production costs, levels of interactivity, and afford distinct opportunities to collect behavior and performance data. We wanted to compare the effectiveness of common modalities that are used in online courses alongside video on learners' affective and cognitive outcomes. For this work, we selected text (which highlighted concepts from videos), assessment (which reinforced concepts from videos), assessment with explanations (which matched the assessment with additional feedback in the form of an explanation of the correct answer), and assessment with a summary interactive (which summarized the content covered in the instructional videos).

In this study, we focused on the impact of routine online course design choices by asking the following questions:

1. How does the addition of multiple choice or short-answer assessments between videos impact learning, persistence, and engagement in a fully online advanced science lesson?
2. How does simple feedback, in the form of explanations to assessment questions, impact learning, persistence, and engagement?

3. How does a summary interactive, which serves as a recap of the content of the lesson, impact learning, persistence, and engagement?
4. What readily measurable variables can be used to predict post-test performance after a learning session in an online course?

Background

The Testing Effect

It is well established that assessment promotes memory and learning (Agarwal, Karpicke, Kang, Roediger, & McDermott, 2008; Pyc & Rawson, 2010; Roediger & Karpicke, 2006). Mechanistically, learning-by-testing is caused by the direct effect of effortful retrieval and diverse indirect or “mediated” effects (for example, improved study behaviors and learning from feedback). The direct effects of testing are strongest with repeated, spaced retrieval of material. In laboratory experiments this has frequently involved repeated study of materials with low educational relevance, such as unrelated word pairs. Although the testing effect has been replicated in laboratory studies with educationally-relevant materials, classroom-based studies produce effect sizes that are typically smaller than those in simple, repeated testing memorization tasks (Gog & Sweller, 2015; Roediger & Karpicke, 2006).

The testing effect has not been extensively studied in online courses. Testing in MOOCs and SPOCs is often limited to simple machine-gradable assessment types (Daradoumis, Bassi, Xhafa, & Caballé, 2013). Understanding the affordances and limitations of these assessment types will guide their usage and help prioritize the development of new assessment types. In the case of formative assessments, the indirect effects of testing may be as important as the direct effects. For example, Agarwal and colleagues (2008) found that testing potentiated the effect of feedback given after the test. In a similar study that included testing or a control (reading content-aligned statements), the effect of testing was not as dramatic (Kang, McDermott, & Roediger, 2007). This suggests that an indirect effect of testing may be targeted re-exposure to the most important content. It is important to note that assessment *format* probably also interacts with the testing effect, as recognition-type testing tasks (multiple choice) are cognitively easier than open-response recall-type tasks (Cabeza et al., 1997). While the learning benefits of testing are well characterized, comparatively few studies have evaluated the impact of assessment in online courses on students’ subjective experiences.

Feedback Enhances Learning

The term “feedback” has many connotations and is sometimes taken to refer specifically to personalized, expert-generated feedback (Margaryan, Bianco, & Littlejohn, 2015). In the current study, we adopt a broader definition of feedback that encompasses any information provided to students about their knowledge or their performance. Thus, we adopt the view that feedback can only exist as a response to a student activity, such as interacting with assessment (Hattie & Timperley, 2007). It is well established that many different forms of feedback, including computerized feedback, are effective for promoting learning, but the details do matter. For example, feedback with praise is less effective than feedback

without praise (reviewed by Hattie & Timperley, 2007). Feedback can work by providing cues or reinforcement to learners, which could include information about learners' current level of knowledge. In online courses, assessment is one common method used to create opportunities for feedback.

Some researchers have argued that there is a particular advantage to *adaptive* computerized feedback, that is, feedback tailored to students' specific misconceptions or errors (for example, Lütticke, 2004). In a recent study, the authors directly compared a very simple form of feedback (knowledge of the correct response) to adaptive feedback, and found that students preferred the more elaborative adaptive feedback (D'Antoni et al., 2015). However, the authors did not examine the impact of generic yet elaborative feedback (such as written explanations of correct answers) to more simple forms of feedback (binary feedback that simply indicates whether an answer is correct or not). This leaves open the possibility that elaborative but generic feedback, such as question explanations, may provide some of the same benefits as adaptive feedback. Elaborative feedback, while simple to add to assessment, is not particularly common in computerized instruction. In a review of common adaptive assessment systems, Saul and Wuttke (2011) found that most systems only provide students with knowledge of the correct response, without further elaboration. In MOOCs, there can be a tradeoff between the quality and quantity of feedback (Ebben & Murphy, 2014).

Optimizing Engagement and Learning in Online Courses

Observational Studies. There has been a great deal of research into patterns of student engagement and learning in online courses, particularly analyses of big data generated from MOOCs. In MOOCs, student engagement is often equated with retention, which generally drops off over time (Ferguson & Clow, 2015; Kizilcec, Piech, & Schneider, 2013). Although these studies have been useful in characterizing patterns of engagement, they are less informative as to *why* students choose to engage or disengage with online courses. Affective elements such as motivation and intent to complete play a key role in engagement in online courses (Greene, Oswald, & Pomerantz, 2015; Reich, 2014; Wang & Baker, 2015), but course-specific factors can influence engagement. Studies indicate that the modality of online content delivery can influence both learning outcomes and engagement (Türkay, 2016). Moreover, video production style influences students' engagement with the videos (Guo, Kim, & Rubin, 2014), and learning outcomes (Chen et al., 2016). Design of online learning platforms can impact engagement by enabling learners to interact with instructors and other learners. In a qualitative study of MOOC learners, many learners highlighted a sense of community they developed through discussion forums and social media groups (Friedman, Liu, Morrissey, Türkay, & Wong, 2015). It is less clear from these studies how components of online courses other than video and discussions impact student engagement.

Certain student-level priors, including past academic performance, standardized test scores, level of educational experience, and some demographic factors can predict students' persistence and grades in traditional educational settings (Casillas et al., 2012; Geiser & Santelices, 2007). In fact, the entire concept of pre-requisites is based on the premise that prior subject knowledge is important for academic success. In MOOCs, completion rates may differ by students' level of prior educational attainment (Pursel, Zhang, Jablow, Choi, & Velegol, 2016), but this is not always the case (Goldberg et al., 2015). Currently, there is a great deal of interest in identifying quantifiable predictors of student retention and engagement as a means to intervene early in both traditional and online educational settings.

Methods

Study Administration

Participant Recruitment and Screening. Overall study design is summarized in Figure 1. Study participants were recruited from Amazon Mechanical Turk using TurkPrime (www.turkprime.com) (Litman, Robinson, & Abberbock, 2016). The HITs (human intelligence tasks) associated with this study were only available to US-based workers with a HIT approval rate of 80% or higher to establish equality and quality of participants. First, we screened participants with a 5-question pre-test to assess their knowledge of biology (Appendix A). Workers received \$0.25 for taking the test. The pre-test had a 3-minute time limit and was administered with Qualtrics (www.qualtrics.com). Three of the test items were drawn from an introductory biology concept inventory (Shi et al., 2010) and the remaining two were written by the study authors. All pre-test items were reviewed and revised in consultation with two additional PhD-level experts in biology. Participants who answered three or more items correctly on the pre-test were invited into the instructional phase of the study. Throughout the study, Mechanical Turk worker IDs were passed over to Qualtrics to permit data linking.

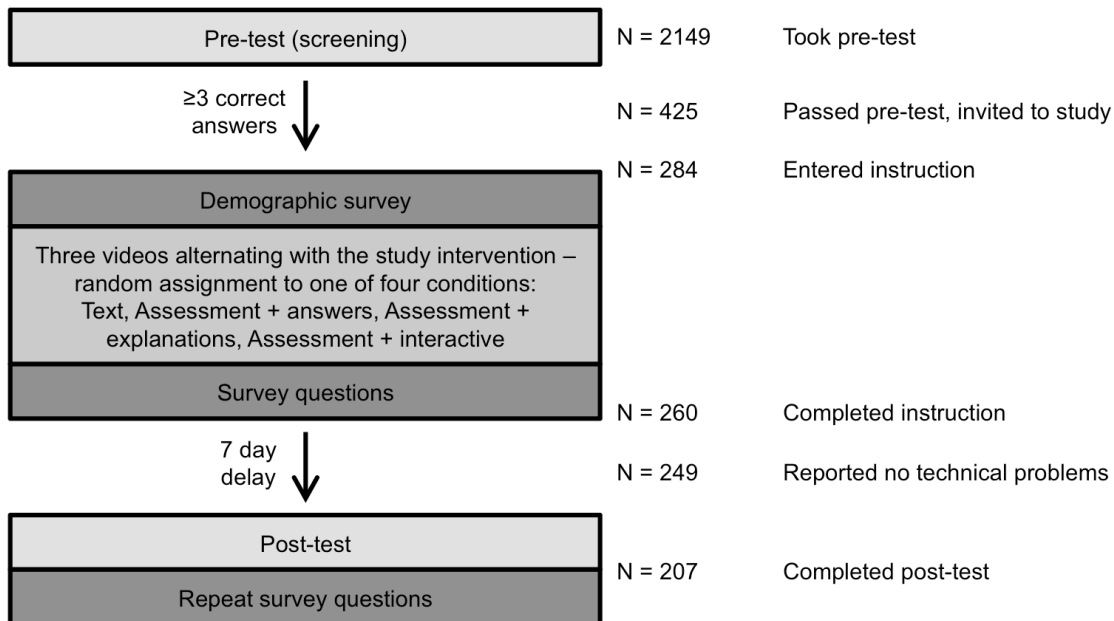


Figure 1. Overall study workflow and participant retention in the study. The phases of the study are indicated in the diagram on the left, while the number of participants at each phase are indicated on the right.

Instructional Phase. All instructional materials are part of actual online courses that are provided to students in pre-health care careers. The text and assessment materials were created by a PhD-level expert in immunology and reviewed and revised in collaboration with two MD/PhD immunology experts with decades of relevant teaching experience. The instructional phase of the study was administered in Qualtrics. Participants were paid \$5.00 for this phase of the study, which took 32 minutes on average to complete. Before starting the instruction, participants consented to the study and filled out

some basic demographic questions (Appendix A). Instruction consisted of three “whiteboard style” videos alternating with different activities (see Appendix B for a screenshot from an instructional video). The videos contained professionally-constructed visual elements representing immunological processes accompanied by a narration and written annotation of these visuals. The videos were planned and produced by a professor with an MD/PhD and decades of experience in teaching immunology, in collaboration with a professional medical illustrator and an MD with decades of medical education experience. The videos auto-played as soon as participants entered a page with the videos; participants could not see the video controls or advance forward until the videos ended. Participants were randomly assigned with equal probability to one of the four different experimental conditions:

1. Text: participants read a series of text statements that corresponded to assessment questions and their answers.
2. Assessment + answers: participants read assessment questions and answered them, then saw the correct answers after answering the questions.
3. Assessment + explanations: participants read assessment questions and answered them, then saw the correct answers with an explanation of the correct answers.
4. Assessment + interactive: participants read assessment questions and answered them, then saw the correct answers after answering the questions. At the end of the instruction, the participants navigated through a review interactive that summarized the steps of the immune process they studied in the lesson. The same team that made the videos produced the interactive.

Immediately after instruction, participants answered a set of survey questions about their study experiences (Appendix A). The survey questions were about the instruction as a whole and not specific to the experimental manipulation (text or assessment questions). We also asked participants to report whether they experienced technical problems during the experiment.

Post-Test and Survey

Seven days after instruction, participants who completed the instructional phase were invited to take a brief follow-up test administered in Qualtrics (Appendix A). The text and assessment materials were created by a PhD-level expert in immunology and reviewed and revised in collaboration with two other PhD-level experts in immunology. The post-test had eight multiple choice items and 10-minute time limit. The total possible score on the post-test was 10 points (two questions were “multiple selection” questions with two correct answers and thus were worth two points each). After the post-test, participants were asked to re-answer the original survey questions regarding their memory of their experiences in the lesson.

Data Analysis

Data Processing and Analysis

Data were downloaded from Qualtrics and pre-processed with Python. Participants who participated more than once were excluded at this phase. For statistical analyses, repeated measures of Likert scale data were averaged (1 = strongly agree, 5 = strongly disagree). Only participants who completed all phases of the study and reported no technical problems were included in the analyses of primary outcomes (N = 207). We also analyzed dropout rates. Compiled data were analyzed and plotted in R, and some summary results were exported to Excel for plotting.

Log File Analysis

In addition to the experimental data described above, we utilized log file data from three separate course runs of HMX Fundamentals – Immunology, the SPOC from which the instructional materials were drawn for this study. Log file data were parsed from JSON format and processed in Python; statistical analyses were performed in R. Overall, there were 69,043 unique assessment attempts of over 300 assessment questions. The summary results were plotted in Excel.

Statistical Analyses

All statistical tests were performed in R. The following statistical tests were used: Fisher's exact test (study dropout, gender distributions, MOOC participation), Kruskal-Wallis with post-hoc Mann-Whitney tests (Likert scale results, post-test scores), ANOVA with post-hoc t-tests (time on task), chi-squared test (show answer behavior), and one-sided t-tests and Bartlett's test of variance (post-test score predictions). Ordinal logistic regression was performed using the lrm model in the *rms* R package. The three conditions with assessment grouped together with respect to two primary outcomes (dropout during instruction and time on task), so these conditions were grouped for some analyses (see Appendix C). Because of the difference in dropout, the assessment groups were compared to each other and the text group data are only provided for visual reference.

Results

Text Compared to Grouped Assessment Conditions

Study retention and time on task. Using a pre-test, we screened more than 2,000 individuals; less than 20% passed and were invited into the study. The overall number of participants and retention in the study are summarized in Figure 1. We first compared the dropout between different experimental conditions. Surprisingly, there was a significant between-groups difference in dropout during the instructional phase of the study ($p = .0046$, Fisher's exact test). None of the participants in the text condition dropped out, while there was dropout in all of the other conditions with assessment, so we compared the text condition to the assessment conditions as a group (the "Grouped Assessment conditions"). Participants in the Grouped Assessment conditions had significantly higher dropout than those in the Text condition ($p = .001$, Fisher's exact test). Dropout from the Text condition was also

significantly different from each of the assessment conditions individually ($p < .01$ in all cases, Fisher's exact test). However, there was no difference in dropout between the different assessment conditions ($p = .860$, Fisher's exact test). These results are summarized in Appendix C. We analyzed two additional sources of attrition: failure to return to the follow-up test, and exclusion due to reported technical problems. There was no significant difference in attrition between the different conditions due to either of these factors. We next compared time on task in the instruction phase of the study. There was a significant between-groups difference in time on task ($F(3)=14.84$, $p = 8.98E-09$, one-way ANOVA). Time on task was greater in the Grouped Assessment conditions than in the Text condition ($t(162.22)=-8.00$, $p = 2.20E-13$, Welch's two-sample t-test), and time on task in the Text condition was significantly different from each of the assessment conditions. However, there was no difference in time on task between the different assessment conditions ($F(2)= 0.012$, $p = .988$). These results are summarized in Appendix C.

Differences in Subjective Experiences

The differences in time on task and dropout between text and all assessment conditions suggest a meaningful difference in participants' experiences between these conditions. Therefore, we compared participants' self-rated subjective experiences in the Text condition with the Grouped Assessment conditions (Assessment + answers, Assessment + explanations, Assessment + interactive). Participants in the Grouped Assessment conditions reported lower levels of mind wandering, greater interest in the lesson, greater effort exerted in the lesson, and more strongly agreed that they would like to learn from similar lessons (Appendix C). There were no significant differences in self-rated difficulty, confusion, enjoyment, or understanding. These results suggest that assessment improved participants' subjective experiences relative to reading text statements, and in particular made the lesson materials more engaging. However, due to the differences in dropout during instruction, we cannot draw causal conclusions about the observed differences in subjective ratings between the Grouped Assessment and Text conditions.

Differences in Post-Test Scores

There was no difference between the Grouped Assessment conditions and the Text condition in the scores of a post-test administered seven days after the instructional phase of the study ($U=4210.5$, $n_1=59$, $n_2=148$, $p = 0.688$). We wanted to ensure that this result was not due to a sensitivity issue with the post-test (although the post-test was content-validated by two expert reviewers). We administered the test to a group of individuals who had passed the pre-test but did not go through instruction (the "instruction-naive" group). Post-test scores were significantly higher in the group of participants exposed to the Text condition ($U= 2305$, $n_1=59$, $n_2=49$, $p = 9.7E-08$) and Grouped Assessment conditions ($U=5795.5$, $n_1=148$, $n_2=49$, $p = 2.7E-10$) than the post-test scores of the instruction-naive group. Post-test results are summarized in Appendix C.

Negative and Positive Subjective Elements of Assessment

Differences in students' subjective experiences between assessment conditions. We compared the different conditions with assessment to look for any differences in participants' self-reported prior variables. The Text condition was not included in this analysis because of the significant difference in dropout between this condition and all others. There was no significant difference between any of the groups in any of the self-reported demographic data we collected, including gender and prior

experience with MOOCs (Fisher’s exact test), time spent weekly on learning activities (ANOVA), attained education level, and prior knowledge in basic biology, advanced biology, and immunology (Kruskal-Wallis test). Moreover, there was no significant difference in pre-test scores between the different groups, nor was there any difference in post-test score between the groups (Kruskal-Wallis test). We next compared the survey responses (Likert scale data) between these groups. The results of this analysis are summarized in Table 1. Significant differences are explored below.

Table 1

Summary of Survey Responses for Assessment Conditions

Statement	Mean Likert Scale Score			H(2)	p value
	Assessment + answers n=53	Assessment + explanations n=46	Assessment + interactive n=49		
My mind wandered during the lesson	3.44	4.11	3.58	11.544	0.0031
I understood the material in this lesson well	2.80	2.21	2.26	11.335	0.0035
I found this lesson difficult	2.43	3.04	2.88	7.604	0.0223
I found this lesson confusing	3.25	3.84	3.56	5.723	0.0572
I found the lesson interesting	1.74	1.52	1.79	4.694	0.0956
I exerted effort in this lesson	2.04	1.96	2.34	4.150	0.1255
I enjoyed learning from this lesson	1.86	1.58	1.71	3.167	0.2052
I would like to learn from more lessons like this one	1.94	1.70	1.80	1.691	0.4293

*Note. Mean Likert scale scores are given (1 = Strongly Agree, 5 = Strongly Disagree). Between-groups comparisons were done with Kruskal-Wallis tests; test statistics and p values are reported in the right-hand columns.

Assessment explanations reduce perceived difficulty and mind wandering. We were surprised to find the largest average difference in subjective responses was found in participants’ perceived level of mind wandering. Participants in both the Assessment + answers and the Assessment + interactive condition reported significantly greater levels of mind wandering than participants in the Assessment + explanation condition (Figure 2A). We hypothesize that explanations provided immediately after the questions is a form of feedback that increases the perception of interactivity. Explanations also affected perceptions of difficulty. The addition of explanations and an interactive reduced the average reported difficulty of the lesson, compared with assessment answers only (Figure 2B). However, the only significant difference in reported difficulty was between the Assessment + answers and Assessment + explanations conditions. This suggests that immediate feedback decreases the perception that material is challenging.

Assessment without additional feedback reduces score predictions and perceived understanding. We also observed a significant between-groups difference in self-rated understanding of the lesson material. Participants in the Assessment + answers condition reported the lowest levels of understanding of the lesson material; this effect was abrogated by the addition of explanations or a summary interactive (Figure 2C). This could indicate that explanations increase students’ feelings of fluency. At the end of the instruction phase of the study, participants were asked to predict their post-test

scores. We measured the accuracy of these predictions by comparing predicted scores to actual post-test scores (accuracy = Predicted Score - Actual Score) (Figure 2D). There was no difference in the variance of accuracy between any of the groups ($T(3)=0.894, p = 0.827$, Bartlett's test). On average, score predictions were low by about one point out of ten in the Assessment + answers group, whereas they were quite accurate in the other groups. The Assessment + answers group was the only group that did not accurately predict their scores, as measured by a deviation from a mean accuracy of zero. It may be the case that participants who completed assessment with only assessment answers as feedback had lower feelings of self-efficacy than participants in the other groups, as manifested by lower ratings of understanding and inaccurate test score predictions. The results suggest that summary interactives and explanations can mitigate a perceived lack of familiarity with instructional material.

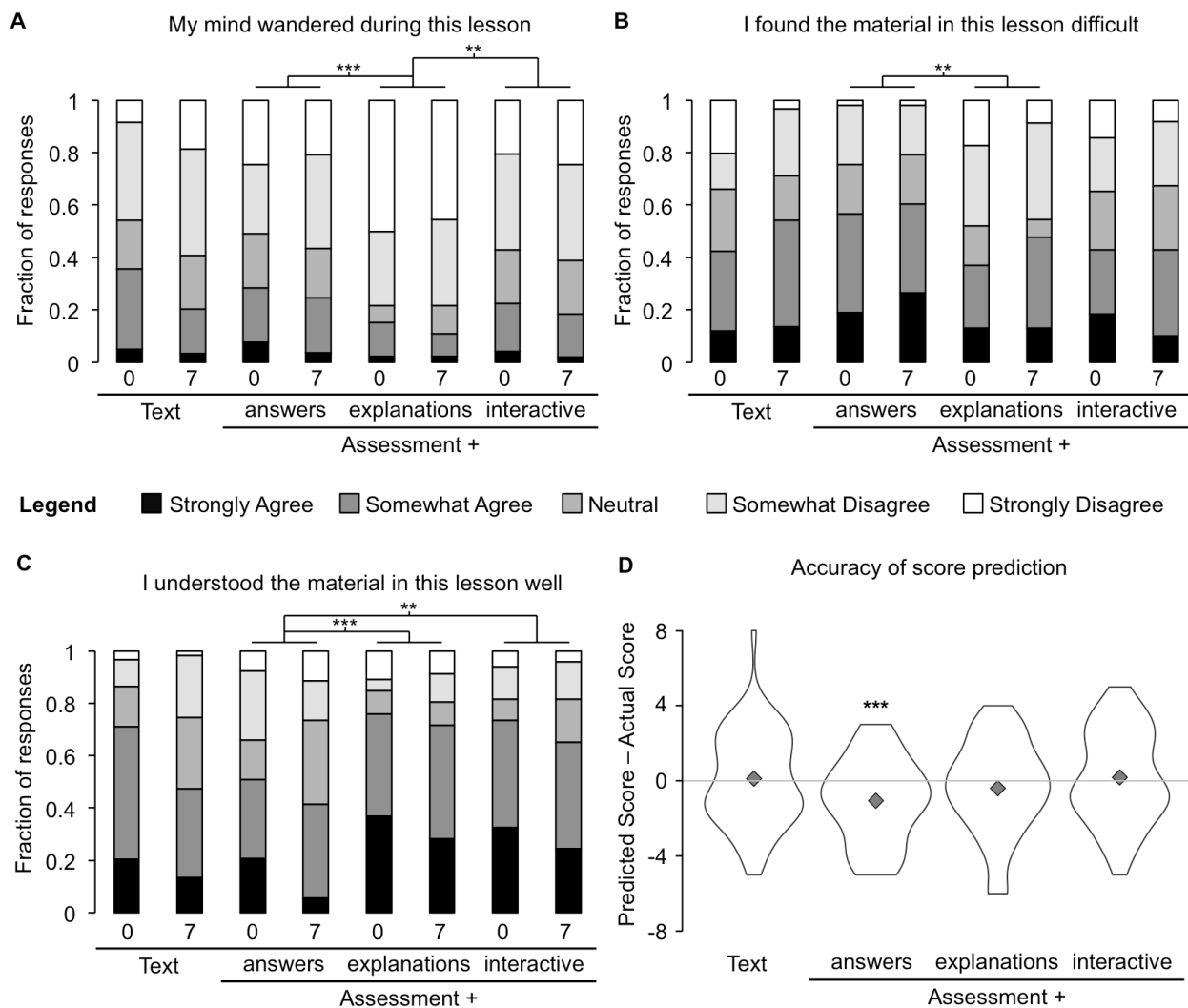


Figure 2. Significant differences in survey responses between the Assessment conditions.

Results from the Text condition are shown for visual comparison, but because of the significant differences in dropout, this condition was not statistically compared to the Assessment conditions. For

panels A-C, all P values were computed with post-hoc Mann-Whitney tests. Sample sizes for each group are given in Appendix C. Frequency of responses the day of instruction (o) and after a seven-day follow-up (7) are shown. A – Participants in the Assessment + explanations condition reported substantially lower levels of mind wandering than participants in either the Assessment + answers ($U=779$, $p=0.002$) or Assessment + interactive ($U=1488$, $p=0.006$) conditions. B – Participants in the Assessment + explanations condition perceived that the lessons were less difficult than participants in the Assessment + answers condition ($U=842.5$, $p=0.008$). C – Compared to the Assessment + answers condition, participants reported greater understanding in the Assessment + explanations ($U=1640$, $p=0.003$) and Assessment + interactive ($U=1701.5$, $p=0.006$) conditions. D – Participants in the Assessment + answers condition made the least accurate score predictions; this group is the only group for which the average accuracy (Predicted – Actual Score) was not equal to zero ($t(52)=-3.4612$, $p=0.0011$). P values on graphs: ** < 0.01; *** < 0.005.

Evidence from an authentic context: Students choose to view assessment explanations in online courses. To test whether our experimental results hold true in a real-world setting, we analyzed assessment interaction behavior in three separate runs of HMX Fundamentals – Immunology, the SPOC from which we drew instructional materials for this study. The course platform provides students with a “Show Answer” button that appears after students have completed a question (meaning the students have answered correctly or used up all assessment attempts). Students were allowed two attempts for most assessments in the course. If students do answer correctly, they already have knowledge of the correct response and the only additional information revealed by the “Show Answer” functionality is an explanation. We analyzed whether students showed the answer and explanation, broken down by the number of answer attempts and whether or not their responses were correct (Figure 3). When students answered correctly on the first attempt, they viewed the explanation almost half of the time (48.9%). This increased if students were incorrect on the first attempt but correct on a later attempt (62.5%). Finally, if students never answered correctly, they almost always viewed the answer and explanation (95.0%). Overall, these results suggest that, even with knowledge of the correct response, students often choose to view assessment explanations.

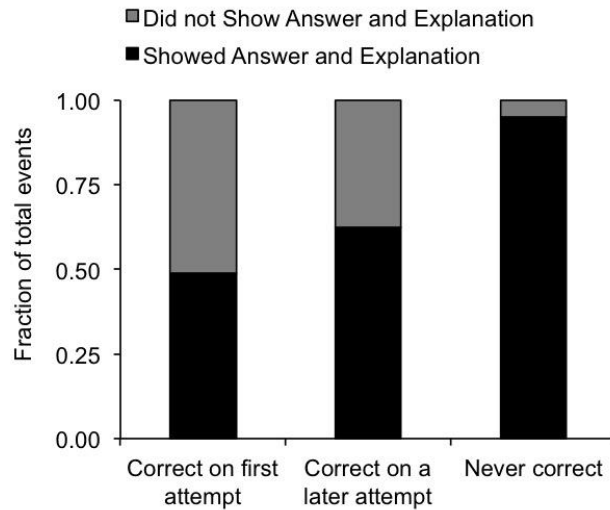


Figure 3. Students opt in to reading explanations in online courses.

Results are from three course runs of a small private online immunology course, comprising 69,043 total attempted questions. Students had the option to view answers and explanations with a “Show Answer” button. In any case where students answered correctly, they already had knowledge of the correct response before selecting “Show Answer”. Most questions in this course allowed the students to attempt the question twice. Approximately half of the time when students had the correct answer on a first attempt, they still viewed the explanation. In cases where the students were incorrect on the first attempt, but correct on a later attempt, students more frequently opted to see the explanation. Finally, when students were incorrect, they viewed the explanation (and correct answer) over 95% of the time. Differences in show answer behavior were statistically significant ($H(2)=5540.2$, $p<2.2E-16$, chi-squared test).

Predicting Post-Test Scores

Prior knowledge and reported confusion are predictive of test scores. Numerous studies have demonstrated a relationship between prior variables, including student demographics, and learning in traditional and online courses (Casillas et al., 2012; Geiser & Santelices, 2007; Pursel et al., 2016). We used ordinal logistic regression to test whether participants’ self-reported background information (gender, education, biology background, experience with online courses, and time spent on various educational activities) was predictive of post-test scores. These variables were not significantly predictive of post-test scores. We generated a separate ordinal logistic regression model to test whether participants’ pre-test scores or survey responses immediately after instruction were predictive of post-test scores. As a precaution, we excluded the results from the follow-up survey (administered after the post-test) because presumably a participant’s perception of her performance on the post-test could influence her survey responses. The results of this analysis are shown in Table 2. The only statistically significant predictors of post-test scores were participants’ pre-test scores and perceived confusion with the lesson. Specifically, higher pre-test scores and stronger disagreement with the statement “I found this lesson confusing” were predictive of higher post-test scores. Surprisingly, participants’ *predicted* post-test scores were *not* significantly predictive of their actual post-test scores in this model (although there was a

positive correlation between these variables). It is less surprising that pre-test performance is one of the best predictors of eventual post-test performance, because the pre-test has the highest level of task similarity to the post-test. However, the finding that confusion is uniquely predictive of final test scores suggests that students' self-reported confusion may be more useful than other subjective ratings for self-evaluation purposes.

Table 2

Predicting Post-Test Scores with Ordinal Logistic Regression

Variable	Coefficient	p value	Likert data?
Pre-test score	0.581	0.004	N
I found this lesson confusing	0.496	0.011	Y
I found the lesson interesting	-0.397	0.051	Y
I enjoyed learning from this lesson	0.462	0.062	Y
My mind wandered during the lesson	-0.238	0.070	Y
Predicted score	0.111	0.160	N
I found this lesson difficult	0.191	0.220	Y
I understood the material in this lesson well	-0.237	0.270	Y
I would like to learn from more lessons like this one	-0.114	0.633	Y
I exerted effort in this lesson	-0.022	0.882	Y

*Note. For Likert data, higher numbers indicate stronger disagreement, thus a positive coefficient indicates that disagreement with a statement was positively predictive of test scores.

Discussion

Practical Applications and Theoretical Implications

Our goal in this study was to test educationally-relevant instructional design choices that instructors and course creators must make when building online courses. From the current study, we can conclude some simple rules to inform the design of online courses. If an instructor chooses to include multiple choice or short answer formative assessments, she should add text explanations of the correct answers. This will improve students' subjective experiences and help to mitigate potential downsides of assessment. If she has the resources to add a summary interactive, this will also improve students' experiences. If instructors do make instructional changes based on these conclusions, students stand to directly benefit from more interesting and engaging online courses.

Simple Feedback Improves Automated Formative Assessment

Although the term "feedback" often connotes personalization and direct instructor involvement, the results of this work suggest that some of the benefits of feedback may accrue from universal feedback, such as written explanations of assessment questions. This feedback increases students' perceptions of engagement and understanding and reduces mind wandering relative to assessment with scoring only. In our experience, elaborative explanations of correct answers are inexpensive to rapidly produce, which suggests that adding answer explanations may be a particularly cost-effective means of improving online courses. Moreover, single explanations are much simpler to implement technically than the multiple

different explanations that would be necessary for personalized feedback. According to the view that feedback can only exist in response to a student activity, explanations that provide information in addition to the accuracy of an answer are a way to provide *more feedback*. While instructors in traditional (face-to-face) courses often grade formative assessments, it is less common to provide explanations for all formative assessment questions. We hypothesize that assessment explanations would improve students' experiences in traditional courses.

Finding Better Measurements of Metacognition

There is some evidence that formative assessment improves the accuracy of score predictions on follow-up tests (Szpunar et al., 2014). In this work, we found that participants in the Assessment + answers condition made more inaccurate predictions than participants in other conditions, including a condition lacking any assessment (the Text condition). However, if the follow-up test were more difficult, the results could have been just the opposite. Almost any measurement of metacognitive accuracy based upon score predictions can suffer from the same problem. However, it is interesting to note that self-rated *confusion* with the material was uniquely predictive of low post-test scores, while other ratings, including score predictions, understanding, and difficulty, added no significant predictive value over pre-test scores and confusion. Paradoxically, this could indicate that the feeling of confusion is a stronger indicator of actual comprehension than feelings of understanding or difficulty, but this is an area that merits further investigation.

Limitations of this Study

Lack of a Testing Effect

We were surprised to find that the addition of assessments to a sequence of materials did not lead to an improvement in post-test scores. This may seem to contradict the testing effect, a widely replicated finding that testing of material increases retention of that material. It is important to note that in this study we controlled for some variables that could explain a lack of a testing effect. The test itself was written by one content expert and verified by two others outside of the study team, and we did find that a matched group of instruction-naïve participants had much lower performance on the test than those who completed the instruction. If the test was not sensitive to learning of the instructional content, or participants did not learn at all, we would not observe such a difference.

In our view, our study differed from other studies that have demonstrated strong testing effects in several key ways that we summarize here. First, the testing effect is the strongest with repeated re-testing of study material. Repeated testing is thought to maximize the direct effects of testing (effects due to effortful retrieval of material). In this study, formative assessment was only delivered in one study session, so re-exposure to the material was minimal. Second, many studies utilize the same test items for study and for evaluation. While this may maximize the measurable effects of testing, it is also less educationally relevant, because the test items can be memorized and it requires no transfer of the material to a different context. In support of this, Gog and Sweller (2015) found that the testing effect disappears as the complexity of the material increases. In this study, we did not re-use assessment items, so no participant

was exposed to an assessment item more than once. Finally, the direct effects of testing are likely related to the difficulty of effortful retrieval of study material. In this study, we deliberately utilized simple machine-gradable assessment types widely used in online courses, which are probably less challenging than free-response assessments. These differences may explain why the direct effects of testing were not observed in this study. There are also indirect effects of testing. In particular, testing helps students to identify areas for improvement and increases cognitive engagement during a study session. Testing may also serve to highlight the most important material. It may be the case that reading interleaved text statements (the Text condition in this study) activates some or all of the same indirect effects. Text statements could highlight the most relevant material or help students to evaluate their own understanding. It may be the case that, in a setting of computerized instruction, simply varying the multimedia modality increases engagement.

Use of Mechanical Turk for Study Recruitment

Amazon Mechanical Turk is increasingly utilized for education and psychology research studies, but concerns have been raised about sample representativeness and screening methods used in Mechanical Turk Studies (Paolacci & Chandler, 2014). We were careful to screen for participants with a baseline level of subject knowledge, reading comprehension, and test taking skills using a pre-test, and we did not exclude participants after the fact unless they had a technical problem. We believe that the direct financial motivations of the study participants may differ from the motivations of a learner who has enrolled in a program of study or online course. In this study, none of the participants in the text condition dropped out, but there was dropout in all of the assessment conditions. Moreover, time on task was significantly greater in the assessment conditions. It may be the case that participants made an economic choice with respect to how much time and effort they were willing to invest in exchange for study compensation. There is some evidence that forms of extrinsic reward can reduce task performance and undermine intrinsic motivation (reviewed by Hattie and Timperley, 2007). Theories of self-regulated learning posit that tangible rewards can abrogate an individual's sense of responsibility for her own learning. Although motivation is a concern for the study population, it is important to note that we did collect strong evidence that the individuals who finished instruction did learn. Moreover, financial compensation is commonplace in laboratory studies of learning, so some of the same concerns about motivation probably hold true for other sample populations.

Conclusions

Our results support the concept that there are negative and positive impacts of formative assessment on students' subjective experiences. In this study, formative assessment was directly linked to attrition - a negative outcome that instructors want to avoid. However, incorporating feedback into assessment, even simple written explanations, reduced mind wandering, enhanced the perception of understanding, and increased predicted performance. This aligns with our observational findings from analyzing student behavior in online courses - students often opt in to viewing assessment explanations, even when they already have knowledge of the correct answer. Adding explanations is a simple change that should enhance the subjective benefits of formative assessment. To maximize the direct effects of testing, instructors should consider utilizing more challenging recall-type testing tasks and increasing the

repetition of formative assessment, although the potential learning benefits of each of these modifications must be weighed against potential impacts on students' experiences. It is important to note that open response (recall-type) assessment is less common in online courses in part because it is more difficult to grade, but there are spaced repetition testing applications that can be incorporated into many major learning management systems.

We also noted some challenges with using Amazon Mechanical Turk workers for education research. This study establishes a simple pre-screening procedure (a subject-aligned pre-test) that likely screens for multiple desirable traits and behaviors in study participants: reading comprehension, test-taking proficiency, attention, and subject-matter knowledge. We would recommend that other investigators use this approach in the future. Finally, we found that prior test performance and the feeling of confusion are predictors of future test performance. We hypothesize that the feeling of confusion may provide students with a more accurate metacognitive barometer than feelings of effort or understanding. This is a hypothesis that merits further exploration in the future.

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Appendix A

Study Materials

Pre-test

This pre-test was administered before the instructional phase of the study as a separate task. Only participants who answered three or more questions correctly were invited into the study.

-----Pre-test text begins here-----

Question 1

This question was drawn from the IMCA exam, an introductory biology concept inventory (Shi et al., 2010). **Question 2** from the IMCA exam was used here.

Question 2

This question was drawn from the IMCA exam, an introductory biology concept inventory (Shi et al., 2010). **Question 9** from the IMCA exam was used here.

Question 3

This question was drawn from the IMCA exam, an introductory biology concept inventory (Shi et al., 2010). **Question 22** from the IMCA exam was used here.

Question 4

Endocytosis is best described as a process of cells
A releasing substances through holes in the cell membrane.
B taking up substances through holes in the cell membrane.
C releasing substances in vesicles.
D taking up substances in vesicles.

Answer: D

Question 5

Which of the following does NOT describe an important cellular function of proteins?
A catalysts of biochemical reactions
B information storage molecules
C structural components of cells
D signaling molecules

Answer: B

Reference for questions 1, 2, and 3:

Shi, J., Wood, W. B., Martin, J. M., Guild, N. A., Vicens, Q., & Knight, J. K. (2010). A diagnostic assessment for introductory molecular and cell biology. *CBE Life Sciences Education*, 9(4), 453–461. <http://doi.org/10.1187/cbe.10-04-0055>

Demographic Questions

This survey was administered at the beginning of the instructional phase of the study.

-----Survey text begins here-----

What is your gender?

- Male
- Female

What is the highest level of education you have completed?

- Did not complete high school
- High school or equivalent
- Some college
- Associate degree
- Bachelor's degree
- Master's degree
- Doctoral or professional degree

How many hours per week do you spend on the following activities?

- _____ Watching instructional videos
- _____ Listening to instructional podcasts
- _____ Reading instructional text online
- _____ Taking online courses

Have you ever taken an online course, such as a massive open online course (MOOC)?

- Yes
- No

How familiar are you with each of the following topics?

	Not at all	Slightly	Somewhat	Very	Extremely
Basic biology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Advanced biology (such as biochemistry, cell biology, or molecular biology)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Immunology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Survey questions

This survey was administered at the end of the instructional phase of the study.

-----Survey text begins here-----

Now please reflect on your experience taking this online lesson. Please answer each of these questions truthfully.

-----New Survey Webpage-----

Please indicate your level of agreement with the following statements

	Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree
I would like to learn from more lessons like this	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoyed learning from this lesson	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood the material in this lesson well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found this lesson difficult	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My mind wandered during the lesson	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found this lesson interesting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I exerted a large amount of effort in this lesson	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found this lesson confusing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

-----New Survey Webpage-----

In one week, you will have an opportunity to take a 10-point multiple choice quiz. All of the questions on the quiz were addressed in this instructional material. Please predict your score out of 10.

- 0 (lowest score)
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 (highest score)

-----New Survey Webpage-----

Did you experience any technical problems taking this study?

- Yes
- No

Please describe the technical problems in detail here.

-----New Survey Webpage-----

Was there anything confusing about this study to you?

- Yes
- No

Please describe confusing aspects of the study here.

Post-test

This test was administered one week after the instructional phase of the study.

-----Post-test text begins here-----

Question 1

Which of the cells below are tissue-resident sentinel cells? **(select two answers)**

- A dendritic cells
- B lymphocytes
- C neutrophils
- D monocytes
- E mast cells

Answer: A, E

Question 2

A _____ is a cell that uses innate immune receptors to recognize and phagocytose microbes; these cells have a short life span within tissue and often rapidly die by apoptosis.

- A dendritic cell
- B macrophage
- C neutrophil
- D monocyte
- E mast cell

Answer: C

Question 3

A _____ is a cell that uses innate immune receptors to recognize and phagocytose microbes. It also will phagocytose and digest apoptotic cells.

- A macrophage
- B lymphocyte
- C monocyte
- D mast cell

Answer: A

Question 4

Which of the cells below are circulating blood cells that will migrate into tissue in response to inflammation? **(select two answers)**

- A red blood cells
- B dendritic cells
- C neutrophils
- D monocytes
- E mast cells

Answer: C,D

Question 5

Pro-inflammatory cytokines and mediators bind to receptors on _____ cells, which respond by undergoing changes that will promote the recruitment of circulating leukocytes from the blood into the tissue.

- A endothelial cells
- B red blood cells
- C epithelial cells
- D macrophages

Answer: A

Question 6

Leukocyte adhesion deficiency (LAD) is a genetic defect that leads to recurrent infections in the tissue and severe problems with wound healing. LAD patients also develop gingivitis (infections and inflammation of the gums). In LAD, leukocyte migration into tissues is severely impaired. All of these problems can be traced back to a genetic defect. Of the genetic defects listed below, which is the most likely cause of LAD?

- A A mutation that impacts blood cell development, leading to below-normal numbers of monocytes, but normal numbers of other blood cells.
- B A mutation that introduces a stop codon into a gene that encodes part of the LFA-1 molecule (leading to a truncated protein).
- C A mutation that increases the stability of the E-selectin ligand protein without affecting its other functions.
- D A mutation that leads to high pro-inflammatory cytokine expression in the tissue.

Answer: B

Question 7

Some of the steps of an acute inflammatory response are listed below. Which of these steps would occur **first** in a given episode of inflammation?

- A Tissue-resident sentinel cells release inflammatory mediators.
- B Microbial molecules bind to innate immune receptors.
- C Endothelial adhesion molecule expression increases.
- D Circulating neutrophils migrate into the tissue.

Answer: B

Question 8

Psoriasis is an inflammatory disease that impacts the skin. It most commonly manifests as scaly, raised, red or white areas on the skin caused by local inflammation. The inflammation leads to overgrowth of skin cells called keratinocytes. The triggers that lead to psoriasis are largely unknown, but microscopic examination of skin biopsies from psoriasis patients reveals massive infiltration of leukocytes into the tissue with no evidence of bacterial or viral infection.

Which drug or therapy would you expect to be **LEAST** effective in treating psoriasis?

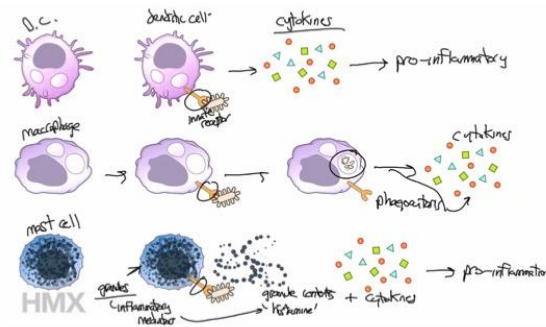
- A A treatment that blocks the release of pro-inflammatory cytokines.
- B A treatment that blocks the removal of apoptotic neutrophils.
- C A treatment that prevents the binding of LFA-1 to ICAM-1.
- D A treatment that kills leukocytes that migrate into tissue.

Answer: B

Appendix B

Representative Image of a “Whiteboard” Video

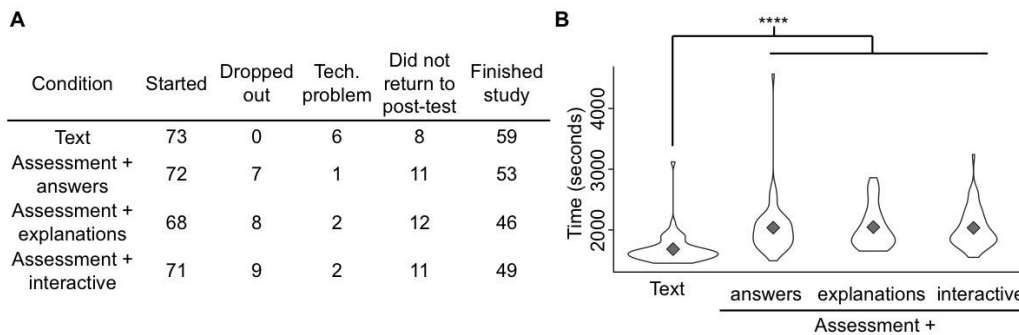
A representative screen-shot from a “whiteboard-style” teaching video that was used in the instructional phase of this study is shown here.



Appendix C

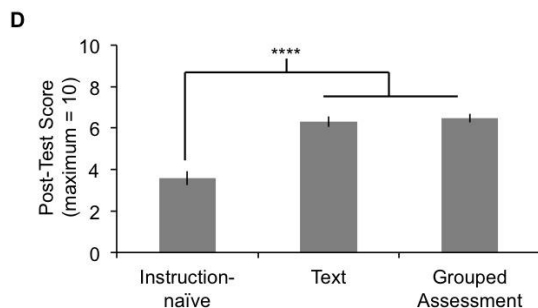
Differences in Dropout and Survey Responses Between Text and Assessment Conditions

A – Differences in attrition between the different instruction conditions. “Started” refers to participants who entered instruction, “Dropped out” refers to participants who dropped out of instruction, “Tech. problem” refers to participants who reported a technical problem, “Did not return to post-test” refers to participants who did not take the 1-week follow-up test, and “Finished study” refers to participants who completed all phases of the study and were included in this analysis. There was a significant difference between groups in dropout during instruction, and post-hoc tests showed a difference between the Text and Assessment conditions, but no difference between the different Assessment conditions (see text for significance tests). **B** – Differences in time on task between the different instruction conditions. **C** – Summary of differences between Text and Grouped Assessment conditions. Mean Likert Score results are reported (1 – Strongly Agree; 5 – Strongly Disagree). Due to differences in dropout, it is not possible to conclude that the more favorable ratings are due to better overall experiences in the assessment conditions. **D** – No significant difference in post-test scores between the groups, although all groups had much higher scores than an instruction-naïve group. P values: **** < 0.001.



C

Statement	Mean Likert Scale Score		U	p value
	Text (n=59)	Grouped Assessment (n=148)		
My mind wandered during the lesson	3.34	3.70	3462.5	0.0189
I found this lesson confusing	3.53	3.54	4144.5	0.5648
I found this lesson difficult	2.82	2.77	4520.5	0.6893
I exerted effort in this lesson	2.36	2.11	5209	0.0276
I would like to learn from more lessons like this one	2.07	1.82	5436.5	0.0047
I found the lesson interesting	1.95	1.69	5432.5	0.0044
I understood the material in this lesson well	2.46	2.44	4641.5	0.4735
I enjoyed learning from this lesson	1.90	1.72	4981.5	0.1006





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Pinch Hitter: The Effectiveness of Content Summaries Delivered by a Guest Lecturer in Online Course Videos



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Abstract

Lecture videos have become an increasingly prevalent and important source of learning content. Lecturer-generated summaries may be used during a video lecture to improve student recall. Furthermore, the integration of a guest lecturer into the classroom may be a beneficial educational practice drawing the learner's attention to specific content or providing a change of pace. The current study measures the effects of lecturer-generated summaries and the inclusion of a guest lecturer on students' ability to recall online video lecture contents. Seven sections of a flipped scientific writing course were divided into three groups. The control group videos featured a lecturer speaking with PowerPoint slides in the background. The *Summaries Only* group viewed the same videos as those of the control, with the addition of lecturer-generated summaries spliced into the middles and ends of the videos, respectively, and these summaries were delivered by the same lecturers of the original video. The *Summaries with a Guest Lecturer* group viewed the same videos as the control, but with the addition of lecturer-generated summaries respectively spliced into the middles and ends of the videos, and these summaries were instead delivered by a guest lecturer. Student recall was measured through two online multiple-choice quizzes. The results of the study show that the Summaries Only group significantly outperformed the other two groups, while no significant difference was found between the performances of the control and the Summaries with a Guest Lecturer group. The results suggest that lecturer-generated summaries help to improve student recall of online video lecture contents. However, the introduction of a guest lecturer shown in a different setting may cause learners to lose concentration, nullifying the benefit of the summaries.

Keywords: e-learning, flipped learning, guest lecturer, quizzes, summaries, video lectures

Introduction

Flipped classrooms are becoming an increasingly prevalent part of the educational landscape (Breslow et al., 2013). Since flipped courses tend to rely heavily on online video lectures, it is necessary to examine how such videos can affect students' understanding and recall of course content. While online video lectures provide students with considerable advantages in terms of accessibility, and the ability to tailor learning to their own pace, there are also valid concerns about the effectiveness of this form of instruction. Some major concerns are that students may not be fully engaged in listening to the lecturers or may skip them altogether (Alksne, 2016), that students may experience a reduced sense of engagement compared to traditional classroom environments, and that video lectures may provide less pedagogical benefit than traditional lectures. In e-learning environments, videos and other media can help by keeping learners interested and engaged in the material (Zhang, Zhou, Briggs, & Nunamaker, 2006).

In flipped courses, lectures are typically provided online in video format rather than live in-class delivery. While classroom practices may vary, practitioners often recommend that class time traditionally devoted to in-class lectures should instead be devoted to more student-centered activities, particularly student-centered problem-solving activities (Ferreri & O'Connor, 2013; Kim et al., 2014; Mason, Shuman, & Cook, 2013; Prober & Khan, 2013; Wilson, 2013). These in-class group activities often require prior knowledge, which students are expected to gain from watching online lecture videos beforehand. In such cases, student engagement with course videos is important, not only from the perspective of gaining knowledge from the videos themselves, but also to maximize the learning opportunities presented through in-class collaborative problem-solving activities requiring prior knowledge from the videos.

There are a broad variety of common methods that are used to improve student retention from lectures, both video and traditional formats, including spoken organizational cues (Titsworth & Kiewra, 2004) and visual ancillary cues (Hirsch, 1987). Brecht (2012, p. 245) found that lecture videos that had "strong presentation of relief and change-of-pace elements" such as alterations in audio or video stimulus, background or setting modifications, changes in the camera angle, or dramatic transitions between various parts of the video were more effective. Barker and Benest (1996) note that the addition of multimedia contents and animations is desirable since it prevents students from losing concentration. Furthermore, Costley and Lange (2017) showed that video lectures with a greater variety of media types lead to students retaining more of the video contents. Other studies suggest periodically changing the pace of a lecture, for example, with a humorous remark, an activity, a question that must be answered, or audio/visual material (Padget & Yoder, 2008; Woodring & Woodring, 2011; Wolff, Wagner, Poznanski, Schiller, & Santen, 2015; Jones, Peters, & Shields, 2007). A drastic change-of-pace element that can be introduced into a video lecture is the appearance of a guest lecturer, which constitutes a type of team teaching. The present study will attempt to assess the effect of integrating a guest lecturer into the context of video lecture content within a flipped learning environment.

The level of learning in online environments is another important factor in understanding the

effectiveness in video lectures. Quizzes are a commonly-used component across all types of courses and are especially prevalent in flipped classroom environments, as quizzes that count towards final grades can be powerful motivators for students to actively watch video lecture contents in such learning environments (Frydenberg, 2013; Tune, Sturek, & Basile, 2013; Enfield, 2013). Quizzes have often been shown to be a good way to measure and motivate student learning (Johnson & Kiviniem, 2009; Herold, Lynch, Ramnath, & Ramanathan, 2012; Kamuche, 2011), and in predominantly or entirely online environments, such as MOOCs, online quizzes may be the only way to do so easily. In most courses, quizzes are connected to the contents of lectures and are seen as a measure of student learning of the course content and of lectures. Quizzes can, therefore, be seen as a representation of the amount that students learn and retain from the content. Video lectures have been shown to positively impact student performance on quizzes (Mason, Shuman, & Cook, 2013; Williams, Birch, & Hancock, 2012), although the effectiveness of these videos when compared to traditional lectures is an ongoing debate.

Literature Review

The Effects of Summaries on Student Learning

In order to increase student retention of lecture video contents, various methods are employed by both students and instructors. Smidt & Hegelheimer (2004) have shown that among the numerous strategies used by students when watching online videos, one of the most common and effective is to listen to the content again. A method that instructors use to improve student recall of lecture content is to provide cues when important information is being delivered. Instructors have many different means to deliver such cues to the students. For example, the lecturer can write important ideas on the blackboard (Locke, 1977), present it visually (Baker & Lombardi, 1985), or simply emphasize it through the manner of speaking (Maddox & Hoole, 1975; Scerbo, Warm, Dember, & Grasha, 1997). Titsworth & Kiewra (2004) found that spoken cues increased student academic performance. Each of these methods has been shown to bring about an improvement in students' achievement. Repetition has been shown to improve recall in learning situations. Mayer (1983) also claimed that recall and problem-solving abilities increased the more that learning content was repeated. Bromage and Mayer (1986) found that repetition enabled students to recall more of what they heard and to remember a larger quantity of structurally and functionally important information, signaling a change in their learning strategies. Webb (2007) examined the effects of repetition on the language acquisition of Japanese students learning English and discovered that knowledge increased with increased repetition, as students who encountered a new word in context frequently were likely to have a deeper understanding of the word's meaning and function.

When providing students with repetition of important content in a course, instructors must also consider the pacing of such repetition. An exhaustive number of experiments conducted by cognitive psychologists have shown the benefits of spaced repetition of content compared to massed presentation (Cepeda,

Pashler, Vul, Wixted, & Rohrer, 2006). Furthermore, distributed practice received one of the highest utility ratings in a comprehensive review of a variety of learning strategies based on the available evidence (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). It has also been found that providing students with a paraphrased version of the content produced an equivalent amount of recall as with a verbatim repetition (Glover & Corkill, 1987). This paraphrasing can be seen, in some sense, as a summary of the previous content.

The Effects of Co-Teaching on Student Learning

A common approach to the structuring and delivery of course material is to divide responsibilities among more than one teacher, and several terms are used in the literature to describe this concept, including cooperative teaching, team teaching, and co-teaching (Welch, Brownell, & Sheridan, 1999). The definition of co-teaching according to Cook and Friend (1996) is “two or more professionals delivering substantive instruction to a diverse, or blended group of students in a single space” (p. 156). Cook and Friend (1996) describe the following five styles of co-teaching. The first of these is called “one teaching / one assisting,” which means that one instructor takes primary responsibility for the delivery of content, while the other plays a facilitatory role. One issue with this method is that the assisting teacher may be seen more as an assistant than an equal partner in instruction. “Station teaching” refers to teachers dividing presentation of the course content as well as the physical space of the learning environment, with each teacher managing a separate part of the classroom and the curriculum, with student groups alternating between different segments of the classroom. “Parallel teaching” is where teachers collaborate in planning course content but then divide the students into groups of equal sizes and are responsible for educating their own respective groups. “Alternative teaching” usually involves dividing a class into one large and one small group, with the smaller group receiving specialized instruction such as pre-teaching, directed practice, and review. In “team teaching,” the instructors take turns in discussing course topics with students or in providing demonstrations through role play. As an alternative to co-teaching, an instructor may choose to bring in a guest lecturer, as the guest lecturer may have more expertise on a particular topic, or in some cases, provide students with a change of pace or a differing perspective. This can also be done in online videos, with cameos by guest lecturers.

It is often claimed that students’ attention spans fall within the 10- to 20-minute mark (Davis, 1993). While the concreteness of this time-frame is debated (Wilson & Korn, 2007), the occurrence of such lapses is not (Bunce, Flens, & Neiles, 2010). This phenomenon is often called the “vigilance decrement” in the literature (Ariga & Lleras, 2011; Farley, Risko, & Kingstone, 2013; Risko, Anderson, Sarwal, Engelhardt, & Kingstone, 2012; Young, Robinson, & Alberts, 2009). To counter the negative effects that attention lapses may have on learning, switching things up or changing pace is recommended to ensure students remain focused (Center for Excellence in Teaching, 1999). One method of doing so includes introducing a guest lecturer to maintain student interest in the lesson (Young, Robinson, & Alberts, 2009). While the literature on team teaching often refers to traditional rather than online or blended learning environments, studies have shown that a variety of student benefits to team teaching, including exposure

to a variety of viewpoints (Letterman & Dugan, 2004), improved achievement and retention of course contents (Johnson, Johnson, & Smith, 2000), improved communication skills (Helms, Alvis, & Willis, 2005) and better student-teacher relationships (Wilson & Martin, 1998). Interestingly, when Dugan and Letterman (2008) compared student's own perceptions of the value of team-taught courses compared to traditional courses taught by one instructor, they found no significant difference between them. Despite this finding, Dugan and Letterman did find that students preferred courses taught by two instructors rather than a panel of three or more instructors, and that the students preferred co-teaching, where each instructor attends and actively engages in teaching the class during each session, over an alternating style of instruction where each instructor would teach during an entire class session on a turn-by-turn basis.

The Effects of Quizzes on Student Learning

Quizzes have been shown to increase the long-term retention of academic lecture content as compared to restudying or not reviewing the contents (Roediger III & Karpicke, 2006; Butler & Roediger III, 2007). Marks (2015) points out that computer-based quizzes enable instructors to pinpoint if some or all students have been struggling with the lesson's content, allowing the lecturer to adjust instruction accordingly. For these reasons, quizzes can be a valuable component in flipped and blended classrooms where students are expected to perform computer-based tasks outside of the class and to engage in group work during class time.

Multiple-choice quizzes are pervasive in university-level courses (Roediger & Marsh, 2005). While they have sometimes been disparaged in the literature, multiple-choice quizzes are often viewed as a necessary evil since they provide instructors with an easy way to grade a large number of quizzes, particularly for large undergraduate courses, where short answer or essay exams may be too burdensome or unreliable (Little, Bjork, Bjork, & Angello, 2012). For the same reasons, multiple-choice quizzes are widely used in MOOCs and other e-learning environments in which large numbers of students are enrolled. (Colvin et al., 2014). Commonly cited criticism of multiple-choice quizzes include their limited ability to measure complex learning (Frederiksen, 1984), their inability to engage students in the type of retrieval processes that lead to long-term retention (Chan, McDermott, & Roediger, 2006; Foos & Fisher, 1988), and their tendency to cause misinformation since studies have shown that simply exposing students to plausible incorrect answers causes them to judge such lures as more true than novel fact answers, though never quite reaching the rated truth levels of true statements (Roediger & Marsh, 2005; Toppino & Brochin, 1989; Toppino & Luipersbeck, 1993).

However, studies have also shown advantages to multiple-choice testing. For example, despite the aforementioned issue of the creation of false knowledge, Roediger and Marsh (2005) showed a substantial positive testing effect when students were given a multiple-choice test in preparation for a general knowledge exam. Little et al. (2012) found that properly constructed multiple-choice questions fostered the recall of previously tested information, where "proper construction" means that all answer choices are plausible, but not so plausible that the question becomes unfair. They further found that multiple-choice

questions aided students in the recall of information related to incorrect answer choices, unlike cued-recall tests (Little et al., 2012). Multiple-choice questions also offer greater reliability in grading and provide students with a greater variety of questions in a shorter period of time than some other constructed response questions, such as essay exams (Walstad & Becker, 1994). A common criticism of multiple-choice questions is that testing factual knowledge does not guarantee competence, as high-level competence requires the integration of knowledge with attitudes and communication skills (McCoubrie, 2004). However, research has shown that knowledge of a subject area is the single best determinant of expertise (Glaser, 1984). Therefore, multiple-choice questions are a valid method of testing competence, as written test forms are the best assessment instrument of cognitive knowledge (Downing, 2002).

Relationship Between Summaries and Quizzes

In a study by King (1992), university students were divided into three groups, one trained in self-questioning (and answering these questions), one trained in summarizing, and one untrained control group who simply took notes and reviewed them. Among the three groups, King found that the summary and self-questioning groups outperformed the control group in the recall of a lecture, with the summary group performing best in the short-term and the self-questioning group performing slightly better than the summary group in the long-term.

Relationship Between Co-Teaching and Quizzes

Adapting the concepts of co-teaching mentioned previously, Jang (2006) devised an experimental team-teaching approach in which two teachers specialized in teaching different parts of a science lesson, and were transferred to different classrooms at different times to provide instruction on that specialization. This approach was combined with a course website where students could access supplemental textbook information, discussion groups, and class notices as well as turn in course assignments. Jang found that students who were taught by this team-teaching web-based approach showed more improvement from their pretest to their posttest scores as compared to students who took traditional classes taught by one teacher with no web component (Jang, 2006).

The Present Study

Considering the need for developing lectures that are engaging and effective for learners, this study is guided by two research questions:

- 1) Do video lectures with summaries result in higher scores for students on related online quizzes?
- 2) Do video lectures with a guest lecturer result in higher scores for students on related online quizzes?

Methods

Experimental Procedures

In the present study, we sought to assess how change-of-pace and structural elements in online videos would affect student learning outcomes in a Scientific Writing course (CC500) at the Korea Advanced Institute of Science and Technology (KAIST) in Daejeon, South Korea. This Scientific Writing course is specialized compared to other academic writing courses offered at KAIST in that it is only offered for graduate students, and it focuses on producing and publishing research manuscripts in science and technology. This focus means that the video lectures cover numerous topics beyond traditional writing skills and include issues such as the function of particular sections of a manuscript and various conventions of scientific and engineering writing, as well as the process of publishing a paper. The course is offered in a flipped format, so that students and professors met once per week, and students also watched videos and took quizzes online for homework.

The present study examined 3 weeks (11 videos) among the total 16 weeks (56 videos) that constitute the entire course. The first batch of five videos were shown to the students in week 6 of the 16-week course and covered the following five topics: “Usage Rules for the Colon and Semicolon,” “Usage Rules for the Hyphen,” “How to Incorporate Numbers into Writing,” “Avoiding Unclear Pronoun Usage,” and “Paraphrasing.” The second batch of six videos was shown in weeks 14 and 15 of the 16-week course and all applied to the theme of “Publishing Your Paper.” This video series was designed to guide the students through the steps that follow the completion of a research manuscript, and the topics were as follows: “Selecting a Journal,” “Open Access vs. Subscription Journals,” “How to Get your Research Published,” “The Peer Review Process,” “Common Reasons for Rejection,” and “Final Thoughts and Advice on Publishing Your Paper.”

For the control group, the video series was prepared in a straightforward style with only one lecturer and no summaries, as shown in Figure 1. For the videos prepared for the “summaries only” group, all lecturing and summaries were delivered by the same instructor, as shown in Figure 2(a). The summaries were around 30 seconds in length and were shown at the middle and end of each video. In the mid- and end-point summaries, the lecturer would mention the main points from the first and second halves of each video, respectively. The video series provided to students in the “summaries with a guest lecturer” group contained more varied change-of-pace elements: each video contained mid and final summaries with identical content to those of the “summaries only” group, but the summaries were delivered by a guest lecturer who was also seated in a “coffee shop” setting projected in the background, as shown in Figure 2(b), rather than standing in front of PowerPoint slide contents, as in the videos of the “summaries only” group.

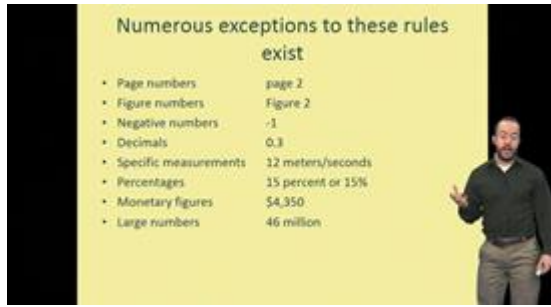


Figure 1. Main video lecture without summaries.

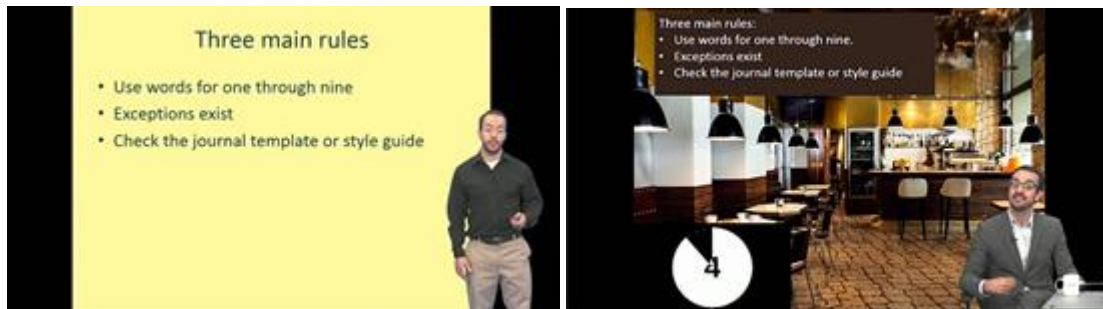


Figure 2. (From left to right) Summaries by the main lecturer (a) and guest lecturer (b).

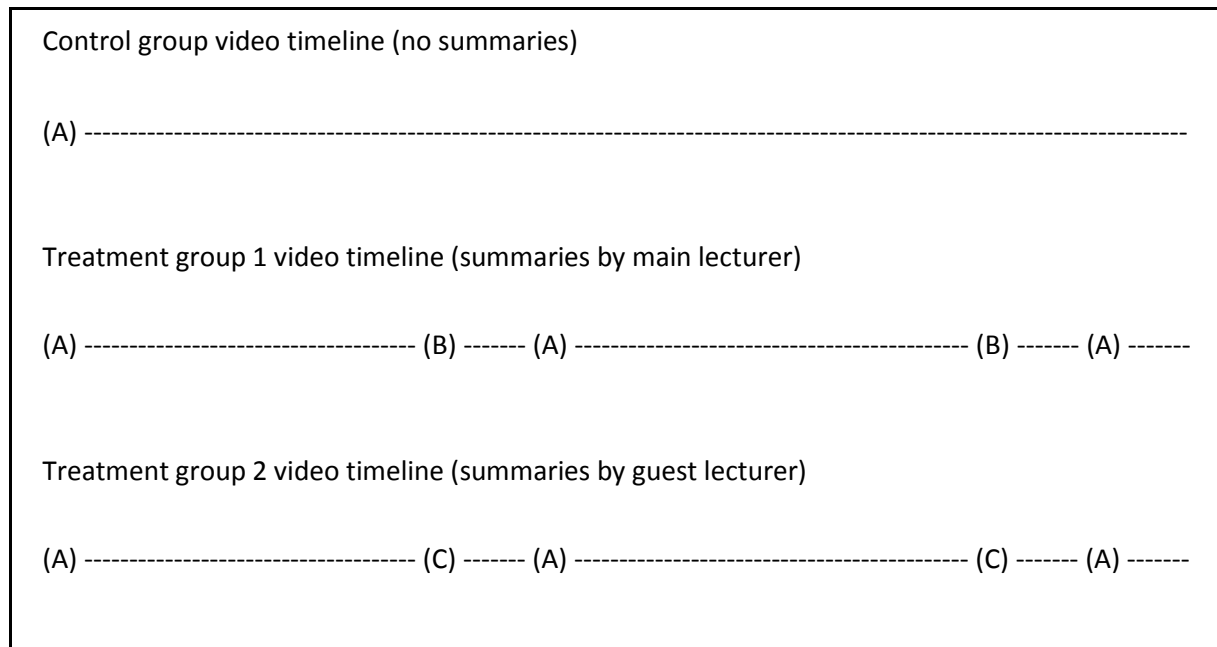


Figure 3. Summary of the video timelines. The letters A-C correspond to the style of videos shown above.

A total of 135 students were divided up into a control group and two treatment groups, with between 39 and 55 students in each group. The respective videos were posted on the school's learning management system in weeks 6 and 15 and were available to watch at the students' convenience. Once the videos were viewed for each week of the study, students took a multiple-choice quiz online, which they could access at any time during the seven-day video viewing period but which must be completed by the respective brick-and-mortar classroom meeting day. The quiz was used to measure the students' comprehension and recall of the contents of the videos. During the respective brick-and-mortar classroom meeting, students were asked to fill out a survey that involved a 10-point Likert scale to assess the videos. Survey forms were assessed, and quiz data was taken from the online learning management system of the course.

Participants and Context

This study was conducted at the Korea Advanced Institute of Science and Technology (KAIST), a large university located in Daejeon, South Korea. Most students at the university specialize in STEM fields. As of 2013, KAIST has a student population of 11,175, with about 60% of those studying at the graduate level (KAIST, 2014b). The university is predominantly male (80%), and international students make up 5% of the total population (KAIST, 2014b). KAIST offers an array of online and blended courses. These include Massive Open Online Courses (MOOCs) made available 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 (KAIST, 2014a).

Participants in the present study were students in classes that were provided as part of KAIST's Education 3.0. The Education 3.0 initiative was started in 2012 with the goal of reducing the amount of traditional lecturing in KAIST courses and enabling students to engage in more interactive and communicative learning activities through a flipped classroom environment (Horn, 2014). KAIST performed a trial run involving four Education 3.0 courses in 2012. Students' performance on exams and overall satisfaction with the courses were higher than those with conventional lecture classes (Horn, 2014). In 2014, 5% of all classes at KAIST were offered in Education 3.0 format, with a goal of increasing that number to 30% by 2018 (Horn, 2014). As a graduation requirement, master's and PhD students at KAIST must be able to compose articles for publication in scientific and engineering journals. To assist them in this process, the Scientific Writing (CC500) course teaches students how to communicate their research through writing in English. The course is conducted in English, and enrollment is generally 20 students per section. In the present study, seven sections of Scientific Writing were included in the experiment. This was a total of 135 participants, 17 of which did not complete the second section of the quiz and so were removed from the analysis done as a part of this study. This left 118 valid responses, of which 32 were female and 86 were male. The oldest participant was 45, and the youngest was 22, with a mean age of 27. The seven selected sections of Scientific Writing were taught as part of KAIST's Education 3.0 program, so they were given in a flipped format.

Measures

Students took two quizzes, the first comprising 25 questions and covering information given in five video lectures and the second comprising 30 questions covering six video lectures. All quizzes were given online and could be taken at any point during the one-week video viewing period (weeks 6 and 15, respectively). The quizzes were made up of multiple choice questions, with some of the quizzes allowing only one answer choice and others calling for one or more answer choices, and example of some of the questions can be seen below in Table 1. For the latter question type, partial credit was awarded when a correct answer was selected, but no credit was given when an incorrect answer choice was selected. Quiz questions were created by the course instructors and were designed to make students demonstrate that they could apply the concepts taught in the videos. Each quiz was worth 5% of the class's total grade. While the effectiveness of multiple-choice quizzes is still being debated, they were an attractive choice for this course, as with most e-learning environments, since they present an opportunity to measure students' recall while allowing students to take quizzes anytime and anywhere (provided they have internet access and a device) with immediate feedback. The topics in the first batch of videos were related to rule-based concepts rather than communicative issues in writing, and provided descriptions and suggestions to guide students through the process of publishing their completed manuscripts in a journal after the conclusion of the course. We felt that such topics were appropriate for measurement via quizzes, while the quality of the students' writing and their ability to clearly communicate their research results were evaluated separately through instructor comments and grading.

Table 1

Sample Quiz Questions

Quiz and question numbers	Question	Choice of answers
Quiz 3, Question 1	Which of the following sentences is correct in terms of writing with numbers? Select one or more answers.	a. 2 apples, three oranges, and five bananas were enough fruit for the class. b. According to the survey, people generally slept seven point five hours per night. c. The club celebrated the birthdays of the five 90-year-olds who were born in the city. d. 6% of the class failed.

- Quiz 3,
Question 8
- Which of the following is true regarding paraphrasing? Select one or more answers.
- a. Information can be copied word for word.
 - b. You use the same words and phrases.
 - c. Paraphrase is generally the same length or slightly shorter than the original source.
 - d. You don't have to mention where the original information came from if you paraphrase.

- Quiz 6,
Question 20
- The aim and scope of a journal _____ . Select one or more answers.
- a. should be inferred by reading.
 - b. is less narrow in high impact journals.
 - c. can be ignored if the submitted data is highly revolutionary.
 - d. can be a deciding factor when accepting or rejecting a submission.
 - e. often change to adapt to trends.

- Quiz 6,
Question 28
- Which of the following is an advantage of a journal transfer? Select one or more answers.
- a. It leads to a higher impact publication.
 - b. It saves time for the authors.
-

c. It separates scientific soundness from interest level.

d. It saves time for the reviewers.

Results

The first point of analysis was to look at any relationships between the demographic variables of gender and age the dependent variable. Using Spearman's point-bi-serial correlations for gender, and Spearman's standard bivariate correlations for age and quiz score, correlation coefficients were calculated and analyzed, which can be seen in Table 2 below. The results showed that the main dependent variable for the study (quiz score) had a small non-statistically significant relationship with both age and gender. However, there was a statistically significant relationship between age and gender. The negative relationship between age and gender was $-.199$, the relationship between gender and quiz score was $.011$, and age and quiz score was $-.051$. The likely reason for the relationship between age and gender is that Korean males are required to do two years of military service, which is usually done after their first or second year of university. These two years of time out of education means that men in graduate school in Korea tend to be older than women.

Table 2

Correlations Between Gender, Age, and Grade

	Gender	Age	Grade
Gender	1		
Age	$-.199^{**}$	1	
Quiz score	$.011$	$-.051$	1

$** p = < .01$

To answer the main research questions that were a part of this study, the mean quiz scores for each experimental group were calculated and compared (see Table 3). The condition with the highest mean quiz score was the condition with the summary only, followed by the summary with a different professor, with the basic lecture having the lowest mean quiz score. It is worth noting that both the basic lecture condition (5.789) and the summary with a different professor (5.827) had very similar means, while the condition that contained summaries only had markedly higher mean quiz scores (6.787).

Table 3

Mean Quiz Score for Each Experimental Condition

	Mean	N	SD	Min	Max
Basic lecture	5.789	46	1.35867	2.53	9.00
With summary	6.787	37	1.68573	3.01	10.00
With summary and different professor	5.827	35	1.44842	2.99	9.53
Total	6.134	118	1.55056	2.53	10.00

After examining the quiz means for each of the three conditions, Analysis of Variance (ANOVA) was used to analyze the differences among and between the group means that were a part of this research. ANOVA tested if there was a statistically significant difference between the basic lectures, lectures with summary only, and lectures with summary by a guest lecturer groups. Table 4 shows that there was a statistically significant difference between the three groups that were a part of this study ($p = <.01$).

Table 4

ANOVA Comparisons for Grades Within the Three Experimental Conditions

	Sum of squares	df	Mean square	F	Sig.
Between groups	15.812	2	7.906	3.633	.005
Within groups	287.250	132	2.176		
Total	303.063	134			

After the overall difference among the experimental groups was established, the Scheffe test was used to examine the specific difference between each experimental group's quiz means, and whether or not those differences were statistically significant. The Scheffe test is a single-step multiple comparison procedure designed to be applied to the set of estimates of all possible comparisons among means. Table 5 shows that in the lecture with summary group, the quiz mean was .998 higher than that of the basic lecture group. Also, the lecture with a summary and different professor group had a quiz mean .960 lower than the lecture with summary group. Both the relationships between the basic lecture and lecture with summary, and lecture with summary with a guest lecturer and lecture with summary were statistically

significant. The quiz mean of the lecture with summary by a guest lecturer was .038 higher than the basic lecture quiz mean, though this relationship is not statistically significant.

Table 5

Scheffe Test for Comparisons of the Three Experimental Conditions

	Basic lecture	With summary	With summary and different professor
Basic lecture	1		
With summary	.998*	1	
With summary and different professor	.038	-.960*	1

* $p = <.05$

A post-hoc survey was conducted to collect students' opinions on their experiences regarding the video lecture element of the course once the semester had ended; grades had already been allocated prior to the email messages being sent. Said messages contained screenshots of the summaries each respective treatment group had encountered to serve as a reminder, as well as a simple request for participants' feelings regarding the summaries; any general comments on the videos were also welcomed. A balanced amount of criticisms to positive responses were logged.

Students from the two treatment groups generally perceived the summaries positively, noting they were helpful for reviewing and emphasizing the salient points of the lecture. Such summaries were seen to complement notetaking and were appreciated as they enabled a time to reflect and take stock of what had been explained so far. For weaker students, they were seen as a tool for clarifying understanding of the content. In addition, the appearance of a guest lecturer for those in the "summaries with a guest lecturer" group was said to have a "refreshing" function by some participants – as if it were a reminder to focus one's attention. One individual in particular mentioned how useful such appearances were to draw one's attention back to the content if they were multitasking. Others claimed the summaries reduced the amount of pausing and (presumably) re-watching.

It was, however, felt (by members of both treatment groups) that while generally useful, summaries may be redundant for shorter videos or those that deal with straightforward content. There was a tendency to favor one final summary in such cases. Furthermore, a common complaint for the second treatment group was that the summaries were distracting as they broke up the structure and disturbed the flow of the

lecture.

Of the 19 replies received, the following represent the spectrum of responses.

Negative Responses to the Summaries

Redundancy.

“If the content was difficult, full of things to memorize, or a lot of additional explanation, then the mid summaries were very helpful. However, if the content is straightforward, I think mid summaries might be redundant.” (T1)

“Mid summaries were such a time consuming point in the lecture in some moments in that it re-explained the content which were studied right before (even in few seconds).” (T1)

“It could make students distracted. I think a concise lecture with only end summary will be great to let student know what is the most important concept on that lecture and what should be remembered and studied.” (T1)

Distraction.

“But I think there may not need the time countdown - It distracts my focus a little.” (T2)

“I did think the coffee scene broke up the structure of the lecture.” (Treatment 2)

Neutral to Negative Responses to the Summaries

Students as directors of learning.

It would be better to collect those summarizing slides and provide them as ppt/pdf. The reason is ... if students already know some of the subsections of the lecture, they can skip those parts and dive directly into the subsections they don't know about. (T1)

If I were to think back and give you some recommendations, I think having an option of speeding up the videos will be great. I used to watch 3-4 videos in parallel because there was no speeding option. Perhaps because I was watching the videos intermingled together, I felt the need to focus more during the summary sections, but I think they are useful anyways because I doubt most students don't multi-task or think of what they are having for dinner when listening to the videos. (T2)

Positive Responses to the Summaries

Help Clarify Content for Weaker Students.

Actually, because of some reasons (poor English skill, not concentrating on the subject, etc.), I couldn't understand the words quite many times. But because of the summaries you gave us, I could catch up on the lecture and understand what's going on at that time. (T1)

Focus Attention (during Attention Lapses).

“I used to get spaced out sometimes while watching videos, but the summarizing slides help me focus on the topics and keep track of the lectures.” (T1)

“Appearance of the guest professors refreshed me to focus on the videos. Of coarse [sic], the summary itself helped me to memorize key points of the lectures.” (T2)

“Sometime[s] it is easy to be distracted while watching the video so, summary gives a nice construct of the contents discussed.” (T2)

Focus Attention on the Most Salient Points.

“When I was attained in Edu3.0 online lecture, I usually paused the video to understand unclear contents. However, these mid and end summaries reduced that, because these showed the key points of the talks.” (T2)

“I enjoyed having some form of summary as this gave me an idea of the most important points of the lecture, giving me a focus on what to revise.” (T2)

A Rest Point.

Regarding the mid and end summaries, I think they were actually the best part of the video lectures. I appreciated having a stopping point in the lectures, and it was helpful having the summarized version in my head before taking the quizzes. (T1)

Assisted Note-Taking.

“Having summaries definitely coincided with my note taking formats and thus was very effective.” (T1)

“Also, in my case, summary slides were useful for preparing the quiz and making a summary note.” (T1)

Useful as a Recap.

In particular, I like mid summaries because I can refresh in the middle of the lecture. Lectures are

sometimes long, and sometimes I cannot remember all the contents of the lecture. The mid summaries help to understand the flow of content. (T1)

Discussion

The students in the "summaries only" group scored an average of nearly one point higher than their counterparts in the control and the "summaries with a guest lecturer" group on the combined 10 points of the two 5-point quizzes given in weeks 6 and 15, respectively. A number of studies in the literature suggest that the use of lecturer-generated summaries, whether spoken or visual, increases learner retention of course content (Hirsch, 1987; Titsworth & Kiewra, 2004). The improved quiz scores of the "summaries only" group as compared to those of the control seem to support this notion. However, the usefulness of lecturer-generated summaries seems to be contradicted by the result that there was no significant difference between the scores of the "summaries with a guest lecturer" group and the control. A reason to expect that summaries with a guest lecturer would have outperformed the other two groups is that several studies have shown that the integration of a guest lecturer into a traditional classroom setting can be beneficial (Jang, 2006; Johnson et al., 2000; Letterman & Dugan, 2004). We expected this tendency to manifest in online course videos, but this did not occur.

One possible explanation for this result is that some aspect of instructor characteristics caused the lack of increase of retention among students who viewed the videos with a guest lecturer. Numerous studies have shown that unfamiliar accents may impede comprehension (Eisenstein & Berkowitz, 1981; Smith & Bisazza, 1982; Anderson-Hsieh & Koehler, 1988), and students often identify accents as an obstacle in understanding a lecture (Richards, 1983; Bilbow, 1989). In the present study, one of the instructors spoke standard American English, while the other spoke standard British English. Considering that the students also met their respective instructor once a week over a 16-week period during the semester for a workshop session in addition to watching the video lectures, it is plausible that the students developed familiarity with the accent and speaking mannerisms of their primary instructor. Perhaps the introduction of a guest speaker with an unfamiliar accent caused difficulties in listening comprehension.

A number of studies have recommended and also shown that change-of-pace elements help maintain students' attention and enable them to better recall course content (Brecht, 2012; Center for Excellence in Teaching, 1999). Because the videos shown to the "summaries with a guest lecturer" group contained a greater variety of presentation elements (e.g., the change of scene to a coffee shop setting, a 30-second stopwatch animation, and the presence of a guest lecturer), we expected the videos shown to the "summaries with a guest lecturer" group to be the most effective. The sudden change in the setting of the video from a familiar-looking PowerPoint slide background to an informal coffee shop scene may have seemed jarring to the students, causing an interruption to their concentration on the content of the video. One student from the "summaries with a guest lecturer" group described his feelings on the videos as

follows: “The summaries cut the flow of the lecture. I was focused on the [content] of the video but the change of professor and background looked so complex. It was disturbing [sic].”

Kim et al. (2014) point out that increases in viewership and student lecture behaviors, such as pausing, seeking backwards and forward, and re-watching videos, occur during particularly unclear or interesting segments of a video. As evidence that the visual design of a video can affect the ability of students to understand the information covered, Kim et al. found, in their study, that 61% of such increased periods of viewership and lecture behaviors occurred during an abrupt change in the background, such as shifting from a slide view to a classroom view, and the researchers further suggest that video content creators refrain from including abrupt scene changes or excessive transitions, as these may cause student to feel confused or to lose the context. While we were unaware of this suggestion when designing the treatment videos and the present experiment, the aforementioned findings provide a plausible explanation for the reduced effectiveness of the videos in the “summaries with a guest lecturer” group compared to the “summaries only” group, and our findings seem to support those of Kim et al. (2014). While both of these groups contained mid- and end-point summaries of equal length (30 seconds each), only the “summaries with a guest lecturer” contained scene changes (from a slide background to a coffee shop setting and back again), as the “summaries only” group kept the same slide background throughout.

Limitations and Future Research

When considering these results, it is also clear that the present study has a number of limitations. Only two weeks of the videos and quizzes were examined, but examining more cases would have provided a more complete view of student outcomes. Furthermore, inclusion of a greater number of course sections of scientific writing, and thereby a greater number of participants, would have improved reliability of the results.

Another limitation is that we were unable to get a clear sense of the guest lecturer effect from the data since the “summaries by a guest lecturer” videos also contained abrupt scene changes. How would summaries given by guest lecturers have compared with summaries given by the original lecturer if each was provided with a minimal scene change (e.g., keeping the same PowerPoint slide background)? A few students who responded to the email survey mentioned that they found the mid-point summaries jarring or interrupting to the flow of the lecture. One way to address these concerns would be to provide only end-point summaries, but the present study did not measure the effectiveness of such an approach. As students noted that summaries were useful for emphasizing the most salient points of the lecture (Table 8) and in keeping with Guo, Kim, & Rubin (2014) who suggest that video lecture designers should “facilitate skimming and re-watching,” we propose that instructors create timeline markers for summaries, so students are aware of the presence of something at a clearly marked point (perhaps shown by a dot or vertical line) on the video timeline bar. Such a feature will address the aforementioned complaint because,

eventually, it will become obvious that the marker indicates the position of the summaries.

Furthermore, in the present study, the guest lecturer spoke using a different type of English from the primary course lecturer (i.e., British vs. American English). Summaries delivered by the primary lecturer improved student recall, but those delivered by a guest lecturer who spoke a different type of English did not; however, it is unclear whether guest-lecturer summaries were ineffective due to the difference in the types of English being spoken between the two lecturers or if the mere presence of a guest lecturer is, in and of itself, distracting to student concentration on course content. This question could be answered by assessing the effects of lecturer-generated summaries delivered by a guest lecturer who speaks the same type of English as the primary course lecturer.

Conclusion

While we cannot say with certainty which of the aspects of the videos in the "summaries with a guest lecturer" group distracted or hindered students in recalling the contents, it is clear from the results of the present study that mid- and end-point summaries provided and delivered by the original instructor enabled students to perform better on related quizzes. With this in mind, we recommend that instructors incorporate short summaries into course videos in MOOCs and flipped and blended classes. The findings of the present study are relevant to instructors in e-learning environments because our data suggest that inserting short summaries into existing course videos is a simple and facile way to improve student recall of course contents. Even though a number of studies in the literature suggest that a greater number of change-of-pace elements will increase student recall of video contents, instructors should also bear in mind that, in certain instances and to certain degrees, such elements may become distractions that may eventually negate the benefits they are expected to provide. This was particularly evident in the case of the scene changes between the slide background and the coffee shop setting in the "guest lecturer summaries" group. As suggested by Kim et al. (2014), avoiding abrupt scene changes in video lectures appears to be sound advice for video content developers for flipped classrooms, MOOCs, and other e-learning environments, and this suggestion was confirmed in the present study.

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Factors Affecting the Participation of the Deaf and Hard of Hearing in e-Learning and Their Satisfaction: A Quantitative Study



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Abstract

Today the digital divide is measured not so much by access to the internet but by people's ability to interact in cyberspace, which calls for specific digital communication skills. These skills are also required for participation in e-learning, bearing in mind that the deaf and hard of hearing have certain characteristics related to their condition. This study aims to identify inequalities in access to e-learning by those who are deaf or hard of hearing, observe how they are related to social and demographic factors, and confirm whether the accessibility of the e-learning environment has a direct influence on their satisfaction. The study has been conducted via an electronic survey in Spain with a non-probabilistic sample, in line with the characteristics of this sector of the population, recording social and demographic data, and information about the participants' experience of e-learning and their satisfaction with the experience. The representative survey sample consisted of 484 deaf and hard-of-hearing individuals in Spain, aged between 16 and 64. Using a chi-square test for independence we obtained a significant relationship between participation in online courses and the following variables: level of education, knowledge of sign language, and number of members in the household. A correspondence analysis was then carried out to detect particular relationships between classes of the related variables.

Keywords: e-learning, deaf, hard-of-hearing, drop-out factors, satisfaction factors, accessibility

Introduction

One could probably find as many definitions of e-learning as there are authors. Sangrà, Vlachopoulos, and Cabrera (2012) conducted a study which began by reviewing literature since 2005. They found that the definitions could be grouped in four categories: 1) technology-driven, 2) delivery-system-oriented, 3) communication-oriented, and 4) educational-paradigm-oriented. They then submitted a Delphi international survey to 33 experts from 16 countries, 31 of whom rated the following proposed final definition positively: “E-learning is an approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning” (Sangrà et al., 2012, p. 152).

The literature describes numerous and varied advantages for the student in e-learning environments (Cabero & Gisbert, 2005; López Camps, 2005; Lowerison, Côté, Abrami, & Lavoie, 2008; Martínez Caro, 2008; Area & Adell, 2009), which can be summarised as follows:

- a) Easy access to a large volume of up-to-date information which complements course content.
- b) Flexibility in terms of time and location: users can access information at any time wherever they are.
- c) Students are independent and responsible for their own learning.
- d) Approaches based on shared learning can be implemented.
- e) Communication can be both synchronous and asynchronous.
- f) Learning can be personalised (pace, personalised tutorials, etc.)
- g) Reduced costs and less travel for students.
- h) Access to education for groups and individuals who cannot attend classes in person.

Despite these advantages e-learning has high drop-out rates. Levy (2007) comments that the literature records drop-out levels for on-line courses of 25% to 45% compared to 10% to 20% for face-to-face classes. Rostaminezhad, Mozayani, Norozi, and Izy (2013) give updated figures based on a review of the literature and have found various studies of drop-out rates recording levels from 23.9% to 54%, concluding from international reports that the average rate is 40%.

The most exhaustive study of the factors influencing drop-out rates may well be that by Park (2007), who analysed the results of 18 previous studies and proposed a model based on four factors to explain drop-out rates among adult students taking on-line courses (Figure 1). However, Lee and Choi (2011, quoted by Grau-Valladosera & Minguillón, 2014) conducted a study that revealed that previous research had focused mainly on the reason for drop-outs, there being no clear definition of what "drop-out" meant, which made it difficult to compare different studies of the subject.

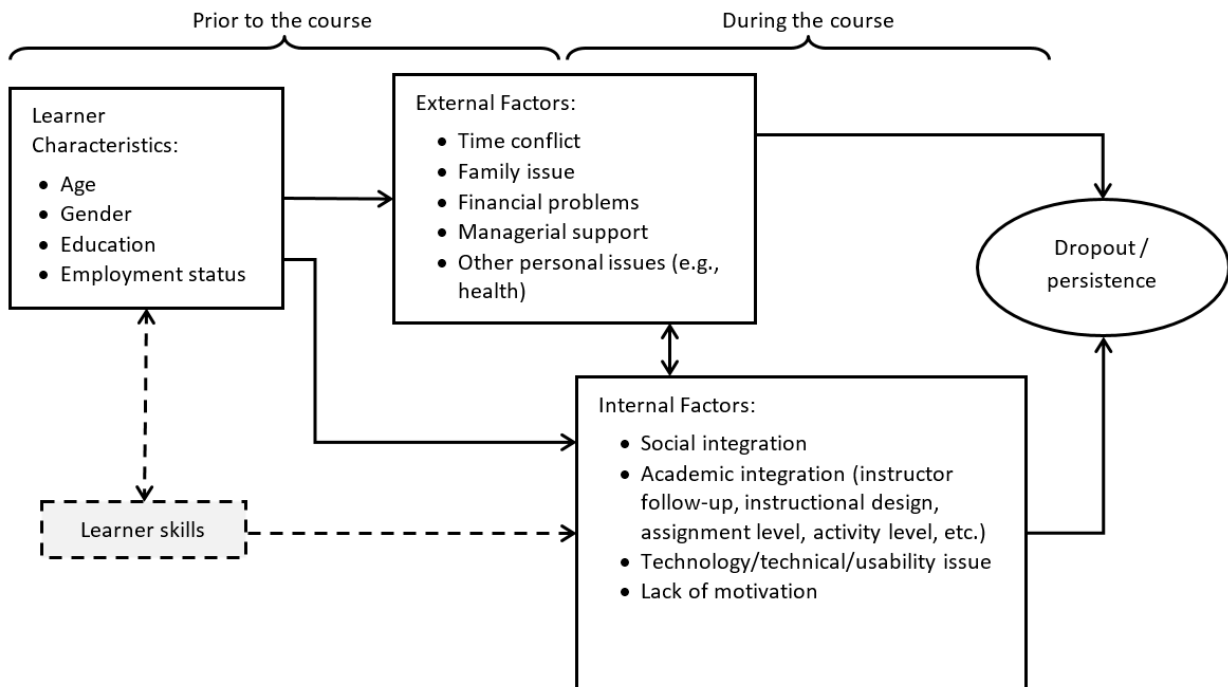


Figure 1. Theoretical model of drop-out levels among adult students following on-line courses (Park, 2007).

Sun, Tsai, Finger, Chen, and Yeh (2008) conducted a review of the literature and grouped the factors that favoured student satisfaction in six dimensions, which included 13 variables. The authors concluded that in Taiwan seven variables accounted for 66.1% of the variation in user satisfaction: students' anxiety about IT, the teacher's attitude to e-learning, the flexibility of the e-learning course, the quality of the e-learning course, perceptions of usefulness, perceptions of ease of use, and variations in assessment. The most important of these is the quality of the course, referring both to the design of the content and to the technological design of the course, the latter playing an important role in students' perception of its usefulness and ease of use.

Digital Divide

The Organisation for Economic Co-operation and Development (OECD) defines the digital divide as “the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities” (Organisation for Economic Co-operation and Development, 2001, p. 5). The underlying causes of the digital divide have been studied extensively, the most important being economic resources, geography, age, gender, and education (UNESCO, 2005; Liangzhi Yu, 2006, as cited by Selwyn & Facer, 2007; Ally & Samaka, 2013).

In Spain, an analysis of the *Survey on the Availability and Use of Information and Communication Technologies in Homes in 2013* (National Statistics Institute, 2013) reveals that the digital divide in access

to the internet is practically the same as that affecting the general public's use of on-line courses, the factors most directly related to levels of participation in such courses:

- Age: the age range accounting for most participants in on-line courses is 25 to 34 years, with 17.5%, the figure falling progressively after this to 8.0% between 55 and 64 years.
- Level of education: the higher the level of education, the greater the participation in on-line courses. Only 3.2% of those with primary studies participate in on-line courses, while 22.5% of individuals with higher studies take part in such courses.
- Employment situation: people in employment account for the largest group (15.5%), followed by students (12.3%).
- Monthly household income: participation increases in line with greater net monthly household income. A total of 19.8% of those with net household income above 2,500 euros per month have taken an on-line course in the last three months, while 7% of those with monthly income below 900 euros have done so.

Gender is an exception, as women participate more than men: 14.3% of women versus 11.4% of men.

Regarding those who are deaf or hard of hearing, a study by Fundación Vodafone España (2013) reveals a clear digital divide in this group, compared with the population as a whole, and a second digital divide within the deaf and hard of hearing group, influenced mainly by gender, age, level of education and family income. We thus find that 32% of women aged 18 to 64 who are hard of hearing use the internet less than men; a person who is hard of hearing is less likely than the rest of the population ever to have used the internet at any age, the difference being more pronounced after the age of 45, when the difference is 48.1%; there is a 30 percentage point difference in middle-level studies, compared with the rest of the population, and the use of the internet by the deaf and hard of hearing is half that of the rest in homes where monthly income is in excess of 2,000 euros.

In the light of its study of statistics for the five continents Miniwatts Marketing Group (Internet World Stats, 2016) proposes strategies to reduce the impact of the digital divide and increase people's motivation to participate in e-learning. One of the central issues raised is universal access to information and the need for people with disabilities to participate and learn from the internet, in line with the words of Berners Lee, WC3 Director and inventor of the World Wide Web: "the power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect" (W3C-World Wide Web Consortium 1997, para. 1). Proposals for closing the digital divide depend on access to information and communication in cyberspace, overcoming economic, social, and geographical difficulties and ensuring accessibility and democratic access.

In the literature, one can find examples of e-learning environments adapted to the characteristics and learning styles of the deaf and hard of hearing (Straetz, Kaibel, Raithel, Spech, Grote & Kramer, 2004; Drigas, Vrettaros, & Kouremenos, 2005; Debevc, Stepanovič, & Holzinger, 2014; Fuertes, González, Mariscal, & Ruiz, 2005; Esparrell & Sánchez, 2011). Notwithstanding the positive results of these e-learning experiences for the deaf and hard of hearing, most of the training currently available is not accessible for such students (Fichten et al., 2009).

Research Questions and Hypothesis

This study attempts to answer the following questions:

- 1) Are there significant inequalities in participation in e-learning activities by people who are deaf or hard of hearing and that of the rest of the population in Spain?
- 2) If there are inequalities in access to e-learning for the deaf and hard of hearing compared to the rest of the population, are these related to social and demographic factors?
- 3) Does the accessibility of the e-learning environment have a direct influence on the satisfaction of those who are deaf or hard of hearing as on-line learners?

These questions correspond to the following hypotheses formulated in the research:

- 1) There are significant inequalities in participation in e-learning activities by people who are deaf or hard of hearing and the rest of the population.
- 2) The inequalities in access to e-learning for the deaf and hard of hearing compared to the rest of the population are related to social and demographic factors.
- 3) The accessibility of the e-learning environment has a direct influence on the satisfaction of those who are deaf or hard of hearing.

Research Methodology

The study was carried out using an individual on-line questionnaire which respondents completed by themselves. This made it possible to compile information with significant savings in costs and materials, as it was not necessary to employ interviewers or meet the cost of travel by the researcher to conduct interviews. Other advantages of this type of questionnaire, compared to others, are that the respondent can choose the best time and place to complete it, taking as long as necessary, and that it guarantees anonymity. With this procedure, the researcher's presence and behaviour do not influence the respondent when he/she is completing the questionnaire, a crucial aspect in standardising surveys based on samples (Corbetta, 2007). Lastly, given that e-learning takes place via the internet, the on-line questionnaire itself, from the start, filters deaf and hard of hearing individuals who participate in cyberspace.

The population under study comprises individuals in Spain who are deaf or hard of hearing and aged 16 to 64. Data from the National Statistics Institute (2013) and Fundación Vodafone España (2013) indicate that there are 141,340 people who are deaf or hard of hearing and use the internet. This means that a sample of 384 individuals who are deaf or hard of hearing are necessary for the study to have a margin of error of 5% and a confidence level of 95%. According to Corbetta (2007) and Pérez (2008) probability sampling is not possible when one does not have a list of the population. There is no official census for the deaf and hard of hearing, only statistical data. We therefore opted for non-probability sampling. Of the non-probability sampling techniques the most suitable for the population in our study could be the "snowball" approach, which is useful for "small groups which are scattered around the country but in contact with each other in some way (members of religious minorities, specific groups, associations, etc.)" (Corbetta, 2007, p. 288).

As well as the usual social and demographic questions, the questionnaire includes others related to respondents' real use of e-learning and their opinions about their personal experience of e-learning. Accordingly, in line with the objectives proposed in this study, it was considered desirable to obtain information about three areas:

- Social and demographic details.
- Experience of e-learning.
- Degree of satisfaction and personal assessment of the experience.

The final version of the questionnaire consisted of 27 questions, 25 of which were closed and two open-ended. Of the closed questions, 19 were multiple-choice, three were dichotomous, and three were filter questions. Closed questions were chosen as far as possible for two main reasons: firstly, they facilitate the standardisation of questions and the uniformity of responses and, secondly, as Corbetta (2007) points out, the respondent is not likely to have given the issues deep thought before seeing the questions.

The Likert scale is used in questions related to satisfaction and the personal evaluation of experience, as it makes it easier to determine the degree of agreement or disagreement in dimensions related to satisfaction and the advantages of e-learning. Given that one of the limitations of closed questions is that they exclude other possible answers not anticipated by the researcher, four questions have the option "Other," which invites the respondent to add any aspect not included in the questions.

The formulation of the questions takes the suggestions of Padua, Ahman, Apezechea, & Borsotti (1979), Sierra Bravo (2001), Corbetta (2007), and Pérez (2008) into account. Although it was not necessary to follow each and every recommendation they make, it seemed especially opportune, given the particular characteristics of the population under study, to take special care to ensure that the questionnaire was accessible electronically for all those who were deaf or hard of hearing. The questionnaire has therefore been translated into Spanish sign language and Catalan sign language for deaf people who use these languages.

When the questionnaire had been designed and the on-line survey tool chosen, it was pretested between May 26 and May 30, 2014, with a subsequent debriefing session, so that some improvements could be incorporated in the final version. Field work was carried out between June 6 and July 13, 2014. The questionnaire was distributed by e-mail to 144 organisations for the deaf and hard of hearing in Spain, use also being made of social networks and text messaging, to develop the "snowball" sampling referred to above. Alzina (2009) points out that one of the weaknesses of internet surveys is that there is little motivation for participants and expressly recommends the use of incentives. We therefore entered all participants in a draw for a 100-euro gift card to be used for personal purchases. In line with the suggestions of Sierra Bravo (2001), the questionnaire was disseminated in various rounds with reminders to encourage participation.

All these elements were included in a flow chart to plan the survey reproduced in Figure 2. Given the characteristics of the population being studied, it was especially important to allow for the accessibility of the questionnaire for all deaf and hard-of-hearing individuals and it was accordingly translated into Spanish and Catalan sign language by professional interpreters.

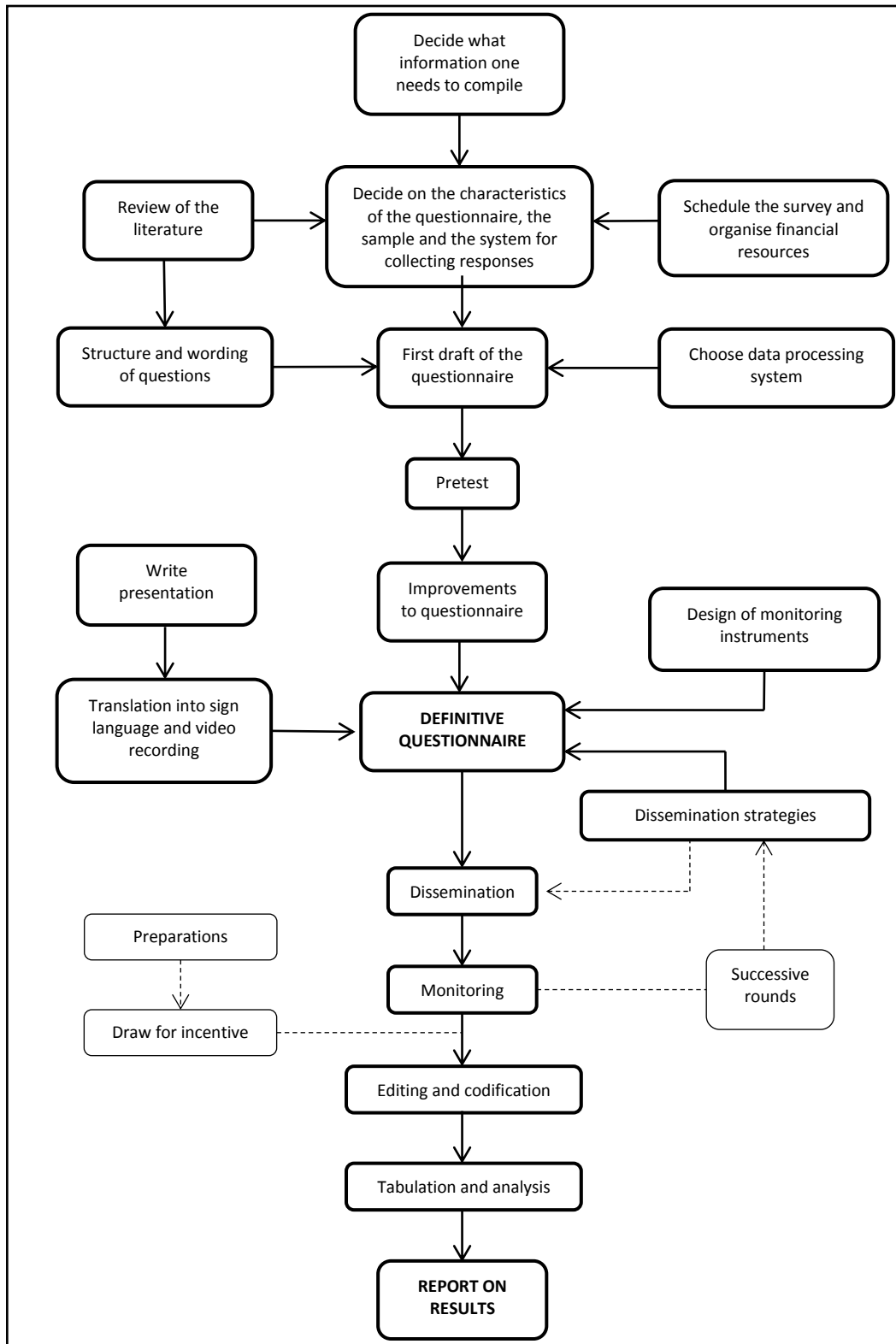


Figure 2. Stages in the development of the questionnaire. Adapted from *Research Methods in Education* (p.210), by L. Cohen, L. Manion, and K. Morrison, 2007, New York: Routledge. Copyright 2007 by Routledge.

Results

Sample

The sample used in this representative survey consisted of 484 deaf and hard-of-hearing individuals in Spain (excluding Ceuta and Melilla), aged between 16 and 64. The breakdown by area of residence is shown in Figure 3. 57.2% of the sample were women and the remaining 42.8% were men. A total of 80.2% of respondents were profoundly or totally deaf and 56.6% had been deaf since birth. The sample was quite balanced in the system of communication used, as 51.1% used both oral communication and sign language in everyday life.

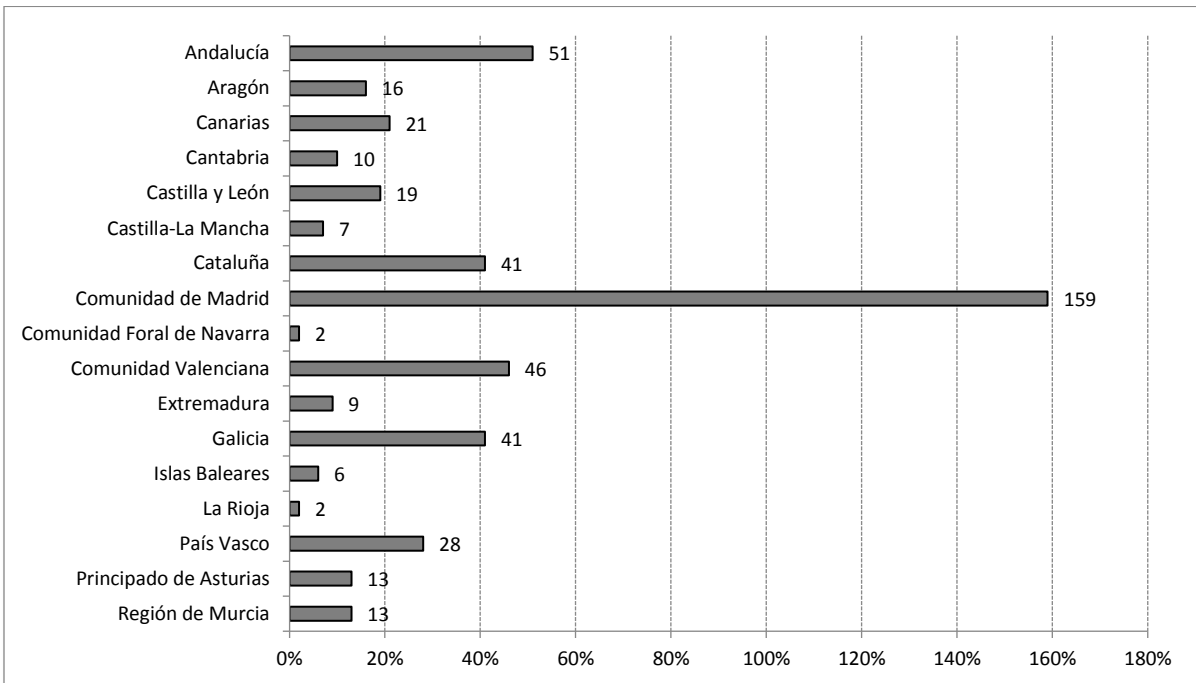


Figure 3. Breakdown of sample by Autonomous Regions (absolute numbers). The regions considered are Spain's first level administrative division, consisting of 17 "Autonomous Communities" with a certain number of transferred powers.

Demographic Profile of e-Learning Participants

The level of participation in e-learning is reasonably high, as 227 respondents (46.9%) have followed an on-line course, nearly half of the sample. 23.2% of respondents have followed such a course in the last year (Figure 4).

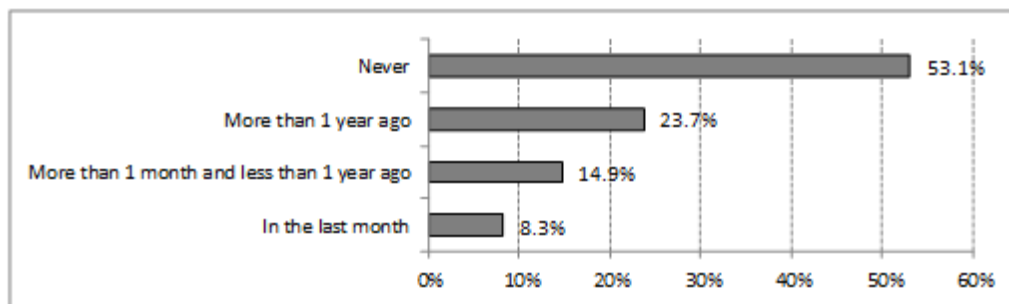


Figure 4. Respondents' last participation in an on-line course (relative data).

It is interesting to examine the social and demographic profile of those participating in e-learning activities to determine whether there are any characteristics that may be related to a greater or lesser degree of participation. In Table 1 we present the p-values of the chi-squared tests for independence between these social and demographic characteristics (X1 to X14) and participation in e-learning (X15). We find significant relationships between participation in on-line courses and the following variables: knowledge of sign language (X5), level of education (X11), and number of members in the household (x14). The most notable of these are level of education and knowledge of sign language.

Table 1

P-Values of the Chi-Squared Tests for Independence

	X15: participation in on-line courses
X1: sex (n=484)	0.325
X2: age (n=484)	0.622
X3: degree of deafness (n=484)	0.157
X4: age at which deafness occurred (n=484)	0.274
X5: knowledge of sign language (n=484)	0.000*
X6: language which respondents understand best and in which they express themselves best (n=421)	0.186
X7: language used normally (n=421)	0.141
X8: size of habitat (n=484)	0.183
X10: nationality (n=484)	0.900
X11: level of education (n=484)	0.000*

X12: employment situation (n=484)	0.121
X13: net monthly household income (n=484)	0.063
X14: number of members of household (n=484)	0.005*

* The relationship is significant at 0.01

Note. All of the variables are considered nominal. X1: man=0, woman=1; X2: 18 to 29=0, 30 to 39=1, 40 to 49=2, 49 to 60=3; X3: mild=0m, moderate=1, profound=2, total=3; x4: not sure=0, after age 15 =1, from 11 to 15 years old=2, from 6 to 10 years old=3, before 6 years old=4, at birth=5; X5: No=0, Yes=1; X6: sign language=0, oral language=1, both; X7: sign language=0, oral language=1, both; X8: data not available=0, less than 10.000 inhabitants=1, 10.000 to less than 20.000=2, 20.000 to less than 50.000=3, 50.000 to less than 100.000=4, 100.000 and over=5; X10: foreign=0, Spanish=1, Spanish and other=2; X11: illiterate=0, primary=1, lower secondary=2, upper secondary=3, vocational education=4, certificate of higher education=5, University=6, Doctorate=7; X12: other situation=0, housework=1, disabled or pensioner=2, unemployed=3, student=4, employee=5, freelance=6; X13: don't know/no reply=0, less than 1.100 €=1, from 1.101 to 1.800 €=2, from 1.801 to 2.700 €=3, over 2.700 €=4; X14: numeric value; X15: never=0, more than 1 year ago=1, more than one month and less than 1 year ago=2, less than 1 month ago=3.

The Kendall and Spearman correlation coefficients are calculated for X5 to X15 (Table 2) and a negative correlation can be observed: participation in on-line courses is lower among deaf and hard-of-hearing individuals who know sign language. There is a positive correlation between level of education (X11) and participation in on-line courses (X15) (Table 3).

Table 2

Kendall and Spearman Correlation Coefficients Between X5 (Knowledge of Sign Language) and X15 (Participation in Online Courses)

			X5	X15
Kendall's tau_b	X5	Correlation coefficient	1.000	-.110**
		Sig. (bilateral)	,	.010
		N	484	484
	X15	Correlation coefficient	-.110**	1.000
		Sig. (bilateral)	.010	,
		N	484	484
Spearman's rho	X5	Correlation coefficient	1.000	-.118**

		Sig, (bilateral)	,	.010
		N	484	484
X15		Correlation coefficient	-.118**	1.000
		Sig, (bilateral)	.010	,
		N	484	484

** . Correlation is significant at 0.01 (2 tails).

Note. All of the variables are considered nominal with the same values described in Table 1.

Table 3

Kendall's and Spearman's Correlation Coefficients for X11 (Level of Education) and X15 (Participation in Online Courses)

			X15	X11
Kendall's tau_b	X15	Correlation coefficient	1.000	.274**
		Sig, (bilateral)	,	.000
		N	484	484
X11		Correlation coefficient	.274**	1.000
		Sig, (bilateral)	.000	,
		N	484	484
Spearman's rho	X15	Correlation coefficient	1.000	.329**
		Sig, (bilateral)	,	.000
		N	484	484
X11		Correlation coefficient	.329**	1.000
		Sig, (bilateral)	.000	,
		N	484	484

** . Correlation is significant at 0.01 (2 tails).

Note. All of the variables are considered nominal with the same values described in Table 1.

Although one individual could have participated in various types of on-line course, only 24.7% of respondents followed an officially regulated course, while 57.3% followed complementary or ongoing education courses (Figure 5).

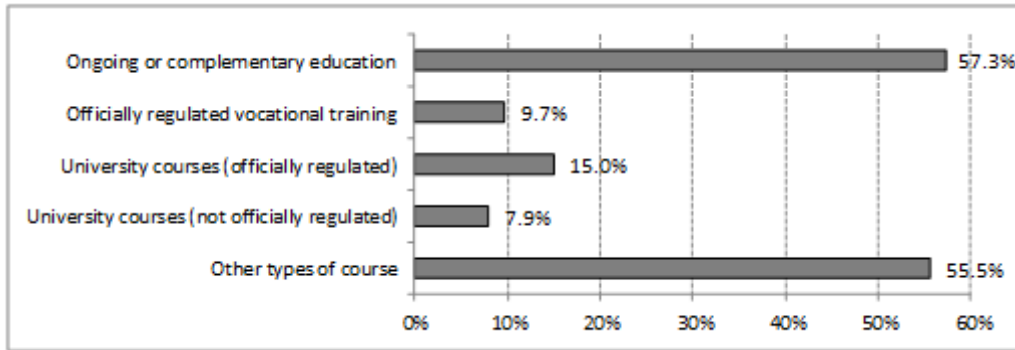


Figure 5. Type of courses in which deaf and hard of hearing individuals have participated at some time (relative data). Multiple answers possible. Valid answers: 227.

Finally, we need to consider why 53.1% of the deaf and hard of hearing have never participated in e-learning activities (Figure 4). Among the main reasons reported, the inaccessibility of e-learning perceived by the deaf and hard of hearing is the second most important reason for 28% of the sample (Figure 6).

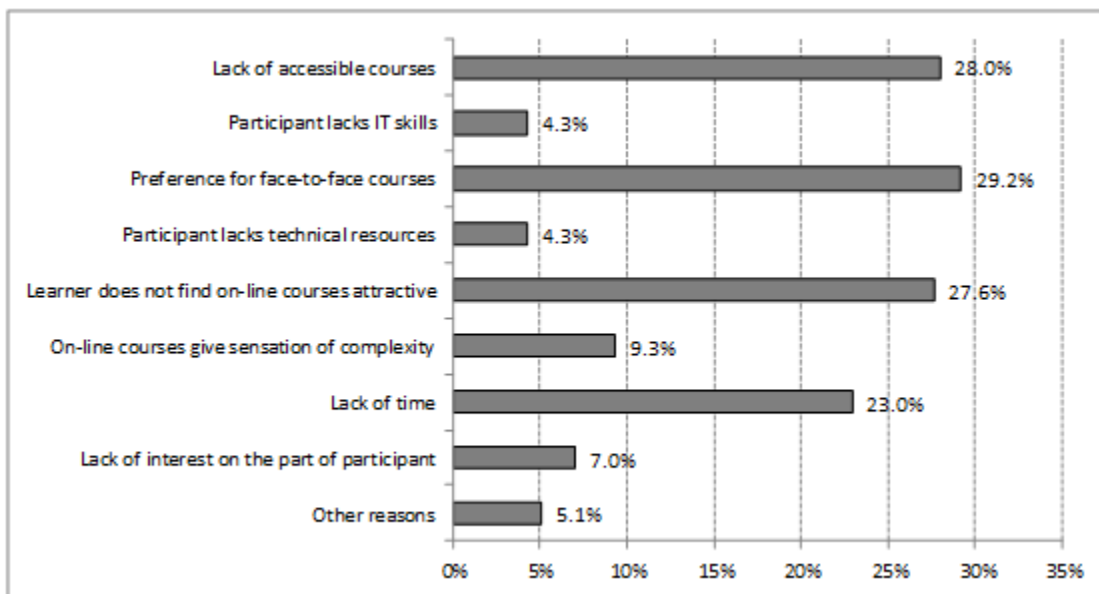


Figure 6. Reasons alleged by deaf and hard of hearing individuals not to engage in e-learning activities (relative data). Multiple answers possible. Valid answers: 257.

Satisfaction and Drop-Outs in e-Learning

In the questionnaire, respondents were asked to assess a series of features according to their degree of importance: the quality and attitude of instructors (Figure 7), course programme and quality of content

(Figure 8), technological quality of the platform (Figure 9), working with fellow students (Figure 10), and accessibility of the on-line course (Figure 11). All these aspects were rated as quite important to extremely important, although clear differences can be observed in two of them: cooperation with peers in on-line courses is the aspect deaf and hard of hearing users consider least important (Figure 10), while the accessibility of e-learning is rated as extremely important (Figure 11).

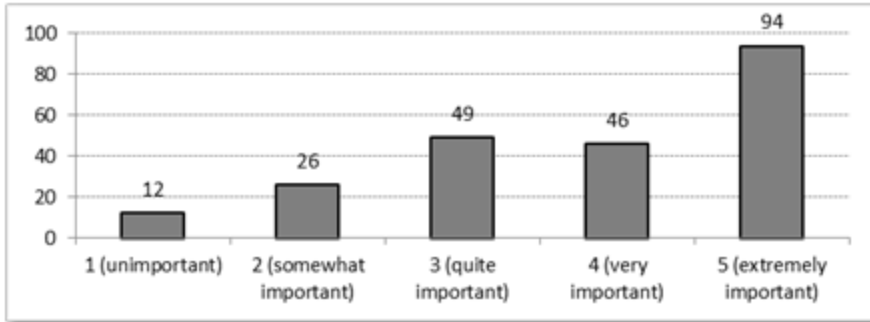


Figure 7. Importance given by deaf and hard of hearing e-learning students to the quality and attitude of instructors (absolute numbers). Valid answers: 227.

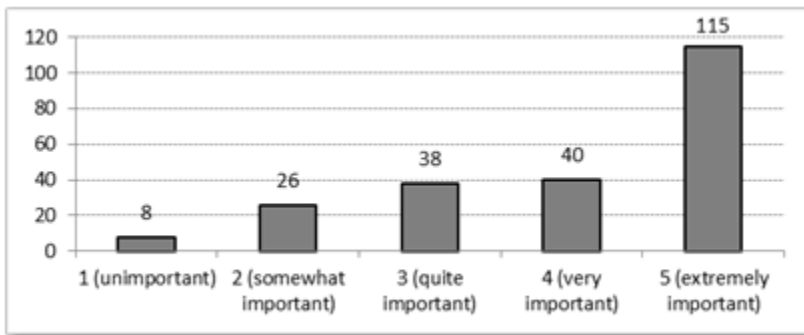


Figure 8. Importance given by deaf and hard of hearing e-learning students to the course programme and quality of content (absolute numbers). Valid answers: 227.

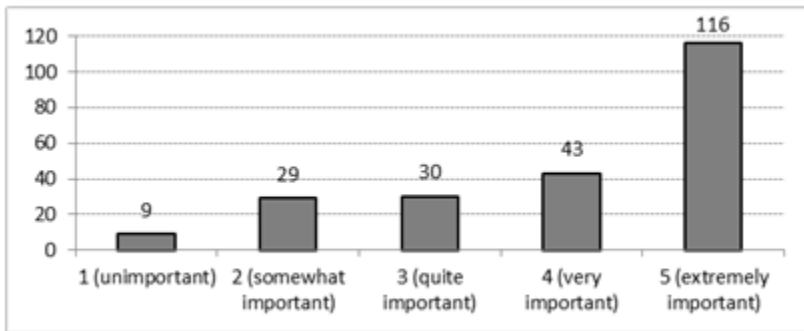


Figure 9. Importance given by deaf and hard of hearing e-learning students to the technological quality of the platform (absolute numbers). Valid answers: 227.

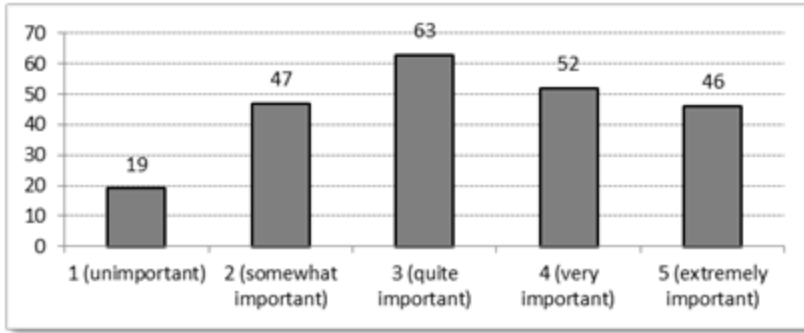


Figure 10. Importance given by deaf and hard of hearing e-learning students to cooperation with fellow learners (absolute numbers). Valid answers: 227.

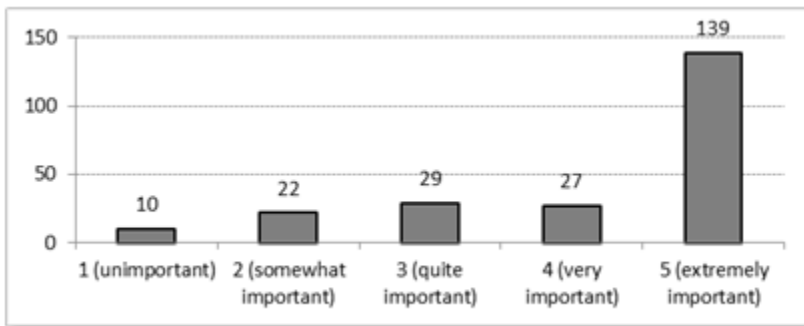


Figure 11. Importance given by deaf and hard of hearing e-learning students to accessibility of the course (absolute numbers). Valid answers: 227.

The two advantages of e-learning emphasised most by the deaf and hard of hearing are access anywhere at any time (68.3%; Figure 11) and reduced costs and less travel (67%; Figure 12). The accessibility of e-learning is seen as an advantage in comparison with face-to-face learning by 60.8% (Figure 13).

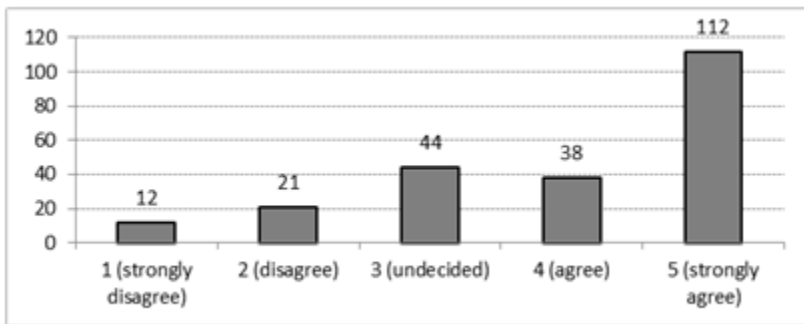


Figure 12. Degree of agreement with the following statement: “access anywhere at any time is an advantage of e-learning” (absolute numbers). Valid answers: 227.

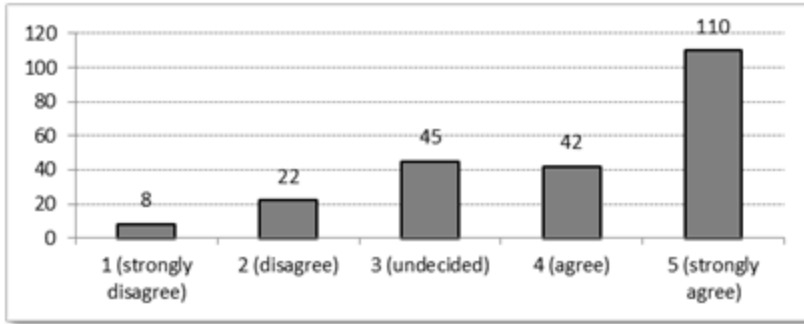


Figure 13. Degree of agreement with the following statement: “reduced costs and less travel are advantages of e-learning” (absolute numbers). Valid answers: 227.

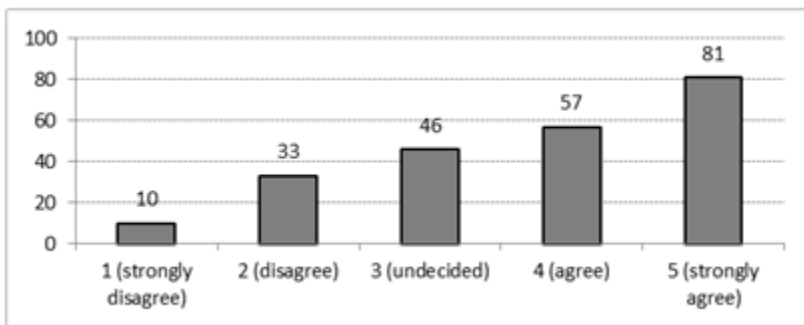


Figure 14. Degree of agreement with the following statement: “the possibility of accessing courses without barriers is an advantage of e-learning not found in face-to-face tuition” (absolute numbers). Valid answers: 227.

Another aspect studied was the number of drop-outs from e-learning courses, a figure of 37.4% being recorded for the sample (Figure 15). The reasons for giving up are many and varied but the most frequently cited is the lack of accessibility in on-line courses (38.8%), followed closely by loss of interest as the course proceeds, mentioned by 36.5% (Figure 16).

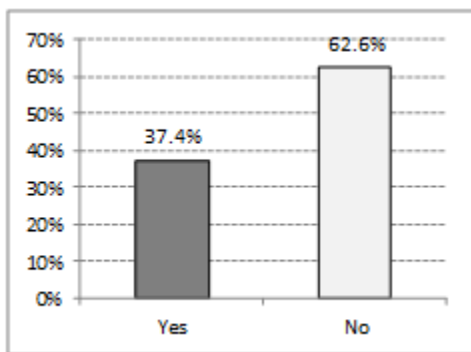


Figure 15. Percentage of deaf and hard of hearing participants who have dropped out of an on-line course at some time (relative data). Valid answers: 227.

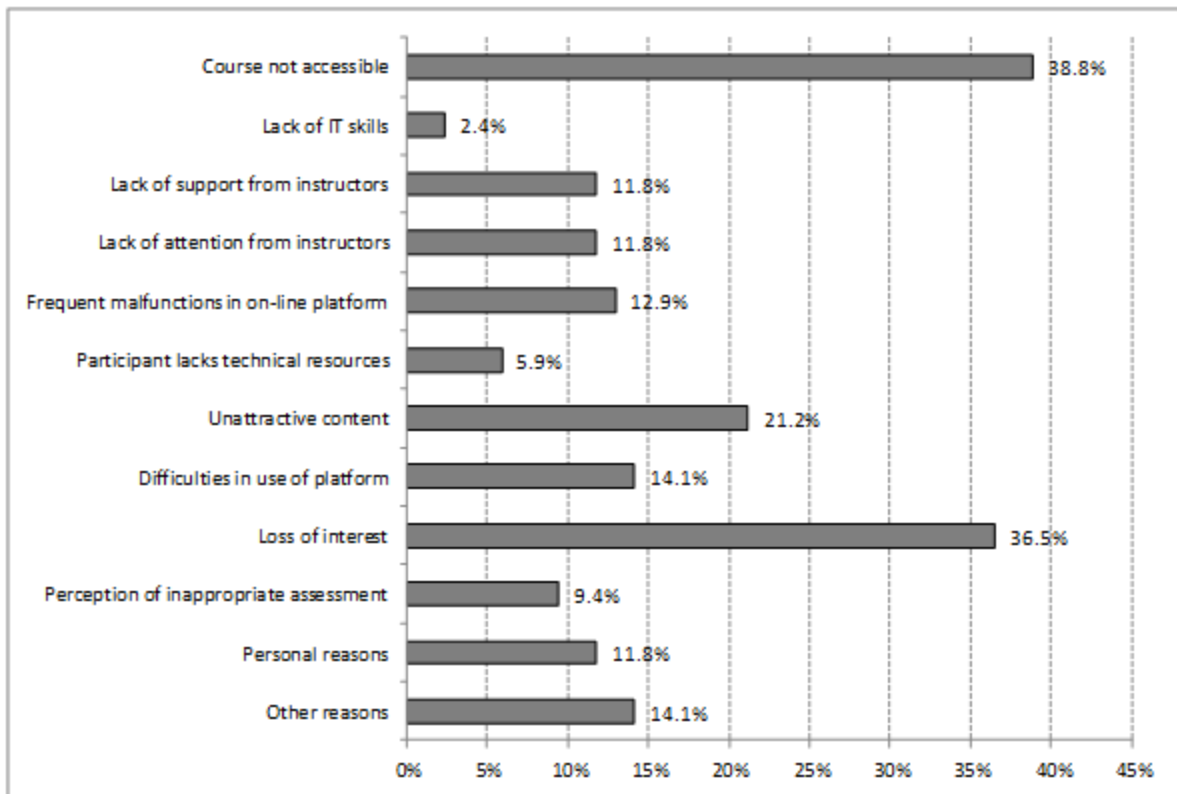


Figure 16. Reasons alleged by deaf and hard of hearing participants to drop out of an on-line course at some time by reason for giving up (relative data). Multiple answers possible. Valid answers: 85.

Levels of drop-out and satisfaction with the e-learning experience were analysed to determine whether there were relationships with the following social and demographic characteristics: sex, age, degree of deafness, age of onset of deafness, language of communication, size of habitat, level of education, employment situation, and net monthly household income (Table 4). Significant relationships were found between:

Level of education (X11) and levels of drop-out (X20).

Level of education (X11) and overall satisfaction with the experience (X22).

Net monthly household income (X13) and overall satisfaction with the experience (X22)

Table 4

P-Values of the Chi-Squared Tests for Independence

	X20: participant has dropped out at some time	X22: general assessment of experience
X1: sex (n=227)	0.197	0.764
X2: age (n=227)	0.580	0.445
X3: degree of deafness (n=227)	0.286	0.739
X4: age at which deafness occurred (n=227)	0.540	0.932
X5: knowledge of sign language (n=227)	0.845	0.694
X6: language which respondents understand best and in which they express themselves best (n=191)	0.845	0.958
X7: language used normally (n=191)	0.918	0.905
X8: size of habitat (n=227)	0.305	0.459
X11: level of education (n=227)	0.038*	0.013*
X12: employment situation (n=227)	0.951	0.674
X13: net monthly household income (n=227)	0.083	0.018*
* Relation is significant at 0.05		
<i>Note.</i> Variables X1 to X13 are considered nominal and have the same values described in Table 1. X20 (nominal): no=0, yes=1; X22 (ordinal): Likert scale from 1 (very negative) to 5 (very positive).		

When Kendall's and Spearman's correlation coefficients are calculated, a positive correlation can be observed between level of education (X11) and general assessment of the experience (X22): the higher the level of education, the better the individual's assessment of their experience of on-line courses (Table 5).

Table 5

Kendall's and Spearman's Correlation Coefficients for X11 (Level of Education) and X22 (General Assessment of the Experience)

			X11	X22
Kendall's tau_b	X11	Correlation coefficient	1.000	.158**
		Sig, (bilateral)	,	.004
		N	484	227
	X22	Correlation coefficient	.158**	1.000
		Sig, (bilateral)	.004	,
		N	227	227
Spearman's rho	X11	Correlation coefficient	1.000	.192**
		Sig, (bilateral)	,	.004
		N	484	227
	X22	Correlation coefficient	.192**	1.000
		Sig, (bilateral)	.004	,
		N	227	227

Note. X11 (ordinal): illiterate=0, primary=1, lower secondary=2, upper secondary=3, vocational education=4, certificate of higher education=5, University=6, Doctorate=7; X22 (ordinal): Likert scale from 1 (very negative) to 5 (very positive).
 ** Correlation is significant at 0.01 (2 tails).

Relationship Between Participation and e-Learning Accessibility

A total of 67.6% deaf and hard of hearing respondents think e-learning videos should be subtitled. The second and third most frequently mentioned requirements, at 47.4% and 45% respectively, are for courses to be taught in sign language and for texts to be translated into sign language (Figure 17).

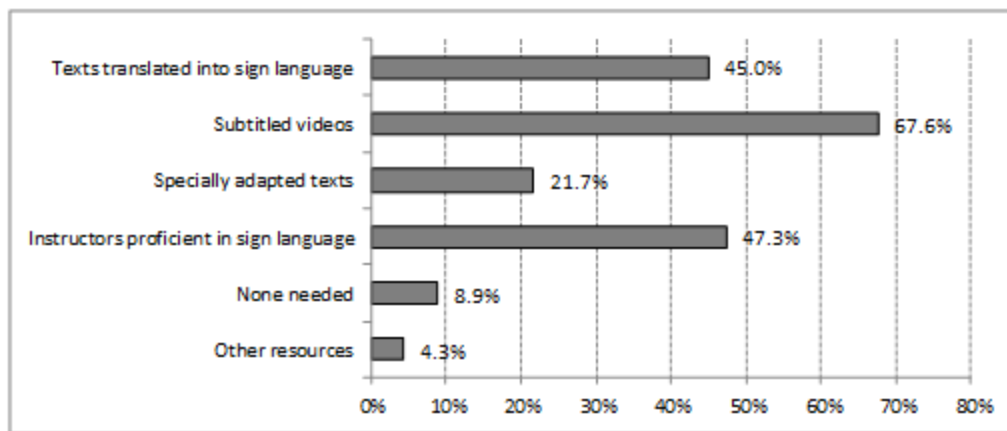


Figure 17. List of accessibility requirements specified by the deaf and hard of hearing for online courses (relative data). Multiple answers possible. Base: 484.

It is interesting to consider here the difference between the accessibility needs of those who have at some time participated in an on-line course and those who have not, the difference between those who have dropped out at some time and those who have not, and the difference between those who report being most satisfied and least satisfied. P-values of chi-squared tests for independence were established between these variables and the accessibility resources requested (Table 6), the results showing that:

- There is a positive relationship between those who have participated in an on-line course at some time (x15a) and the need for subtitled videos (X25b) and the need for other resources (X25f).
- There is a relationship between those who have dropped out of an on-line course at some time (X20) and other resources (X25f).

Table 6

P-Values of The Chi-Squared Tests for Independence Between Accessibility Requirements and e-Learning Participation, Dropping Out and Satisfaction

	X25a	X25b	X25c	X25d	X25e	X25f
X15a (n=484)	0.053	0.000**	0.783	0.798	0.957	0.021*
X20 (n=227)	0.396	0.402	0.318	0.118	0.471	0.046*
X22 (n=227)	0.230	0.590	0.259	0.335	0.398	0.729

* Relationship is significant at 0.05

** Relationship is significant at 0.01

Note. X15a=individuals who have participated in e-learning at some time. X20=individuals who have dropped out of an on-line course at some time. X22=assessment of the experience. X25a=need for texts translated into sign language. X25b=need for subtitled videos. X25c=need for specially adapted texts. X25d=need for teachers with knowledge of sign language. X25e=no accessibility resources needed in e-learning. X25f=need for resources other than those above.

X15a (nominal): no=0, yes=1; X20 (nominal): no=0, yes=1; X22 (ordinal): Likert scale from 1

(very negative) to 5 (very positive); X25a (nominal): no=0, yes=1; X25b (nominal): no=0, yes=1; X25c (nominal): no=0, yes=1; X25d (nominal): no=0, yes=1; X25e (nominal): no=0, yes=1; X25f (nominal): no=0, yes=1.

Discussion

The chi-square p value shows a close relationship between level of education and participation in on-line courses ($p=0.000$ significant at 0.01). Calculating Kendall's and Spearman's correlation coefficients (Table 3) it can be seen that when the level of studies is lower, there is less participation in on-line courses. This factor, related to the digital divide, coincides in the deaf and hard-of-hearing and the general population, as does the number of members of the household, but there is a third socio-demographic factor that is not related to the digital divide in e-learning in the general population but is relevant in the case of the deaf and hard-of-hearing: knowledge of sign language has a 0.000 negative correlation with participation in on-line courses (significant at 0.01), individuals knowing sign language participating less in such courses.

Knowledge of sign language is not a factor that appears in studies of the population as a whole, as we have already pointed out, but among those who are deaf or hard of hearing there is a negative correlation, so that those who know sign language are less likely to participate in e-learning activities. This could be due to the fact that instructors proficient in sign language and texts translated into sign language are two of the resources most often requested by the deaf and hard of hearing (47.3% and 45.0% respectively; Figure 17), while the availability of accessible e-learning in Spain is very limited, despite the efforts made in certain specific cases in recent years (Fuertes et al., 2005; Fuentes & Hernández, 2011).

Turning to social and demographic factors, we find no significant relationship between gender and the degree of satisfaction with the e-learning experience ($\rho=0.764$) so we may conclude that the satisfaction of deaf and hard of hearing participants is independent of gender. However, there is a significant relationship at 0.05 with the participant's level of education ($\rho=0.013$), showing that the higher the level of education reached by deaf and hard of hearing participants, the greater their satisfaction with the e-learning experience. A significant relationship can also be seen between monthly household income and satisfaction with the e-learning experience [Kendall's and Spearman's correlations pending]

The opinions of those who are deaf and hard of hearing generally coincide with the dimensions affecting the satisfaction of participants in e-learning identified by Sun et al. (2008), although here we have not compiled information on all the variables contained in these dimensions. One exception is that only 43.1% of the deaf and hard of hearing consider cooperation with peers important in on-line learning. In the study carried out by Sun et al. this dimension corresponds to the variable of perception of the student's interaction with others (environment dimension). On the other hand, 73.1% of deaf and hard of hearing learners consider the accessibility of the course important, which does not correspond to any of the variables identified by Sun et al.

Their preference for face-to-face courses is the most important reason why 29.2% of the deaf and hard of hearing have never participated in e-learning activities. In fact, among deaf and hard of hearing individuals who have participated in e-learning at some time, 73.1% consider accessibility to be the most important factor but do not identify it as one of the main advantages of e-learning over face-to-face

tuition. We thus find that those who do not participate allege that problems of accessibility are the main obstacle and those who do participate assign great importance to accessibility, although it is not precisely seen as an advantageous characteristic of e-learning. Finally, lack of accessibility is also the main reason why 38.8% of the deaf and hard of hearing who have participated in e-learning at some time dropped out. It is therefore clear that accessibility has a significant influence on the deaf and hard of hearing, regarding both their participation in e-learning, their satisfaction, and the likelihood that they will drop out, confirming the results of Fichten et al. (2009) and the ICT Accessibility Observatory (2013).

Deaf and hard of hearing individuals who have participated in e-learning activities at some time confirm all the advantages reported in the literature for the population as a whole, flexibility regarding time and location (68.3%) and reduced cost and less travel (67%) being the advantages most often reported by the deaf and hard of hearing (Figures 11 and 12).

Regarding drop-outs, Levy (2007) says that in the literature a 25% to 45% drop-out rate is recorded for e-learning courses among the population as a whole. Among deaf and hard of hearing students the drop-out rate is 37.4%. Although this is high, it is near the 40% average that emerges from the international reports examined in the review of the literature carried out by Rostaminezhad et al. (2013).

Rostaminezhad et al. (2013) cite motivation as the factor most often given as the reason for dropping out of e-learning courses. Among deaf and hard of hearing students, the most important cause for 38.8% of the sample was problems of accessibility in the course, a factor which is not expressly mentioned in Park's (2007) theoretical model for the population as a whole. However, the second factor coincides with the observations of Rostaminezhad et al., as loss of interest during the course accounted for 36.5% of cases, considerably more than those related to the third cause, unattractive course content (related to Park's academic integration factor).

Finally, the accessibility of the on-line course was the aspect deaf and hard of hearing learners considered most important (73.1% rated it as very important or extremely important), which suggests that the more accessible a course is, the more participants there will be. The accessibility resource requested by most respondents is the subtitling of videos (67.6%). It is followed by the availability of instructors proficient in sign language (47.3%), the translation of texts into sign language (45%), and the availability of texts at different levels of reading difficulty (21.7%). There is also a significant negative correlation at 0.05 bilateral between those who are less satisfied and the need for texts translated into sign language ($\rho = -0.137$), suggesting that one of the reasons for the dissatisfaction of deaf and hard of hearing learners is the absence of this resource in the e-learning environment.

Three limitations to this study need to be pointed out. Firstly, although snowball sampling is the most suitable approach for the target group, it has certain limitations and other studies will need to be carried out in future to confirm the results. Secondly, this study does not take account of the characteristics of the e-learning courses in which the respondents participated, such as prior motivation, the educational context in which they take place, their technical characteristics, etc. and it would be interesting to examine these aspects in greater depth in future. Finally, in this study no distinction is made between different geographical regions or urban and rural areas and there is scope for further work on the findings.

In future research, studies could be carried out to examine qualitatively in greater depth the motivation of deaf and hard-of-hearing people to take part in e-learning courses, the specific accessibility problems they have to face and how they deal with them. Secondly, studies could be carried out to look more deeply into possible differences in the study strategies used by the deaf and hard-of-hearing as e-learning students according to the language of communication used (sign language or oral communication).

Conclusion

The purpose of this study was to examine the existence of inequalities in access to e-learning by individuals in Spain who are deaf or hard of hearing and aged 16 to 64, compared with the population as a whole and to confirm the following hypotheses:

1. Are there significant inequalities in participation in e-learning activities by people who are deaf or hard of hearing and that of the rest of the population in Spain? Yes, there are significant inequalities in access to e-learning by people who are deaf or hard of hearing compared with the rest of the population, caused by problems of accessibility, and there are also inequalities related to social and demographic factors. We could thus refer to up to four digital divides in access to e-learning. Two digital divides in access to Internet: first digital divide with inequalities in comparison with the population as a whole and second digital divide with inequalities among the deaf and hard of hearing related to social and demographic factors (gender, age, level of education and family). And two digital divides in access to e-learning: therefore, third digital divide with inequalities of participation in comparison with the population as a whole related to accessibility barriers and fourth digital divide with inequalities among the deaf and hard of hearing related to social and demographic factors, in particular, the individual's level of education and the knowledge of sign language.
2. If there are inequalities in access to e-learning for the deaf and hard of hearing compared to the rest of the population in Spain, are these related to social and demographic factors? Yes, there is more participation in e-learning and dropout rates are lower if deaf and hard of hearing individuals have a higher level of education (this being the most influential factor). Deaf people who use sign language also experience a higher degree of exclusion from this type of education.
3. Does the accessibility of the e-learning environment have a direct influence on the satisfaction of those who are deaf or hard of hearing as on-line learners? Yes, accessibility is the most important factor in determining satisfaction with e-learning for 73.1% of the deaf and hard of hearing. Lack of accessibility is the reason why 28% do not participate in e-learning activities and the main reason for dropping out for 38.8%. The accessibility resources most often requested are (in this order): subtitling of videos, instructors proficient in sign language, the translation of texts into sign language, and the availability of texts at different levels of reading difficulty.

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Special Report on the Role of Open Educational Resources in Supporting the Sustainable Development Goal 4: Quality Education Challenges and Opportunities



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Quality Education: Role/Contribution of OER

Open Educational Resources (OER) and their offspring, Massive Open Online Courses (MOOCs), are becoming important factors in achieving the *Sustainable Development Goal 4: Quality Education (SDG4)*. This was recognised early on by UNESCO in 2004 when they first coined the term “Open Educational Resources” and in 2012 with the OER Paris Declaration. UNESCO is continuing its support of OER with the 2nd OER Summit in September 2017. There is recognition that OER and MOOCs, while not being *the* solution to the world’s educational crises, will play an important, if not essential, role. The OER movement is less than 15 years old and is growing rapidly as more and more nations and institutions adopt the view that publicly-funded research and educational content belongs to the people and should therefore be open and accessible to them. Canada can play an important role in supporting SDG4 by increasing its support for OER and open education in general, both in Canada and abroad.

It is reasonable to argue that OER can greatly benefit developing countries, even more so than those that are considered developed. As such, they can play an important transformative role in supporting the SDG4 goal. OER can be used to increase access to learning for those living in unfavourable circumstances, and can also be used to address issues of cost, quality, and equity. They are free of licensing restrictions that inhibit quality improvements and because they are openly available, OER can facilitate both internal and external collaborations among instructors and institutions, both locally and internationally, while ensuring equitable access to knowledge and learning. OER are presently being actively used in all sectors of education including literacy, vocational, and adult education, as well as with immigrants and refugees (with prior learning assessment and recognition). OER can be instrumental in improving the quality of

education through open curriculum development. And, most importantly, OER are digital; the world economy is digital and students must learn how to work (and play) in digital environments.

Because OER can be reproduced at virtually no cost, they can be effectively used to reach vast numbers of learners, while supporting quality enhancements. As well, since they can be reused, revised, remixed, redistributed, and retained, OER can be adapted to different learning environments (Wiley, 2014). It was UNESCO that first used the term *open educational resources*, defining them as “teaching, learning or research materials that are in the public domain or released with an intellectual property license that allows for free use, adaptation, and distribution” (UNESCO, 2002, par. 2). The UNESCO Paris Declaration of 2012 followed, supporting OER for development and recommending that educational materials developed with public funds be made available under open licenses (UNESCO, 2012). Additionally, because OER are open, they can be translated into different languages and localised to meet the needs of different countries, regions, institutions, and learners (Butcher, Kanwar, & Uvalic-Trubic, 2015).

OER, as content, are free of cost to learners and teachers. However, there are other costs that must be taken into account, including the salaries and time of the OER creators/adapters/assemblers. These costs can be significantly reduced by sharing OER with other institutions. For example, an institution, rather than creating its own course material, can choose to make use of OER that have been created by others, thus saving the cost of content creation; however, there still may be costs for searching/finding, assembling, and adapting the content. In addition, an appropriate technological infrastructure needs to be in place with access to adequate bandwidth and wifi, as well as trained support staff. (Please note that these costs are the same when using commercial content.) Furthermore, the cost of commercial textbooks is becoming a greater problem as the prices are all too often increasing beyond the ability of students to pay for them. As a result, there has been rapid growth in the number of learners internationally, who cannot afford the high cost of textbooks. The advantage of OER is that they are cost-free and can be adapted freely. The ability to adapt and modify content is an important advantage, especially when targeting specific populations such as those with disabilities or special needs.

Indigenous Knowledge

OER can also be used to preserve and distribute Indigenous knowledge, which is being supported now in many countries. OER can be used to support the “participatory principle” that is common in many Indigenous communities, as well as preserving and distributing Indigenous knowledge that has traditionally been open. Indigenous knowledge is seen as belonging to the community as a whole and like OER, it can be continually enhanced and expressed in many forms such as in stories, dance, songs, and through the wisdom of elders. Sharing is conducted through personal interactions among the community/kinship or religious groups (Bertini, 2010).

Maskwacis First Nation Cultural College

As a Canadian example, in Alberta, the Chair has worked with this college to introduce them to OER. They received funding from the Ministry of Advanced Education for the development of Indigenous content

aimed at driving “stronger Indigenous perspectives in Alberta post-secondary learning.” The project was designed to support the need for Indigenous students to learn in new technological environments and become digital citizens, while maintaining their Indigenous perspectives. They have implemented several courses in OER and even translated the Creative Commons licences into the Cree language.

Indo-Educa

This is a community-based OER project building a repository for Indigenous content in both Portuguese and different Indigenous languages. The organisers believed that OER was a concept “fundamentally in sync” with the Indigenous way of knowing. The aim was also to preserve traditional knowledge, while linking Indigenous communities with the wider society. Indigenous university students were enlisted to prepare relevant and appropriate OER for use in schools. The OER preserve and open access to more than 200 traditional stories, rituals, beliefs, and other cultural artefacts (Rossini & Castro, 2016).

AgShare II

This is a collaborative project in OER of three universities: Haramaya (Ethiopia), Makerere (Uganda), and Mekelle (Ethiopia). Its aim was to investigate the forms of Agricultural Indigenous Knowledge used by different groups of farmers for managing soil fertility and preparation, pest control, and diseases, weed control, planting, harvesting and storage of Indigenous root crops and animals (AgShare II, 2015.). This research project sponsored by the *Bill and Melinda Gates Foundation* has determined good strategies for documenting and disseminating Indigenous knowledge as OER, which is contributing to both sustainable food security efforts and educational for all.

Considered very important by many are the affordances available with OER that support innovation in teaching and learning. The training of faculty in the use of educational technology is a major task. Faculty must not only master the technology, but also be skilled in its pedagogical uses to improve learning outcomes. OER, because of the flexibility and openness, can enable the best teaching practices and increase student achievement levels both for knowledge and skills. The open licences used by OER, unlike commercial content, allow users to localise content to meet the special conditions of learners, teachers, institutions, and nations. For example, OER can be designed to meet the accreditation requirements of schools and agencies, or they can be translated to local languages or adapted to respect the exigencies of a particular culture. They can also be used to support active learning by students. OER can be manipulated and altered to support this and other constructivist approaches to learning; students can work with instructors in creating more effective learning environments (Butcher & Hoosen, 2012).

OER can be used to create alternate or complementary pathways to education. It is estimated that there will be a need for more than 80 million places for additional students internationally by 2025 (Daniel, 2012). OER can be used to create additional places using access to credentials as, for example, the case of the OERu, which is a consortium of plus 30 institutions on five continents, creating OER pathways to degrees from credible public universities (Mackintosh, McGreal, & Taylor, 2011).

MOOCs grew out of the open education movement and, as such, represent an important part of the OER landscape. Yuan and Powell (2013) have described how MOOCs developed out of the OER, open education, open source, and open access movements, although there are also commercially licensed

versions of MOOCs now in operation, such as Udacity and Coursera. Weller (2014) has described MOOCs (at least the non-commercial ones) “as part of a continuum” that has proceeded from open source computing, to open access, OER, and open education.

Commercial textbooks and other content come with Digital Rights Management (DRM) otherwise known as Technological Protection Measures (TPM) or colloquially as “digital locks.” These “locks” on materials restrict students from making effective use of the content. They cannot copy, paste, highlight, print out, change devices, etc. In addition, there are legal restrictions that prevent users from breaking locks or making use of the content as they would like. For example, they are legally prohibited from showing their textbook content to anyone else. The publishers own all the data created, and they control how the textbook is used. Because of these restrictions, it is essential for educators to use OER, which can be used freely without locks or legal restrictions.

Canada: An International Leader in OER

Canada has important areas of expertise in OER at the post-secondary level. Although there is no federal government strategy specifically supporting OER or other forms of open education, there has been activity at the provincial level in Western Canada, and more recently in Ontario with the creation of eCampus Ontario. For the most part, OER development and open initiatives in Canada have focused at the level of individual institutions and on access and availability issues as opposed to practice and policy and/or initiatives to encourage openness (McGreal, Anderson, & Conrad, 2015).

Canada is unique in the world in that it is the only country whose national government has no authority in education; in Canada, education is exclusively a provincial responsibility. In large and complex countries with diverse educational institutions, especially in a Confederation such as Canada, where each province has total autonomy in education, it is difficult to be aware of the many varied practices and policies that are emerging. While other countries can develop national policies, it is only possible in Canada to develop trans-Canadian provincial partnerships in education, but these partnerships operate without national government involvement.

Nevertheless, there are several national open access initiatives, including the federal government's [Open Data](#) pilot project, which enables access to content that can be used to support OER development. In addition, the Tri-Council funding agencies—*Canadian Institutes of Health Research* (CIHR), the *Natural Sciences and Engineering Research Council of Canada* (NSERC), and the *Social Sciences and Humanities Research Council* (SSHRC)—have all agreed on a [Tri-Agency Open Access Policy](#), supporting open access publishing of all federally-funded research. While, this federal policy focuses on research publications, many of these, when used for teaching, can be considered to be OER. There is confusion between OER and open access, along with the concept of openness in general; there is a large grey area between open access and OER, in addition to openness. Even so, the federal government policies support the principle that all publicly-funded content should be openly accessible and reusable.

Nationally, the *Council of Ministers of Education, Canada* (CMEC) has supported the UNESCO OER

Paris Declaration, reaffirming “their commitment to open access to knowledge and education and to the need to adapt teaching and learning practices to the new realities of the information age” (Council of Ministers of Education Canada, 2012, p.15). The Vancouver-based *Commonwealth of Learning* was a co-partner with UNESCO in initiating the first UNESCO conference in 2012; and they are continuing this partnership in supporting the 2017 UNESCO summit in Slovenia.

Canada is perceived as a world leader in OER, primarily because of the initiatives in British Columbia and Alberta. B.C. was the first province to initiate an OER project where BCcampus has created and populated a repository of more than 150 open textbooks. Alberta followed with a \$2 million project to support the creation, assembly, and adaptation of OER. Regionally, the three Western provinces of British Columbia, Alberta, and Saskatchewan have signed a *Memorandum of Understanding* agreeing to cooperate on the development of common OER (Memorandum of Understanding, 2014). Alberta, Campus Manitoba and eCampus Ontario have partnered with BCcampus in using the [Open Textbook](#) repository. In 2016, eCampus Ontario sponsored an OER Request for Proposals available to Ontario post-secondary institutions.

Canadian leadership has been recognised by the Open Education Consortium: Alberta hosted the 2015 international conference in Banff Athabasca University received an Award of Excellence for the OER Knowledge Cloud, a repository of more than 1600 scholarly articles and reports related to OER; the UNESCO/COL/ICDE Chair at Athabasca University received a Lifetime Achievement Award; and BCcampus has also received an Open Education Consortium Award of Excellence in Education.

The reality in Canada is that, although there are significant initiatives in OER at the post-secondary level, there is little if any activity in the primary and secondary levels (K12) other than ad hoc implementations by individual teachers. (Unlike the USA, where there are now more than 25 states supporting OER in K12 schools, and South Africa with Siyavula's open textbooks for primary and secondary schools).

The creation and use of OER benefits from the development and use of Creative Commons licences, which provide the legal framework to share these resources. Creative Commons (CC) Canada, an affiliate of the larger international body, is an organization born of the global open education movement. The author of this paper and UNESCO Chair is the board member of CC Canada, and Canadian-born Ryan Merkley is now the CEO of Creative Commons worldwide. Most recently, in May 2017, the CC international Summit meeting was held in Toronto.

OER universitas (OERu) offers free online university courses in collaboration with Canadian partners so that learners can gain formal credentials from the partner institutions. As has been previously noted, OERu is a consortium of more than 30 institutions and several organizations on five continents. It is dedicated to widening access and reducing the cost of post-secondary education for learners internationally by providing OER pathways to achieve formal and recognized credentials (McGreal, Mackintosh, & Taylor, 2013). There are seven members of the OERu located in Canada: three universities (Athabasca, Thompson Rivers, and Kwantlen Polytechnic); one community college (Portage College in Alberta); and three organizations (BCcampus, eCampus Alberta, and Contact North in Ontario). Two Canadians sit on the OERu Board of Directors: Dr. David Porter, CEO of eCampus Ontario, and Prof. Rory McGreal, UNESCO/COL/ICDE Chair in OER.

Following a recommendation by the *Organisation Internationale de la Francophonie*, whose conference was hosted in February 2013 in Moncton, NB, there has been renewed interest in Québec in the promotion of *des ressources éducatives libres* (REL). The Ministère de l'Éducation, du Loisir et du Sport du Québec is financing the website *BRER* (*banques de ressources éducatives en réseau*), which hosts French language OER as well as other content. *Thot Cursus* is another Québec organization that has implemented a repository that includes OER. These are rather limited initiatives, in comparison with the Western Canadian initiatives and with France, which is strongly committed to REL. Sophie Touzé, who serves as an expert in Digital Education and Pedagogy for the French Ministry of Higher Education and Research, has been elected president of the international Open Education Consortium.

It is not well known that MOOCs are Canadian in origin. The name dates to an experimental course led by George Siemens at the University of Manitoba and Stephen Downes at the National Research Council in 2008 (Tamburri, 2014). They taught a MOOC titled, *Connectivism and Connective Knowledge* (Downes & Siemens, 2008) with more than 2,200 learners online.

The Canada-based Commonwealth of Learning (COL) is charged with promoting open education throughout the 53 countries of the Commonwealth. They have been supporting OER and delivering MOOCs to Commonwealth citizens since 2013. In 2017, in collaboration with Athabasca University, they are delivering a MOOC entitled, *Introduction to Technology Enabled Learning*, which is accessible globally. Several of Canada's larger universities have been delivering MOOCs as part of the Coursera or EdX consortia based in the USA. As an example, The University of Alberta delivered one of the first such MOOCs in Canada on *Dinosaur Paleobiology* in 2013.

The International Development Research Centre continues to be very active in supporting OER research. They are the donor (C\$2.8 million) for *The Researching Open Educational Resources for Development (ROER4D)* project, which is a South-South research network on OER and development. This network, with participants in South America, Asia, and Africa is charged with analysing and producing knowledge on the impact of OER in higher education. A previous project in Asia has led to major OER initiatives in several countries (International Development Research Centre [IDRC], 2017)

Open Access (OA) to scholarly research is related to OER. Open Access supports open licensing for research rather than education. Nevertheless, OA can be used as OER, if the open content is used in a teaching/learning context. The three Canadian research funding agencies—CIHR, NSERC, and SSHRC—have agreed on a policy supporting open access in scholarly publications. OA initiatives also include support for OA Journals. The SSHRC and UNESCO supported *International Review of Research in Open and Distributed Learning (IRRODL)* was one of the first open journals worldwide. There is also support for open university presses such as *AUPress* at Athabasca University and limited open titles from the *University of Ottawa Press* and others. Universities are also promoting openness through the use of Creative Commons (CC) licences.

To move forward as international leaders, Canadian OER supporters must continue to increase awareness of OER among learners, teachers, administrators, and most importantly, among provincial education officials who are in a position to support open policies including those responsible for the CMEC. Specifically, provinces should be encouraged to build on the Tri-Council decision to support open access

for research and extend it to OER in both higher education and in the schools. The experience of Alberta shows that students, concerned about the increasing price of textbooks, can have a significant impact on government policies regarding OER. Leadership is enjoyed by those who are actually implementing OER initiatives. The implementation of open education in Canada remains in its early stages. However, the growing interest in MOOCs, the recent OER initiatives, and the inter-provincial partnership MOU in Western Canada, could well be harbingers of future cooperative and/or collaborative developments in Canada, placing it as a leading nation on a fast track to national and international collaborations, policy, and standards in open education.

OER: Opportunities and Challenges

Perhaps the most important opportunity for OER is in the global free exchange of knowledge. OER render this knowledge not only accessible but also reusable by learners and teachers in a variety of formats; anyone can access information on the Web, but if it is restrictively licensed, it cannot be downloaded or reused, whereas OER does allow this. In addition (as previously noted), OER are very much “in sync” with the “participatory principle” noted in diverse Indigenous communities and so can provide Indigenous organisations with an opportunity to support the distribution and preservation of their cultures and Indigenous knowledge (Bertini, 2010). OER have also made possible a move towards South-South exchanges, whereas previously knowledge flowed uni-directionally from the North to the South. For example, lusophone learners in Brazil are accessing Portuguese language OER created by the African Virtual University (Diallo, 2011).

Any implementation of OER becomes an opportunity that presents challenges. OER can save time and money, but as has been noted above, the implementation does not come without costs both one-time and recurring. One-time costs include those of searching, transferring, adapting, assembling, etc., while the recurring costs are for the infrastructure and updating. Note, that there are similar costs when implementing commercial content. Many teachers and learners still do not understand the difference between freely accessible content on the internet and OER, believing that all web resources are OER (Chen & Panda, 2013).

However, most available OER are in English. This can be seen as both an opportunity and a challenge as the English language is widespread as a first or second language in most countries, counting hundreds of millions of speakers, but it is still not understood by the vast majority of the world's people. Another major challenge for OER advocates is to overcome what has been seen as a unilingual and one-directional flow of knowledge and resources from the global North to the South (Glennie, Harley, Burcher, & van Wyk, 2012), often referred to as “cultural imperialism,” based on an unequal distribution of power.

A most serious challenge for the global South, and in underserved remote regions in the global North is the lack of infrastructure. This includes not only available devices but also access to high bandwidth either by wire or wireless. Nevertheless, more than 90% of the world's population is within range of effective wireless signals, which raises opportunities for learning using mobile device (M-learning). The demand for a mobile learning can be used to convince governments of the importance of providing an adequate,

reasonably priced infrastructure to elevate the educational level of citizens.

The increasing volume of OER that are becoming available represents an opportunity for teachers and learners everywhere. On the other hand, this increasing volume has created a serious challenge in the effort that is often required to find and evaluate relevant OER (Chen & Panda). However, this is becoming less of a barrier in the first year of higher education, as more robust and capable search engines and OER repositories are becoming available for searching out content in the major subject areas. In less popular subjects and in the upper levels of university, finding relevant OER still remains problematic.

OER can also be used to raise the quality of education, not only of the teaching content but also of the teaching itself by supporting the transformation of the educator's learning environment. Nevertheless, quality issues have been raised regarding the use of OER. Criticisms include not just subject matter quality, but quality in relation to the local environment, culture, and pedagogy. However, unlike commercial content that must remain static and untouched, OER can be localised and customised to the specific environment and to different approaches to learning. They can also be formatted for delivery in a variety of ways including print form, when needed. In India, the National Knowledge Commission (NKC) has recognized that OER can be used to address the poor quality of teachers, poor infrastructure, poor libraries, and poor educational resources. They recommend that OER can be very effective in reducing these problems and improving the quality of education while increasing accessibility (Dutta, 2016)

There are an increasing number of OER and MOOC initiatives being implemented internationally. To date, most projects have been in North America and Europe; however, important exceptions include [Siyavula](#) and the [African Virtual University](#) (AVU) in South Africa, the Indian NKC OER initiative, and several universities in Asia. There is research on several of these initiatives, their impact on the demand for OER, and on their reuse. Lessons can be learned from these and also from research on activities in the more developed countries (Das, 2011; Dhanarajan & Porter 2013; Dutta, 2016).

MOOCs (Massive Open Online Courses)

There are huge educational benefits becoming available through MOOCs. These are not limited to significant cost savings, which can be substantial, because they can also provide worldwide access to high-quality learning content with at least vicarious interactions with experienced instructors. This combined with anytime, anywhere learning, make MOOCs, combined with OER, a valuable and significant factor in meeting the United Nations and UNESCO's educational goal. While providing access to learning for large numbers of learners, MOOCs have become instrumental in the transformation by institutions to more technologically enhanced learning, improving the quality of both online and blended learning. On the other hand, MOOCs have been criticised for the quality of their pedagogy, relying on traditional video lecture formats; their low completion rates; and a failure to deliver on inclusive and equitable quality education (Darco, Rosewell, & Kear, 2016)

MOOCs represent a major opportunity for meeting the Quality Education goal. However, they also present serious challenges. MOOCs cannot be seen as a solution for all (like classroom-based teaching,

which is not for all and has its own challenges). MOOCs are being used by many institutions solely as a marketing tool. Moreover, to date, MOOCs are mostly being accessed by those with higher levels of education rather than the masses of learners who lack access to traditional education (Rohs & Ganz, 2015). It is argued that MOOCs are simply extending the digital divide by expanding inequalities of opportunity. In addition, other barriers can be insurmountable for many learners. These include information overload, lack of local language support, and access to well-trained teaching professionals. Educators must find new strategies for addressing the needs of these non-traditional learners. Nevertheless, MOOCs can be used to improve educational quality while massifying the educational market. Haber (2014) cautions that just because they are not a cure-all does not mean that MOOCs are not important in promoting quality education – despite their limitations.

The future of MOOCs will depend on approaches taken to accreditation. Students not only want to learn but also want their learning recognized officially. The OERu is attempting to remedy this with their OER courses and testing by the participating universities (for a fee) for students who want a credential. Several MOOCs now offer certificates while others offer badges. Automated testing and prior learning assessment will play a key role in supporting credentialing as MOOCs become more popular.

MOOCs have the potential to open up education to many more students at substantially lower costs. Scholarships can be awarded to students who monitor other students in MOOCs. The world economy is digital and students can learn to help each other online and become proficient digital citizens. MOOCs are capable of being used to reach large numbers of teachers anywhere at any time and are in fact benefiting from this now. For example, The Commonwealth of Learning and Athabasca University are delivering [Technology Enabled Learning](#) training via a MOOC to large numbers of learners, many of whom are in the least developed countries or on small island states.

UNESCO/COL Chair in OER and Awareness Training

The full potential of OER and their MOOC offspring can be realised with executive commitments and the approval of strong open education policies, along with the implementation of appropriate technologies (Miao, Mishra, & McGreal, 2016). These measures should be combined with training for knowledge about OER and the skills to effectively use them. These include expanding awareness of OER and MOOCs; the integration of OER into institutional administrative frameworks; and developing and applying sustainable OER business models, including faculty incentives (Cox & Trotter, 2016).

The role of the UNESCO/COL/ICDE Chair in OER is to continue lobbying for OER initiatives and policies among the relevant constituencies (School Boards, Higher Educational Institutions, Ministries of Education and Advance Education, faculty, students, etc.) in Canada and internationally, particularly in the global South, in order to expand participation and extend access. The Chair must lead by example by collaborating on OER projects with other Canadian and international educators and researchers, as well as those in his home institution. He has a role also in advising administrators and government officials in how best to implement OER initiatives, including quality assurance and issues of privacy and ethics

(Ferguson, Scanlon, & Harris, 2016, p.21). The creation of templates, standards, and guidelines for OER implementations and use are also important activities that are being undertaken.

Success builds on success. The Chair in OER has been instrumental in supporting BC's initial leap into OER; was heavily involved with students in the lobbying of the Alberta government to support OER, resulting in a \$2 million grant; and was named co-Chair of the Alberta OER initiative. His efforts have had some (if limited) influence in Ontario where he has advised Ministry and eCampus Ontario officials on OER. Internationally, universities in Malaysia, Pakistan, India, the Philippines, South Africa, Uruguay, Bahrain, and other countries, have all benefitted from OER consultations with the Chair, resulting in many responding with significant OER initiatives. The role of the Chair, then is to support OER implementations wherever possible.

OER: Advancing Sustainable Development Goal 4?

Ensure Inclusive and Equitable Quality Education and Promote Lifelong Learning Opportunities for All

As I have represented above, OER can be a significant aid in ensuring inclusive and equitable quality education and can promote lifelong learning opportunities for all. OER, by their very nature as freely available and usable learning resources, can be considered important, if not essential, for supporting the expressed goals in all areas of education. From pre-kindergarten to lifelong learning, including technical and vocational training, OER can have significant impact.

Governments can better support free K12 education financially because the OER are available at no cost. They can be taken “as is” or modified and they can be made available to all. This includes all levels from early childhood to secondary school. Affordable education for vocational and technical education as well as university is also made more affordable with OER. MOOCs with their ability to serve large numbers of users can be used to increase the number of youth and adults with relevant skills. Gender disparities can be diminished when both men and women have equal access to the free content. People with disabilities will benefit, because the OER can be adapted and reformatted to meet their individual needs. And, OER fit very well with the community-sharing culture of many Indigenous communities.

One of the biggest boosts to literacy is the open availability of OER. They not only assist in promoting literacy education, they actually can serve as an incentive. With the world's knowledge freely available and re-usable, this provides a reason for people to become literate and numerate, not to mention technology literate.

OER can be used to help ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity, and of culture's contribution to sustainable development. OER can be child, disability, and gender sensitive, and provide safe, nonviolent, inclusive,

and effective learning environments for all, including diverse Indigenous communities. And if not, OER can be altered and or modified to be so.

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