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Editorial

Collaborative Efforts, Quality, and Performance: Hallmarks of Successful Teaching and Learning

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In a confused and often-angry world that regularly seems on the brink of "something," it's heartening to see research that features collaboration among researchers and countries and the linkage of ideas and processes. Our first several articles that do just that, specifically attending to issues around OER, MOOCs, and, of course, learning.

Castaño-Muñoz, Colucci, and **Smidt**, responding to the increased demands on European systems given the increasing numbers of new arrivals, presents the results of a qualitative study that was carried out as part of the Moocs4Inclusion project of the Joint Research Centre (JRC) between July and December 2016. The study, which has a European focus, considers Free Digital Learning (FDL) initiatives by three most common purposes: a) language learning, b) civic integration and employment, and c) higher education. Their results show that there are overlaps between the purposes of FDL initiatives and their design principles, and makes recommendation for better design.

Affouneh, Wimpenny, Ghodieh, Alsaud, and **Obaid** trace the process of development of the first Palestinian MOOC, Discover Palestine, from its early inception as a cross institutional online course, to its current delivery and engagement with a global and diverse group of learners. The findings share not only the hurdles the Discover Palestine team had to navigate during MOOC development, but also how academic collaborations promoting open education practices offer powerful tools for the reciprocal exchange of knowledge, not least in shifting mindsets, and offering opportunities for shared fields of understanding to be realized in revealing creative, cultural practices, as well as lost histories.

Is there value to online group projects and the collaborative efforts they require? (And that many students heartily dislike?) **Donelan** and **Kear** address these challenges by exploring students' and tutors' experiences of a group project. Findings highlighted four key aspects for successful online group projects

and for motivating students to participate fully. An important aspect for success is authenticity. Not surprisingly, findings also showed that tutors were unconvinced of the value and fairness of assessing students partly on a group, as opposed to an individual, basis.

Blomgren observed the commonalties in the perceptions of purpose, practical uses, and challenges in the use of Open Educational Resources (OER) in Higher Education (HE) and K-12, both sharing the need for high-quality educational resources to assist in teaching and learning, finding benefits in cost-savings for resources as well as user-generated content, instructor creativity, and contextualized and responsively timely learning opportunities. Increased OER awareness is needed at both levels to enhance and deepen good practice.

The Commonwealth of Learning (COL) has identified the development of open educational resources (OER) as a potential answer to the challenges of providing relevant access to inclusive and equitable learning. **Abeywardena, Karunanayaka, Nkwenti,** and **Tladi** describe the collaborative development of 29 provincial/regional OER policies and guidelines that were developed in Sri Lanka, Botswana, and Cameroon. Their paper discusses how they made this large collaborative project work and highlights the success factors, challenges, and follow-up activities of the project.

Zhang's article on OER also concerns connection but focuses more directly on developing language learners' meta-linguistic understanding of the interrelation among linguistic form (grammar/vocabulary), meaning, and context. By drawing written documents and student interviews conducted over an academic semester in an EFL writing course, this qualitative study shows that the systemic functional linguistics (SFL) theory-based material adoption did a good job of supporting EFL students in their internalization of language knowledge from both open educational resources and traditional textbooks, while also enabling students to use materials flexibly instead of passively following along with the content in the mandatory textbook.

We hope and optimistically expect that from collaboration and sharing comes quality. Issues of quality are high in importance for reasons of academic integrity, accountability, and the practicalities of funding, recruitment, and marketing.

From Nigeria, **Reju** and **Jita** examined students' experiences with distance and online learning of undergraduate mathematics in two major Nigerian universities. They identified problems: the results of the study suggested that the abstract nature of mathematics was not appropriately addressed in the course content and that the absence of helpful and visible tutors for the subject complicated the challenge of understanding abstract mathematics. They also identified the the need for improvement in the design, development, and provision of mathematics course materials and programmes for distance and online mathematics learning.

Staying with quality in international contexts, **Marciniak** examined quality issues in Spain. In her paper, she presented a model designed to assess the quality of online higher education online programmes that includes the assessment of the quality of the programme itself. In order to design the model, **Marciniak** conducted a bibliographical analysis of different standards, models, and guides developed in Spain and other countries to assess online education. The model guides the implementation of online programmes

and allows for a more comprehensive assessment of the programme to discover opportunities for improvement.

Faulconer and **Gruss** examined the nature of non-traditional labs that are increasingly used in higher education. While their research indicates that these non-traditional approaches to lab experiences are as effective at achieving the learning outcomes as traditional labs, their research outlines further important considerations such as operating and maintenance cost, growth potential, and safety. They identify several weaknesses in the existing literature and conclude that although novel work on non-traditional labs continues to be published, investigations are still needed into cost differences, acquisition of procedural skills, preparation for advanced work, and instructor contact time.

In their article on quality of a different (and not much discussed) sort, **Poalses** and **Bezuidenhout** used a comparative mixed method design using the Job Demands-Resources tool to measure work stress on academic and administrative staff at an open and distance learning university in South Africa. Findings from 294 university staff members elucidated their experience of work stress within a university in the developing world. Mindfulness about the stressors that influence university personnel can inform strategic interventions required to alleviate distress for each employment category.

Quality and performance form another close linkage. The following four articles deal with a variety of performance issues.

Perceiving a gap in research on the importance of the relationship of goal orientation to the predictability of academic performance in adult distance education**, Neroni, Meijs, Leontjevas, Kirschner,** and **De Groot** investigated the relationship between goal orientation and academic performance in adult distance learners at an open university in the Netherlands. A mixed model regression showed performance approach goal orientation to be a positive predictor of academic performance, whereas performance avoidance and work avoidance were negative predictors of academic performance. Implications of these results are discussed.

Sun, Lin, and **Chou** were also concerned with online learners' performance. Their study classified 160 graduate students into three group types: low reading duration with low motivation, low reading duration with high motivation, and high reading duration based on a second-order cluster analysis. After performing a sequential analysis, this study reveals that highly motivated students exhibited a relatively serious reading pattern in a multi-tasking learning environment, and that online reading duration was a significant indicator of motivation in taking an online course.

Skordaki and **Bainbridge** present the results of a research study on the reliable application of scientific software training in blended learning environments. A key issue in current literature is the requirement for a theory-substantiated training framework that will support knowledge-sharing among scientific software users. Following a grounded theory research design in a qualitative methodology, researchers report that the study's findings indicate the importance of three key themes in designing training methods for successful application of scientific software: (a) responsibility in comprehension*;* (b) discipline; and (c) ability to adapt.

Ali and **Arshad** proposed that m-learning will continue to have a massive role in the development in teaching and learning and that learners' desire to use this technology is the main factor that will eventually lead to successful implementation of m-learning. To explore this contention, they developed a research model that included the unified theory of acceptance and use of technology (UTAUT) as well as learners' autonomy (LA) and content quality design (CQD). Significant results and the limitations of the findings are discussed along with areas of possible future research in this area.

IRRODL is always happy to accept shorter articles that fall into the category of "Notes" and book reviews. For more information on our various formats, please access the detailed information on the Online Submissions page, which not only describes these formats but also provides advice on submissions, formatting, and other important academic matters. We encourage potential authors to familiarize yourselves with IRRODL's requirements. While we are delighted to be constantly overwhelmed by huge numbers of submissions – as evidenced by the number of issues published each year – the workload is also huge. You can expedite your journey to publication as much as possible by submitting neat and accurate manuscripts that adhere to our standards.

On that note, we have in this issue two notes. The first is a field note from **Petrovic-Dzerdz** and **Trépanier.** With the notion of "online hunting and gathering" captured in an intriguing title, the authors suggest that the "individualization of learning," which can result in a very solitary and isolated endeavour, does not have to be the case. They provide an example of a successful online course with carefully crafted online instructional design strategies that contribute to a flexible and rich experiential learning environment thus permitting learners and teachers to remain closely interconnected, engaged, and accountable for both individual and group success in knowledge "hunting, gathering, and sharing" activities.

Shea and **Bidjerano** present the second note, a research note that also deals with issues of learner performance. Their state-wide study was based in SUNY's 30 community colleges where they sought to find if there was a "tipping point" at which online course loads becomes problematic for community college learners seeking to attain a degree through a mix of online and face-to-face coursework. Results indicated that community college students who take more than 40% of their courses online begin to lose the benefits of enhanced degree completion conferred through a mix of online and face-to-face enrollment. Variables are discussed.

That concludes the Spring 2018 issue 19(2)! We have three more 2018 issues on-the-go! We appreciate your support and wish you pleasant and informative reading.

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Free Digital Learning for Inclusion of Migrants and Refugees in Europe: A Qualitative Analysis of Three Types of Learning Purposes

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Abstract

The increasing number of migrants and refugees arriving in Europe places new demands on European education systems. In this context, the role that free digital learning (FDL) could play in fostering inclusion has attracted renewed interest. While the existing literature highlights some general design principles for developing FDL for migrants and refugees, there is little information on the use of FDL at specific education levels, or for specific learning purposes. This paper presents the results of a qualitative study that was carried out as part of the Moocs4Inclusion project of the Joint Research Centre (JRC) between July and December 2016. The study, which has a European focus, disaggregates the analysis of FDL initiatives by what were identified as its three most common purposes: a) language learning, b) civic integration and employment, and c) higher education. For each of these topics, the study sheds light on the approaches used by a wide sample of initiatives, users' levels of awareness of what is available and take up, and migrants' and refugees' perceptions of the current offer. In order to collect the information needed to cover different approaches and perspectives, semi-structured interviews with 24 representatives of 10 FDL initiatives and four focus groups with 39 migrants and refugees were carried out. The results show that there are indeed overlaps between the purposes of FDL initiatives and their design principles. Specific recommendations on how to better design FDL initiatives for migrants and refugees, taking into account their specific purposes, have also been identified.

Keywords: free digital learning, MOOCs, open education, migrants, refugees, Europe, higher education, language learning, civic integration, employment

Introduction

European countries are being asked to support the integration of third-country migrants (non-EU nationals) much more than they did in the past. In 2015, the number of asylum applications in Europe reached 1.3 million, three times what it was in 2013 and twice what it was in 2014. These numbers have diminished somewhat recently, due to increased control imposed by the EU Member States. According to Eurostat, the number of first-time asylum applicants decreased by 51% in the fourth quarter of 2016 compared with the same quarter of 2015 and by 43% compared with the third quarter of 2016 (Eurostat, 2017). However, the question of how to provide knowledge, information, and education that can support the integration of those who are arriving or are already in Europe, remains a glaring priority.

In 2015, 10.1% of the individuals born in the EU were not in education, employment, or training. This figure was 19.8% for individuals between 15 and 29 years old who were not born in the EU but were living in it (Eurostat, 2016). In addition, young (18-24) non-EU citizens are at greater risk of becoming school dropouts than young EU citizens (Eurostat, 2016). On the other hand, adult migrants seem to participate more in less formal types of education: individuals between 25-54 years old, born outside of the EU, tend to participate more in lifelong learning activities than individuals of the same age living in the EU Member State they were born in (Eurostat, 2016). Only 50% of refugees worldwide have access to primary education, compared with an overall access level of more than 90%, and only 1% of refugees are enrolled in higher education (HE; The United Nations High Commissioner for Refugees [UNHCR] 2016). Information on refugee enrolment in formal education at EU level is patchy; though the situation may be better than the one reflected by UN figures (which primarily refer to refugees in camps outside Europe), there are huge challenges to ensure the integration of the very diverse migrant population. For example, according to an NGO study, refugee children remain out of school for 1.5 years on average after arriving in Greece, a country receiving high numbers of refugees (Save the Children, 2017).

Various studies have found that learning is critical for migrant inclusion (Schneeweis, 2011; Nonchev & Targarov, 2012; Organisation for Economic Co-operation and Development (OECD), 2015; De Paola & Brunello, 2016). Subsequently, the importance of providing education for migrants and refugees has been recognised by governments and national and international organisations. A document accompanying the New Skills Agenda for Europe recognises the need for adequate migrant and refugee education. This document states that “besides meeting refugees" most urgent needs, such as accommodation and food, there is a need to help improve their long-term situation, including by helping them to quickly improve their skills in the language of their host countries, in order to integrate into society, and to find employment” (European Commission, 2016a, p. 17). This vision goes beyond access to formal education, and recognition of prior learning, and also recognises the importance of less formal types of education.

In this context, the role that digital learning could play in widening access to education, developing the skills and knowledge needed by migrants and refugees in host countries (and further afield), and in fostering inclusion has attracted renewed interest. Digital means are seen as cost-effective and flexible solutions that could be scaled up to provide learning opportunities to migrants and refugees. The UNHCR (2016), for example, is increasingly considering e-learning to be an important way to bring flexible learning to refugees, particularly in refugee camps. It also recognises that the use of technology and the internet is not restricted to tertiary education and is useful for developing skills

and competences that can be immediately useful in the host country. Along the same lines, the European Commission specifically mentions the use of technological advancements, such as the internet, smartphones, and interactive learning, as valuable tools to make integration and learning easier in its 2016 Communication *Lives in Dignity: From Aid-Dependence to Self-Reliance* (European Commission, 2016b). In parallel, a plethora of initiatives are flourishing, both bottom-up and government/donor supported, and engaging different stakeholders (see Moocs4Inclusion homepage for an overview of initiatives in Europe).

However, despite digital learning's potential, research has found that the use of some types of digital learning, such as Massive Open Online Courses (MOOCs), by vulnerable groups (including migrants and refugees) and less educated individuals, is lower than expected Liyanagunawardena, Adams, & Williams, 2013; Glass, Shiokawa-Baklan, & Saltarelli, 2016). When it comes to the use of digital learning by economically underprivileged populations, the existence of cost-free materials, courses, and learning opportunities for learners is extremely important (Lewis & Thacker, 2016). But the fact that an online learning resource is free is not enough: instructional design principles and support services play an important role

Key Design Principles for FDL for Migrants and Refugees

The use of free digital learning, specifically for migrant and refugee education, is a new field and there is little research that assesses its take-up and impact. There are, however, some academic reports that provide design and delivery principles for digital learning content targeted at this population.

Guided instruction: Self-directed learning and digital skills are recognised as two important components for participation in digital learning (Song & Hill, 2007; Jansen, Janssen, Kester, & Kalz, 2017; Castaño Muñoz, Kreijns Kalz, & Punie, 2017). However, literature signals that migrants and refugees may require additional guidance in the usage of digital learning sources, due to the fact that certain cultural learning traditions and skills may differ from the traditional online learner, and their stressful situation might impede their learning. Mason and Buchmann (2016) suggest that an outreach plan and support structures (vs self-learning) are essential when targeting migrants and refugees with FDL initiatives. Colucci et al. (2017) show that migrants and refugees prefer approaches which are tailored to their specific needs and characteristics, and include support mechanisms. These approaches are also in line with the UNHCR's recommendations for delivering education in crisis and conflict situations (UNHCR, 2016). Finally, Lewis and Thacker (2016) signal the usefulness of technology, not only for developing learners' skills, but also for promoting support structures to guided-learning, for example using ICT for teacher training or helping relief organisations.

Personalized learning: Personalized learning, as a type of instruction focused on meeting students' individual learning needs and preferences, has been signalled as promising strategy for increasing academic performance (Pane, Steiner, Baird, Hamilton, & Pane, 2017). Migrants and refugee learners are a more heterogeneous target group than traditional learners and several studies highlight the importance of understanding their learning needs and capabilities (De Waard et al., 2014; Lewis & Thacker, 2016). Mason and Buchmann (2016) identify various factors that affect learning initiatives in the context of the refugee crisis, which have to be taken into consideration when designing digital learning for refugees. These factors include the number of refugees, their different backgrounds, their previous education, where they are located, their literacy and language skills, whether their studies were interrupted, and any traumatic experiences they may have had. From an "education in emergencies" perspective, Moser-Mercer (2014) also argues that in higher education it is important to

tailor learning activities to the needs of the concrete target audience, taking into account their existing skills, the learning environment and their learning culture. The same authors (Moser-Mercer, Hayba, & Goldsmith, 2016) conclude that "human-centred" design is central to both pedagogical and technological development in fragile contexts and that ideally learning should be designed following a bottom-up approach that involves the learners.

Blended learning contexts. Social networks are valuable tools for finding and sharing resources, and facilitate migrants' participation in the society (Poros, 2008), labour market (Kahanec & Mendola, 2007), and education (Calvó-Armengol Patacchini, & Zenou, 2008) of the host-country. However, while 100% online learning can be a useful way to transmit knowledge, it is less clear if it is appropriate for developing contact and personal connections, especially when it comes to large courses such as MOOCs (Toven-Lindset, Rhoads & Lozan, 2015) Consequently, despite the possibilities of online interaction (Castaño-Muñoz, Duart, & Sancho-Vinuesa, 2013), migrants and refugees may need more face-to-face contact than traditional students. Moreover, face-to-face learning may be useful to build a higher sense of community, which is associated to higher satisfaction with and persistence in online learning (Rovai, 2002).

Blended learning is considered a cost-effective delivery mode for education (Escueta, Quan, Nickow , & Orepoulos, 2017) that may benefit from the best of the online and face-to-face learning. Literature recognises peers and teachers as components of the personal network of migrants and refugees, and recommends that digital learning for these groups should accompany and supplement but not replace on-site interaction, support, or tutoring. Mason and Buchmann (2016) affirm that while standalone digital offers, like MOOC platforms or other online courses, are valuable resources, they rarely reach and enable migrant and refugee learners as such. UNHCR (2016), Dahya (2016), Lewis and Thacker (2016), and Colucci et al. (2017), also argue for blended learning approaches. These studies consider that digital resources should not (and cannot) replace face-to-face teaching, especially if the former does not ensure formal and reliable certification that may help to the transition into the labour market or formal education.

Objective

Most of the papers and reports quoted above deal with general design principles for digital learning initiatives for migrants and refugees. Some have focused specifically on conflict situations and refugee education in camps, for example. However, few of them have differentiated between specific types of digital learning for specific education levels or for specific learning purposes. In order to contribute new knowledge, we conducted a qualitative study of migrants/refugee learners and FDL providers, where we disaggregated the analysis according to three primary purposes. These purposes had been previously identified as those for which the development of FDL initiatives and resources for integration, and inclusion of migrants and refugees had been most intensive (Colucci et al., 2017): obtaining a higher education degree, language learning, and civic integration and employment.

We purposely excluded from the analysis digital learning that requires payment by learners. For the purposes of this study, we focused on free digital learning (FDL) defined as follows:

> all learning activities (formal – leading to a degree or certification, informal and non-formal) at all education levels, undertaken with the support of ICT tools (e.g. computers, tablets, mobile phones, apps, used online or offline) at no (or very low) cost to the learner, barring potential additional costs for validating or certifying the learning or other extra services. This

> would include online courses such as MOOCs, offered in a stand-alone manner or in the context of a targeted migrant/refugee learning initiative, online or downloaded language courses, apps that provide learning opportunities, digital games with an explicit learning purposes and other online learning content directed at migrant/refugee inclusion and integration in their host societies and future job markets. (Colucci et al., 2017, p. 10)

The aim of the study is to highlight transversal approaches, problems, and success factors' but also identify the specificities for each type of learning purpose under analysis. For this, the guiding research questions are as follows:

- RQ1: What are the approaches taken by various FDL initiatives for migrants and refugee in Europe? Do they vary by learning purpose?
- RQ2: What are the current awareness and take-up of current FDL initiatives by migrants and refugees in Europe? Does it vary by learning purpose?
- RQ3: What are the learners' perceptions of the effectiveness of current FDL initiatives aimed to migrants and refugees in Europe? Do they vary by learning purpose?

Methods

The data for this paper comes from the Moocs4Inclusion project conducted in the second half of 2016 (Colucci et al., 2017). The Moocs4Inclusion project used a combination of research methods: literature review, compiling a catalogue of FDL initiatives (http://moocs4inclusion.org/index.php/catalogue) for migrants and refugees, and qualitative techniques (interviews with providers of FDL and focus groups of migrants and refugees). The use of qualitative techniques was based on a constructivist paradigm, which was considered adequate due to the novelty of the topic and the fact that our aim was to understand the meaning that different groups (migrants, refugees, and FDL providers) ascribe to FDL. Moreover, our research intended to have a transformative nature rather than build a new theory; it aims to generate knowledge that could be used to better adapt different types of FDL to the current needs and preferences of the learners.

This paper presents a refined analysis of the primary qualitative data collected during the project, notably from the interviews and focus groups. In order to give a more comprehensive view of the phenomenon under study, the qualitative part of study brought together the perspective of learners and the perspective of those designing and managing FDL initiatives. Information from the initiatives was especially useful for responding RQ1 and RQ2 and information from the learners for RQ2 and RQ3. The analysis is complemented with results from a literature review and the catalogue of initiatives which provide useful information to respond to RQ1.

The inclusion of a variety and diversity of learners and initiatives in the research allowed us to analyse the data in a disaggregated way. This approximation allowed us to obtain a panoramic vision of the perceptions and use of FDL by migrants and refugees in Europe for different purposes, as well as the opportunities for FDL outlined by providers and its approaches.

Understanding the Use of FDL Through Users' Perspectives: Focus Groups

In order to introduce the perspectives of potential FDL learners, four focus groups, involving in total 39 individuals, were conducted in between August and October 2016 in four different countries. All participants gave their informed consent previously to their participation in the focus group interviews. The focus groups all had different profile: Sweden focused on newly-arrived refugees who were still in a reception camp, Cyprus focused on migrants and refugees who had been in the country typically over five years, Belgium focused on migrants who were participating in an obligatory Belgian integration course, and Germany focused on newly-arrived refugees with higher education backgrounds. The choice of location for the focus groups was based on an assessment of the critical mass of migrant/refugees in the countries, the different immigration policies the countries may employ, and the relative geographic and linguistic diversity. One group was dedicated to higher education due to the many current initiatives in this field found by the literature review.

The 39 refugees and migrants who participated in the focus groups came from nine different countries: Afghanistan, Bangladesh, Ghana, India, Iran, Morocco, Palestine, Somalia, and Syria, and were between 19 and 55 years old. Twenty-four of them had been enrolled in higher education in their home countries and 18 had a 3-year or longer academic degree. None of the participants in the focus groups had been in refugee camps outside Europe. In the Swedish and the German focus groups, all participants (17 in total - three females) were refugees. The Cyprian and Belgium groups were mixed: 12 participants (11 females) were migrants (as opposed to those with refugee status). The refugees who participated were predominantly male, in their 20s, and had a tertiary education background, whereas the migrants who participated were largely women, over 30, with no tertiary education.

The focus groups were semi-structured. Questions about awareness, level of use of FDL, and perceptions (perceived barriers, advantages and disadvantages, and priorities in terms of learning purposes) were included (See Appendix A). In order to guarantee validity and reliability, the topics and questions were discussed by experts on ICT in education and migration studies, which were part of the research consortium. The groups used Arabic, English, and/or the local host country language. In the interests of encouraging the participants to be open and uninhibited, discussions were not recorded but notes were taken. So as to guarantee adequacy and reduce possible bias, notes were taken by two different persons in each focus group and triangulated in the codification done after the focus group.

Understanding the Use of FDL Through Providers Perspectives: Semi-Structured Interviews

In order to supplement the perspectives of learners/beneficiaries with those of the designers, developers, and managers of FDL initiatives, telephone interviews were held with representatives from 10 different FDL initiatives, including CEOs, founders, partners, and those in charge of business development, academic/content development, and research. The interviews were semi-structured and included guiding questions about their philosophy and creation, approach, the challenges they face, their business models, and the advice that the interviewees would give to others in the field (See Appendix B). In the same way as for the focus groups, informed consent was provided by interviewees, the questions were internally validated by experts and, although not recorded, notes were taken by two different members of the research team and triangulated in the codification phase.

The chosen initiatives were: Edraak, Funzi, Information Sweden, InZone, Jamiya Project, KIRON Open Higher Education, Language, Academic Skills and E-learning Resources (LASER), Meeting the

Health Literacy Needs of Immigrant Population (MEET), Ready for Study, and Welcomm!. The initiatives vary in how long they had been running, nature, type of FDL employed, approach, business model, and target group within the refugee/migrant population. It should be noted that the majority targeted higher education, which reflects a current focus in this sector. Six initiatives specifically target higher education students and/or students in refugee camps (Edraak, InZone, Jamiya, Kiron, LASER, and Ready for Study), and four target adults, notably for civic integration and language learning (Information Sweden, MEET, WELCOMM!, and Funzi). Funzi, providing mobile learning, aims to provide mobile learning for civic integration and employment, while the Information Sweden initiative is a stand-alone platform which aggregates FDL resources for civic integration and language training. Two initiatives (MEET, WELCOMM!) have piloted FDL resources (including training on how to use them), which are now available as Open Educational Resources for reuse in other contexts.

The selection demonstrated the variety and richness of the chosen initiatives, which, together with complementary data from the catalogue of initiatives, allowed us to obtain information about the approaches they take, their development trajectory, and how they work with and assess potential migrant refugee learners and their needs.

Analysis

Thematic analysis was used for the data analysis. The data obtained through interviews with the FDL initiative representatives and focus groups was categorized in three broad topics that reflect our research question:

- Offer and Approaches: Quantity, types, and strategies developed by initiatives in order to effectively deliver FDL.
- Awareness and Take up: Understanding and degree of knowledge about FDL by migrants and refugees.
- Perception by Migrants and Refugees: How learners/potential learners perceive the potential of FDL for inclusion, integration, and further learning.

Following a semi-structured approach, we combined a top-down approximation with a bottom-up one. Although some sub-topics were defined by the research team (e.g., perception of barriers, advantages, and disadvantages), the analysis tried to capture the vision of the interviewees and participants in the focus groups in an open way. Consequently, sometimes different and not comparable sub-areas of interest emerged for each of the three types of FDL analysed. The section below summarizes the main results of the analysis and serves as a summary for the topics that emerged.

Results

Technical Issues

An important precondition for the up-take of FDL resources is that they can be accessed and used anywhere (Moser-Mercer, 2014). Migrant, refugees, and providers confirmed that a stable Internet connection is a natural priority for participating in FDL, but it is not always guaranteed in the case of migrants and refugees, especially when they are in transition phases or refugee camps. As a consequence, the possibility of implementing of mechanisms of circumventing connectivity issues, (for example, FDL provision offline and m-learning, and the use of simple graphic designs, no-frills apps, and applications that can work with low bandwidth) were highly recommended and valued by learners.

Understanding of FDL and Take-Up

In general, the focus group interviews indicated that migrants and refugees lack general information on, and awareness of, what FDL are being offered. In addition, in all four focus groups (but especially the ones in Sweden, Brussels, and Nicosia), there was an initial reluctance to understand and embrace FDL, which could be partly due to unfamiliarity with digital learning, or to the fact that FDL offers may not be provided in their first language. However, as the focus group interviewed progressed, a broader understanding of the concept emerged, the participants began to reflect on how FDL, and how more generally flexible educational provision, could support inclusion and integration. A participant in the Berlin focus group stated this as follows, "as (a) student in an online education program or course, you have more authority and you can be more active. The flexibility to repeat and access the educational material is positive."

Social media was the most well-known, best understood, and most frequently used FDL channel by refugees, particularly the different Facebook groups that target refugees at different stages of their migration process. Facebook and other social media groups are not strictly within the definition of FDL used for Moocs4Inclusion project, but were considered by the participants as an important resource.

FDL Purposes

While Moocs4Inclusion project attempts to generally categorize the FDL initiatives identified through the project into different learning purposes, some FDLs overlap and have double purposes. For example, it was found that initiatives for language learning often co-target civic integration and vice-versa. Civic and integration and employment-related initiatives were also found to be often directly connected, even though some employment-related initiatives are more like job portals and offer transversal skills for employment while civic integration initiatives help migrants and refugees with administrative and legal hurdles when they arrive in a country.

Our analysis indicates that there are more similarities than differences between the purposes of FDL initiatives, irrespective of the target group. The following sections summarises some of the specific issues related to the three different purposes for FDL for refugees and migrants, as identified by this study.

FDL for Language Learning

Offer and approaches**.** Language-related FDL tends to have a dual focus on language skills for migrants as an introduction to living in the host society, and on civic integration (Information

Sweden, Welcomm!, and MEET). It can also provide a pre-qualification for participating in higher education (Ready for Study, LASER).

Compared with the two other fields, there is abundance of resources for FDL language learning and of media. The existence of many current FDL initiatives in this field, as well as digital materials that can be reused and/or adapted, has been identified as an opportunity. In first instance, learners can participate in this kind of learning more easily because of the availability of mobile phones (although not always necessary to have an internet connection) and a plethora of translation apps, other commercial mobile apps (such as Duolingo or Babbel), or educational videos (e.g., YouTube). In addition, providers can use or readapt many Open Educational Resources (OER), MOOCs, and university language courses to provide free digital language learning for migrants and refugees.

Besides using translators, commercial mobile applications, and re-appropriating online language courses, providers are also experimenting with more innovative approaches. One approach to free digital language learning is the creation of innovative learning materials that can be used online, off-line, or in face-to-face classes. For example, Welcomm! aims to encourage migrant children and families to learn a language by creating learning materials linked to their own world – family, kids games, sports, arts, etc. – and by promoting non-formal learning. MEET is another example of an EU project that provides innovative digital resources, in this case to teach health vocabulary.

A first step of integration for migrants and refugees is to learn their host country's language in order to be able to participate, not only in society and the labour market, but also in other digital or face-to-face learning activities. Upon arrival, many migrants and refugees are not able to understand or speak the local language or English. In order to address this problem, several initiatives are offering a Content and Language Integrated Learning (CLIL) approach (Coyle, 2007) that facilitates language learning through the acquisition of relevant content that can enhance (e.g., civic integration, employability, or higher education).

In higher education, some initiatives have incorporated language learning programmes either as a parallel track or added service, or as integral to the higher education offer. Some use and promote the plethora of existing language apps. Others develop their own language services in a blended learning model. Kiron has developed a Language School that offers students a selection of online and offline courses. ReadyforStudy, uses the CLIL approach and builds on the MOOC concept. It targets refugee students who want to apply to German universities and combines language learning with social and practical competencies regarding accessing and succeeding in the German HE system. LASER, an initiative that targets displaced students in Jordan, Syria, and Lebanon, takes a three-pronged blended learning approach: face-to-face language courses facilitated online, access to accredited higher education distance learning through the Open University and Amity University, and language and academic skills training delivered in Syria by a partner organisation (SPARK). This varied offer caters for the needs of different refugees in different settings, and is also directly linked to eventually accessing higher education degrees.

Awareness and take up: Despite the general lack of knowledge about FDL, among the refugees (as opposed to the migrants present in the groups), language apps were well-known and were found particularly useful for translation. The use of other language apps (targeted towards refugees and including language tests) varied greatly; no clear pattern was discernible except that they were used more frequently by younger refugees with a tertiary degree. Participants in focus groups were

generally reluctant to pay for advanced versions of language apps. When these functionalities are not for free, they may be underused by migrants and refugees.

Migrants' and refugees' perceptions: All the refugees and migrants who participated in focus groups agreed that their top priority was to learn the language of the host country and/or learn or improve their knowledge of English. This priority was further accentuated in relation to (civic) integration/inclusion, employment, and further education - especially for the younger refugees. In general, language was considered to be a means of overcoming the challenges that the practicalities of life in a new country pose.

FDL for language learning was also perceived as a way of starting to learn the local language before arriving in the host country (e.g., while refugees are in camps, fleeing, waiting for asylum, or while future migrants are still in their countries of origin). The participants in the focus groups found that they needed to start language learning as early as possible and while still applying for asylum.

FDL that is used in a blended learning approach was generally more valued. The focus groups made it clear that language FDL is ideally a complement to practicing the new language with other individuals. The participants found that face-to-face teaching yields better outcomes than stand-alone online language training. They also valued engaging with other students, learning from others' oral mistakes, and being physically present in a classroom environment. That said, they found that FDL resources (through mobile apps) offer a readily available tool that can enhance their vocabulary base and reinforce the basics of grammar. It was stated by a participant in the Swedish focus group as follows:

> We can learn from apps, but we need contact to real people. We can learn the grammar, but we need to learn how to string sentences together. We have to talk to real people for us to be integrated into "real life."

FDL for Civic Integration and Employment

Offer and approaches: FDL initiatives that aim to enhance the civic integration and employment for refugees and migrants use diverse technologies: platforms (Information Sweden), apps, YouTube, videos, mobile learning (Funzi), and online tool kits/learning resources (MEET). They can be stand-alone or supplement face-to-face skills training. They can serve as information/reference points, be a way of testing or presenting existing knowledge, or certifying the knowledge acquired. The knowledge provided through these initiatives typically covers civic rights, legal knowledge for asylum seekers, housing, health insurance, education, etc., but also "softer" information on how to meet locals, how to apply for employment, and what different employment sectors demand from employees. Other FDL initiatives provide information on the history and the culture of the host country and can also be utilised in face-to-face integration courses.

These initiatives often have elements of the CLIL approach (see FDL languages) and do not generally lead to certification. However, there is one exception among the initiatives studied: Funzi, which uses mobile learning as its platform and is easily adaptable when it comes to content, currently provides civic integration training and information to refugees in the Nordic countries. It also collaborates with local partners, primarily in Africa and Asia, to deliver short skills courses for employment. The latter type of FDL has a clearly (non-formal) educational scope and can provide certification (badge) for a fee, often paid by an employer at this stage.

Another example of a platform that targets civic integration is Information Sweden, which aggregates a host of different FDL initiatives in nine different languages, quality assures the content, and provides a wider selection of FDL for civic integration, employment, and language training.

Awareness and take up: The focus group participants generally had little knowledge and understanding of FDL for civic integration and employment, except for the refugees with higher education experience in the Berlin group. Here, all the group participants used social media and Facebook groups that provide information relevant to their situation and the country that they are in. Others pointed to LinkedIn. While this is not strictly within the definition of an FDL, it can be seen as providing peer-learning, and as an important platform for FDL initiatives with a civic integration/employability purpose to reach their target group.

Perception by migrants and refugees: Focus group participants were least aware of FDL for civic integration and employment and therefore generally found this type of training difficult to relate to. When asked how they would integrate, focus group participants pointed out that a digital tool cannot, in itself, provide social integration or contact with an employer. As such, these tools were considered "exclusionary" rather than "inclusionary." As with learning a language, participants in the focus groups generally agreed that it is necessary to meet physically (with locals, employers, officials, or other refugees and migrants) in order to exchange experiences and ask questions when they had difficulty understanding certain concepts or regulations that could affect their inclusion and settlement. Meeting face-to-face was also perceived as a chance to establish a social network. Thus, they made the case for FDL for civic integration, in particular, to be part of a blended learning activity. Regarding employment, the participants stressed their need to create new networks, though they valued the apps and platforms. Refugees in Berlin brought up the example of the German App *SINGA*, which matches German volunteers with individual refugees as "friends or mentors." These volunteers can then, if necessary, guide and help the refugee towards civic integration. Other examples are apps developed by refugees for refugees that can be defined as train-the-trainers/ "peer-education" models, where refugees and migrants can use FDL for teaching each other in the community. Finally, in many cases, the certification from online courses was perceived as less useful in the labour market, though none of the participants had experience with this: "traditional education certificates are still more likely to guarantee obtaining the job."

FDL for Higher Education

Offer and approaches. Most of the new comprehensive FDL initiatives (as opposed to apps or individual FDL resources) are for formal education/degree purposes, most specifically higher education. Most of the larger scale FDL initiatives for migrants/refugees identified through the Moocs4Inclusion project have taken place in this area (six out of the 10 initiatives studied focused on higher education, including Kiron, Jamiya, Edraak, InZone, LASER, and Ready for Study).

In terms of content, initiatives vary between developing new content (like Jamiya, which delivers original MOOCs in Arabic, based on existing university courses) and re-purposing digital/online course content through cooperation with universities and MOOC platforms (Kiron). The cost implications of these different approaches are being closely studied, especially as many initiatives are donor-driven or crowd-funded and are struggling with their present cost models. In general, blended and facilitated models cost more, though it is agreed that they have more impact.

The HE initiative representatives interviewed concurred that it was essential to provide higher education opportunities to migrants/refugees, in order to a) enable them to work and integrate into their host societies, and b) to ensure that their skills and qualifications remain relevant, should they be able to return to their home countries. However, diverse approaches were being employed in this sector. All the initiatives were in the process of re-conceiving and developing different models for FDL in higher education that could be scaled up to reach a greater number of refugees in camps, in neighbouring countries, and in further host countries. All professed to be experimenting with these models and to be continuously receiving feedback from their students and the partners that they work with. Most participated in collaborative models made up of HE providers, ICT developers and tech start-ups, social workers (particularly in the camp context), local and federal government funders, other international organisations and, most importantly, the students themselves.

Several initiatives aim to help students with the transition from their "displaced" status into the formal higher education sector. Though the refugees are perceived as ordinary students, they are also seen as vulnerable and thus they have a need for more time, student support services, mentors, and knowledge about studying in a new and (unfamiliar) environment. As a result, the HE initiatives prefer the blended and facilitated approach. Kiron, for example, offers a 2-year online course to refugees (including those that do not yet have their formal paperwork in order or proof of prior learning), followed by entry into a partner university to complete the degree in situ. InZone combines on-site and virtual learning with support and mentoring in refugee camps outside Europe.

The research also demonstrated that European universities are interested in enrolling and engaging with refugees. Some see the recent refugee crisis as an opportunity for internationalising their campuses (the University of Oslo, for example, is leading a new EU project called *Academic Refugee* and has opened its language learning resources internationally to refugees). According to representatives of Kiron and Jamiya, many universities are keen to collaborate with FDL initiatives for refugees, though they confess that resources for developing FDL, and specifically MOOCs, are still lacking. In addition, problems regarding recognition of FDL studies remain. In this respect, there is a strong movement towards utilising Bologna Tools (ECTS, learning agreements) for FDL course content and seeking accreditation in respective European education systems. InZone, Kiron, LASER and Jamiya are committed to working with ECTS, for example, and Kiron and InZone in particular, employs learning agreements with universities for the recognition of FDL as prior learning up to the amount of 60 ECTS.

A transversal concern with regards to the accessibility of higher education FDL for migrants and refugees is the language of delivery of the FDL offer. Most of the higher education initiatives studied are incorporating language support into their offer. Jamiya and Edraak have based their offer on the premise that more high quality FDL is needed in Arabic: "There is a scarcity of Arabic learning content online and this is a huge challenge; Less than 3% of digital content globally is in Arabic and this 3% is debatable in terms of quality." Jamiya believes that by using Arab scholars to teach most of the course in Arabic, Syrian students will benefit from culturally sensitive teaching, adapted to and applicable in a European context. FDL in Arabic/native languages are thus an important component of the general FDL panorama.

Awareness and take up. Several of the representatives of initiatives interviewed stressed that the take up of FDL was generally greater by migrants/refugees with higher education, due to higher digital literacy and general motivation to learn, who needed to continue interrupted higher education studies

and/or upgrade their existing qualifications. That said, higher education was deemed to be secondary to language learning and civic integration, which were (or had been) transversal needs for all refugees/migrants that participated in focus groups.

Perception by migrants and refugees. Blended learning approaches with support structures seemed to be unanimously preferred for higher education delivery, for many of the reasons that these are also preferred for civic integration and language learning. These approaches are often delivered in partnership with established higher education institutions (HEI).

Obtaining credits and eventually a recognised, accredited degree, is considered both a desired outcome and a challenge for these initiatives: in words of a participant in our research "Bologna Process tools are absolutely useful in the FDL context." This is an additional motive for working with existing higher education institutions. Kiron works closely with partner universities that have committed to recognizing modules from the MOOC-based courses that the students take online. Jamiya has worked with the University of Gothenburg to adapt existing programmes, deliver them in Arabic and subsequently gain recognition in the Swedish system. InZone is backed by the University of Geneva, and provides certification through the university.

Discussion and Conclusions

The analysis presented above was based on information from focus groups with 39 refugees and migrants and interviews with 24 representatives from 10 different FDL initiatives. When disaggregating available FDL by learning purpose, we found that there are not many differences regarding the basic principles, though some specificities can be found. Although our analysis is not based on a comprehensive sample of initiatives for migrant and refugees in all situations, a wide range was covered (and collected in the catalogue from which this current sample was collected). Thus, some conclusions and recommendations for developing and exploiting FDL in Europe can be derived from the research. It should be noted that the field is a moving target, as more initiatives and FDL resources are emerging almost daily, and more studies are being commissioned to assess the potential of FDL for users.

Transversal Conclusions and Recommendations

The results of the interviews with representatives from the initiatives and the focus groups with migrants and refugees confirm the results from previous literature (De Waard et al., 2014; Lewis & Thacker, 2016; Mason & Buchmann, 2016): the use of a personalized and guided pedagogical approach is one of the main success factors. FDL as teaching material for migrant or refugee education can be an adequate tool, if a context and culturally-sensitive approach is used. Migrant/refugee learners are a fragile target group with needs that go beyond simply providing learning content and information. All focus groups participants, irrespective of age or of the type of FDL in question, agreed that face-to-face contact in the learning process would be ideal, and saw FDL as a (potential) compliment. One hundred percent of online learning is considered exclusionary since is does not allow refugees and migrants to build social networks via face to face contacts with local people or others in similar situations. A blended and guided format with facilitators, mentors, student support, and career services was considered important for the success of the FDL. This is especially true for those FDL that aim to achieve civic integration or access to higher education. Adaptive learning technologies aim to customize content and learners' paths (Somyürek, 2015) and evidence

shows that these approaches could contribute to better outcomes (Escueta, Quan, Nickow & Orepoulos, 2017). All in all, research indicates that guided and personalized approaches that respond to specific cultural/context sensitivities, and mix face-to-face with digital learning are adequate for the success of FDL for migrants and refugees.

Refugees and migrants generally are not familiar with FDL that targets them directly as a group. However, the majority of refugees and migrants are familiar with using a mobile phone, translation applications, and social media. The group that is most familiar with FDL is that of young refugees with a higher education degree or part of a degree. In addition, when FDL is explained to migrants and refugees, they seem to value the flexibility of learning that it offers. The possibility of FDL to target individuals who are not able to access other types of education due to lack of formal documentation of prior learning, low availability of education or regulatory barriers for entry is considered a strength. It was also suggested that FDL offers should be promoted to migrants and refugees before they arrive in their host country, so as the facilitate uptake upon arrival. A clear strategy for communicating FDL initiatives to learners, funders, partners, and the general public is critical for awareness rising. Consistent with previous literature (Reichel, Siegel, Andreo, Carrettero Gomez, & Centeno Mediavilla, 2015), our results show that the use of social media is high among migrants and refugees and hence it could be a good instrument for both promoting FDL offers and also surveying the needs of the changing migrant/refugee learning population.

Specific Conclusions and Recommendations

FDL that aims to provide or facilitate access to higher education has some specific characteristics. First, it was found to be very important to assess the prior language and academic knowledge of learners. This was regarded as important for ensuring the students' success. Secondly, although accreditation and certification is a key issue for nearly all learners and FDL initiatives (with the exception of the more informal types of learning for civic integration and employment), it is particularly important for higher education students. Therefore, the use of the Bologna Process architecture (recognition, quality assurance, and qualification frameworks) and transparency tools (learning agreements, learning outcomes, and ECTS) are considered helpful by initiative designers when it comes to the recognition of FDL initiatives and in aligning them to the labour market and the European Higher Education Area (EHEA).

Language is considered a transversal success factor in education (EURYDICE, 2009; Rangvid, 2007), which has also been found to be true for FDL. Language learning was a transversal component of all the initiatives studied, whether as an objective in itself, a means for employment or civic integration or as a compliment/added service in obtaining a HE degree. The provision of FDL for language learning was found to depend very much on, a) the location of the target group, and b) the purpose of the training. While language apps and google translate are the more popular FDL tools among migrants and refugees, they are seen more as a compliment to face-to-face and/or facilitated language learning, which is considered more desirable.

Finally, regarding the use of FDL for civic integration and employment, it is worth highlighting that the recognition of FDL by employers is a key issue (Witthaus et al., 2016) and according to the participants in the focus groups, it may have an impact on the employability of migrants and refugees. According to the perception of the FDL providers and learners, the use of recognition systems that are accepted by employers, and ideally developed in partnership with them, could be a valuable solution and facilitate the uptake of FDL by migrants and refugees.

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Appendix A

Focus Groups Common Guide

- In your country of origin context, is it common to take part in digital learning? Are you familiar with Digital learning?
- Do you think (free) digital learning can help you prepare for your integration, future employment, language/cultural preparation, keeping up your skills and knowledge?
    - If yes, which digital learning initiatives do you think could enhance integration and inclusion: language, cultural courses, civic education courses, academic courses/skills-development/upgrading courses, re-training, formal courses/education?
    - If yes, at what stage would they be most useful? Why were you interested in these digital learning tools and initiatives (for which purpose)? (if previous experience)
- Which digital learning initiatives (apps, videos, learning platforms, MOOCs) would you liked to have while awaiting asylum? Why?
- What are the opportunities and what are the challenges for the encountered/aspirational digital learning initiatives?
- What are the barriers: physical (availability of “equipment”), language, time, legal, financial, family?
- Do the initiatives need to be targeted specifically at you (and how)? That is to say, would you need extra support in accessing and using these digital learning offers, even if they are open and free?

Appendix B

Interview Guide

1- Origin and Development

- What has been the inspiration for this initiative and what did you want to achieve? If you are a partner of this initiative (and not a founder), why did you get involved?
- Who are the partners? How did you identify your partners?
- Who commissioned this initiative? Who pays/paid for it/the development of it? Who has been involved in its development? Which stakeholders have been consulted for its development and how?
- What is the mission? What is the core target group? Objectives?
- What is the business model? What were the start-up costs? What are the intentions for longer-term financing?
- What type of initiative is it? A MOOC or MOOC platform? On-line and blended learning? An App? A combination? What is the specific approach and/or pedagogy used?
- What type of technology is used? Why was this elected?
- When did this initiative start? Is it a one-off or does it have a longevity goal?
- Do you feel like you have a good perspective on similar initiatives in the field and how to coordinate with other initiatives? Have you taken practices from/been inspired by other initiatives?

2- Access and Recognition

- What are the prerequisites for access (open, free, limited to certain groups)?
- Has it been developed in collaboration with the target population? How has it been promoted to the target population?
- Recognition of learning outcomes (if relevant) - How is this done? Are there problems certification, accreditation, etc.?

3- Monitoring and Sustainability

- What are the aspirations for sustainability and further development? Could it be spread or up-scaled?
- What kind of QA procedures have been developed for the initiative? Are there concrete monitoring plans?
- Are effects and impact measured? Is this public information? Are the statistics on impact that are not yet public and can they be shared?
- If not, are you planning impact assessment and how? What is the planned approach?
- Do you have data on participation or do you have plans to collect it?
- If you are not assessing impact or tracking participation would you like to participate in an impact assessment study in the future? Would you be interested in a European research project of this nature?

4- Challenges and Recommendations

- Are there conclusions regarding the challenges and/or encountered problems? What, in your opinion, is the main challenge?
- Do you think FDL is the best option for migrants and refugees? Why? Or rather, is it a better option for certain/specific targets in the migrant/refugee population and why? In what format?
- How can policy makers support the integration of migrants and refugees via FDL? What would you ask of your policy makers in order to better support your initiatives or similar initiatives, to guarantee success and impact?
- Would it be possible to talk to someone who has participated in the initiative (a student)?

[i] The views expressed in this article are purely those of the authors and should not be regarded as stating an official position of the European Commission.

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Reflection on MOOC Design in Palestine

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Abstract

This paper will share Discover Palestine, an interdisciplinary Massive Online Open Course (MOOC) and the first MOOC to be created in Palestine, by the E-Learning Centre, Faculty from the Department of Geography, and Department of Tourism and Archaeology from An-Najah National University in Palestine. The paper traces the process of development of the Discover Palestine MOOC from its early inception as a cross institutional online course, to its current delivery and engagement with a global and diverse group of learners. Using a descriptive case study design and thematic analysis, the reflective experiences of four course team members involved as facilitators/designers in the design and delivery of the MOOC are shared. Three key themes, namely, "Informing pedagogies including delivery methods," "A commitment to a national cause," and "Teacher presence," are presented and contextualized with data evidence. The findings share not only the hurdles the Discover Palestine team had to navigate during the MOOC development, but more importantly, how academic collaborations promoting open education practices offer powerful tools for the reciprocal exchange of knowledge, not least in shifting mindsets, and offering opportunities for shared fields of understanding to be realized in revealing creative, cultural practices, as well as lost histories.

Keywords: Palestine, MOOC, pedagogy, OpenMed

Introduction

In striving to preserve the cultural and religious heritage of the Palestinian people, and to increase knowledge of this heritage, the *Discover Palestine* initiative began in 2012 when An-Najah National University (ANNU) in Palestine, and Montclair State University in the USA, signed a cross-institutional agreement to create the Discover Palestine course to be taught at both universities. The course content explored the ancient land of Palestine, considering the geographical and ecological makeup of the land, the different types of agriculture and water installations that have been adopted by various groups over the centuries, as well as trade and other relations between groups living side-by-side and without the region. In its focus on the history of the range of groups of people who have lived in the area, the Discover Palestine course attempted to present as fair and unbiased a picture as possible, whilst also promoting learning about the art, architecture, and technology of the country through its different historical periods.

What the initiative highlighted, evidenced from the student online course evaluation, was the transformative potential of opening up teaching and learning practices through cross-institutional learning, and the way in which reciprocal respect, with regards to both Faculty and students, shifted. For example, whilst the American students were "shocked" to find the Palestinian students were not primitive but similarly technologically-advanced and progressive, the Palestinian students also expressed a new-found respect towards their American student-peers, and the difference between people and government attitudes. In short, Palestinian and American students found a common field of understanding.

In 2014, building on the success of this cross-institutional initiative, and as a result of Montclair State University moving away from Moodle as the shared course platform (and no longer offering the course), the E-Learning Center together with the Department of Geography and Department of Tourism and Archaeology at ANNU [i],worked together to develop the Discover Palestine course to be taught universally, transforming it into a MOOC - the first English language certified MOOC to be created in Palestine. The course was offered three times during 2015-2016 with a total of 247 participants from 45 countries registering on the course, engaging a global and diverse group of learners, and is still offered to date. This paper will reflect on the facilitator/designer learning experience of MOOC pedagogy from the first three cycles. It will also consider how the Discover Palestine MOOC has functioned as a tool for identity building.

An-Najah National University

ANNU is a vibrant hub of learning which has promoted the acquisition of modern knowledge in the fields of Medicine, Engineering, Humanities, Social Sciences, and the Natural Sciences whilst remaining committed to the transmission and preservation of Palestinian history, heritage, and culture (Affouneh & Raba, 2017).

As a leading academic institution in the Middle East with a clear vision of progress, the university is dedicated to advancing scientific research on a global level whilst also meeting the local community's needs by participating in sustainable economic, technical, and human development. As such, ANNU is cultivating a multicultural, pluralistic outlook amongst students through a number of initiatives designed to foster cross-cultural dialogue and tolerance. As a pivotal institution in Palestine, (with 20,000 students enrolled in the university's four campuses, comprised of 13 faculties, 79 bachelors degree programs, 23 intermediate diploma programs, 52 graduate programs including

three high diploma programs in medicine, and two PhD programs in chemistry and physics) the university continues to inspire its student body to realize their own potential, and to have a positive impact on the society in which they reside.

The E-Learning Center (ELC) at ANNU was founded in 2012 in order to achieve several goals which included, creating an encouraging environment of e-learning across the university faculties and academic programs; to develop both student and academics' skills in digital fluency; to spread the culture of open education practices; and to produce high-quality (blended) courses. ELC's vision has remained one of providing excellence in both learning and teaching. Whilst ANNU is focused on demonstrating excellence to engage learners and maintain its presence in the competitive market of higher education provision, of fundamental importance for the institution is to provide educational opportunities for the benefit of social learning at a local and global level through its' networked communities of learners. The ambition of ELC is therefore about capacity building; nurturing academic staff who can design and deliver effective connectivist pedagogy, and facilitate student engagement and digital competency through its course offerings, to create knowledge-producing opportunities for the betterment of society. However, whilst experienced in designing blended courses and e-learning in general, the MOOC was a new concept for the ELC team.

Context and Informing Literature

MOOCs vary immensely in their nature and content and it is outside the remit of this paper to focus on this in-depth (for a detailed discussion of the varied nature of MOOCs see McAuley, Stewart, Siemens, & Cormier, 2010; Yuan & Powell, 2013; Bates, 2014; Bayne & Ross, 2014). What is evident from the research literature on MOOCs is the differing degrees of participation, reflection, collaboration, usage of multimedia, and the nature of assessment used (Terras & Ramsay, 2015). This includes how MOOCs can offer a range of opportunities to widen access and participation in education, especially when the knowledge and capacity of both the instructors and the students are emphasized in exploring the content, while deemphasizing the teacher as the sole source of content (McAuley et al., 2010).

As identified in the review of research practices about MOOC initiatives conducted by Gašević, Kovanović, Joksimović, & Siemens (2014), research topics which receive most attention include student attrition, engagement in learning, and assessment strategies. Less attention has focused on issues around practical guidance on course design, including "teaching presence" and how this impacts upon the learner/facilitator experience. Furthermore, despite MOOCs being a global phenomenon, the majority of research is dominated in the West, and as such, what is less clear is the experience of other countries, cultures, and economies.

What is interesting is the polarized debate within the literature about the potential of MOOCs, which on the one hand have been criticized as merely e-learning tools for the massive, with little evidence of significant impact on pedagogical practices (Selwyn, 2007; Laurillard, 2013), to the transformational practices, and ways in which MOOCs can revolutionize teaching and learning (Parr, 2015). It is evident that the massiveness of MOOCs, their accessibility, and the wide range of questions they raise, make MOOCs fertile areas for research (Bates, 2014). Though some early expectations have proven unrealistic, as Anders (2015) contends, MOOCs are a maturing technological innovation, and complementary to this, a greater diversity of MOOC practitioners and stakeholders are engaging in MOOC research within the realms of open, distance, and distributed learning.

Open Education Practice and the OpenMed Project

OpenMed[ii] is an international cooperation project co-funded by the Erasmus + Capacity Building in Higher Education programme[iii] of the European Union during the period October 15th, 2015 - October 14th, 2018 involving five partners from Europe and nine from South-Mediterranean (S-M) Countries (Palestine, Morocco, Egypt, and Jordan). The project is focused on how universities from Palestine, Morocco, Egypt, Jordan, and other S-M countries can join in the action, as community partners, in the adoption of strategies and channels that embrace the principles of openness and reusability within the context of higher education (HE).

OpenMed fosters the role of universities as knowledge providers not only to their on-campus students but also beyond the walls of institutions. Within the project framework is the continuous need for collaboration and enhancement of sharing and networking opportunities. Open Education Practices (OEP) assume a crucial and essential role, not least due to the typical top-down governing systems of universities in S-M countries where there has been an often-timid participation of university institutions in relation to OEP.

The OpenMed project seeks to transform and support all universities across the Mediterranean region to contribute to the democratization of knowledge, focusing on a bottom-up approach to OEP. In this context, OEP is a way to give back to the universities their awareness of their role in society, not only through the use of open practices, licenses, and open education contents, but also by providing the skills and tools required for promoting active dialogue and participation in our knowledge sharing society.

As a project partner in OpenMed, colleagues from ANNU have been building relationships with HE institutions from across the two shores of the Mediterranean as well as in North Europe, and in the first phase of OpenMed the Discover Palestine MOOC was selected as a case study to provide inspiration and insight into the current practices around Open Education Resources (OER) and OEP in the S-M region, and to promote reflection and discussion about current practices and priorities for change for OpenMed (Wimpenny, Merry, Tombs, & Villar–Onrubia, 2016[iv])

Local Context

As a country, Palestine does not currently have a formal national policy on open education, and the Palestinian Ministry of High Education does not accredit online degrees. However, the development of a policy on open education is in progress as OpenMed has fostered a regional debate in the S-M region on what the best strategies are to embed OEP and OER in universities. This debate, which has involved HE managers, decision-makers, educators, and other members of staff as well as policy makers, revolves around the OpenMed OER Regional Agenda for the S-M, a document that, starting from an understanding of the long-term challenges and priorities which are necessary for opening up HE in the S-M countries, presents a set of strategic actions aimed at maximizing the benefits of OER and OEP to increase the access, the quality, and the equity of HE in the region. Concurrently, ANNU does not have a formal definition of open education but practices "openness" describing it as "offering an opportunity for learning with no boundaries."(Wimpenny et al., 2016, p. 86) The university is moving towards improved awareness of OER and OEP through OpenMed, and is developing resources such as open databases, an e–library, a university-hosted, openly available, repository of recorded lectures, journal articles, conference papers, and master's theses, accessible to learners inside and out with the university, and through MOOCs such as *Discover Palestine*.

Opening up teaching and learning in Palestine through the Discover Palestine MOOC, presents an important means of achieving a just peace between Israelis and Palestinians. Through the power of online tools and open content, the story of the conflict can be heard from both sides. Arguably, Israelis have been able to deliver their story, mainly to Europe and North America, more efficiently than the Palestinians. The Discover Palestine MOOC was viewed as offering an efficient means of helping present the Palestinian story to thousands of people around the world, and to provide a platform for discussion and debate. This may contribute to the global efforts to solve the conflict peacefully, and to enable the Palestinian people to have their rights restored.

MOOC Course Design

The pedagogical considerations inherent in effective MOOC design deserve attention. Arguably, MOOCs have tended to be technologically-driven not least as their provision was enabled by the interconnected nature of the Internet (Terras & Ramsey, 2015). However, in order that longer-term educational benefits can be realized, MOOCs must become pedagogically-driven and informed by the rapidly developing knowledge base of e-learning theory and practice (Fischer, 2014).

As such, there is a key role in capacity building for teachers/facilitators in the future success of effective MOOC-based learning (Bayne & Ross, 2014). The challenge for Faculty is in how their role and presence is defined, and if they are to be viewed more as a curator/facilitator than a teacher. As Allen and Seaman (2013) contend it takes more time and effort for a Faculty member to teach an online course than to teach a corresponding face-to-face course, and with that come other considerations such as semester schedules, and how Faculty consider managing the interaction with a global set of leaners across time zones. What is clear is that building online courses is not about mirroring existing face-to-face frameworks, which do not work in the MOOC format. Yet, Faculty are often faced with teaching on a range of courses and struggle to manage competing modes of pedagogical delivery.

Reflections From Staff About the Complexities and Challenges Inherent in Delivering MOOC Pedagogy

In focusing on ways to address the demands on course delivery across face-to-face, blended, and online-only course offerings, Faculty and e-learning colleagues at ANNU, as course team members, were prompted to question what can be delivered effectively through a MOOC in a way that benefits their on-campus students, as well as the value in engaging the hundreds of other global learners, including those who do not have the privilege of attending HE. Drawing on descriptive case study methodology, (Simons, 2009), used to develop a detailed account of the subject of study, question prompts were initiated and developed by the second author, and lead researcher of the OpenMed Compendium. As the OpenMed project is focusing on capacity building in order that academics from universities in the S-M adopt strategies that embrace the principles of openness, it felt appropriate that the Discover Palestine team shared their facilitator/designer learning experience of MOOC pedagogy. Four staff including the Director of ELC (first author), the Head of the Geography Department (third author), a Lecturer from the Department of Tourism and Archaeology (fourth author), and a Research Teaching Assistant (fifth author), shared their experiences with the second author, who then used thematic analysis (Braun & Clarke, 2006) to analyze the reflective responses. The analysis focused on how the data sets revealed the course teams' perspectives about the learning experience of designing, delivering, and facilitating the MOOC. The analytic process progressed from description, where the reflective data were organized to show patterns in content, and summarized to interpretation, where themes were developed, illustrating the significance of the patterns and their broader meanings and implications.

This required an iterative process of reading, re-reading, preliminary coding, and generation of themes and their subthemes. Themes were defined and contextualized with data evidence and shared with the course team for member checking. The following section goes on to present the key findings under three main themes, namely informing pedagogies including delivery methods, a commitment to a national cause, and, teacher presence.

Informing Pedagogies Including Delivery Methods

Whilst the course team had previous experience of delivering blended and e-learning courses, this was a first-time experience to design and deliver the Discover Palestine MOOC and the initial pedagogical approach was geared towards a content transmission mode of learning, including delivery methods such as setting weekly readings and structured activities around tasks and projects.

It was evident that "learning by doing" was key as well as having a set of outline aims for the MOOC that helped to provide the course design features, which included, the need for content to be accessible in English - as a focus was to reach out to new and diverse learners - and, for the content to be engaging, multimodal, and of high quality.

> Designing a MOOC was my first time, but it was not my first experience in blended courses and e-learning in general, I designed several blended courses before and have supervised many courses, and have conducted many training sessions for hundreds of teachers at our university. However, the MOOC was a new concept for me and my colleagues, so we learned by doing and we learned through an online course for designing a MOOC and through our reading online about MOOCs, and through the research papers published. It was a very challenging task, but learning by doing was our methodology. (Director of ELC, ANNU)

The course team researched about Learning Management Systems (LMS) for MOOCs to find that Moodle itself could be used as the MOOC platform, and as ANNU uses Moodle as its LMS, the Discover Palestine course was hosted there.

It was also recognized that "the amount and quality of knowledge and information required for a MOOC is much more that of traditional teaching methods" (Research and Teaching Assistant) and, how there was preparatory work required to enrich the course with different types of resources: audio, video, and text. Developing teaching resources required capacity building and efficient team work. They assigned specific tasks amongst one another; Faculty staff as content providers, the ELC staff as pedagogy experts who helped transfer content into the online resources, with support from Learning Technologists' know-how. They took time to think about what content would work best, and with which visual and audio materials.

It was evident that the team experienced uncertainty in the mapping of the course content and the learning resources. There was concern about how to ensure a baseline for quality and a questioning of whether they were "doing it right?" and indeed how could this be confirmed, and by whom? Here, the team drew on the support of an external evaluator to evaluate and comment on the content. There was also ANNU's International Department, who helped with proof reading the English translations including the video footage.

In terms of the content mapping, several factors were under debate in terms of how much content to include without creating too much workload difficulties, and in responding then to learner needs and

translation issues. Of more significance, was the sensitivity of the topic relating to the Palestinian-Israeli conflict, and the historical mapping of content to help promote all that could be shared about Palestine, including writing content in an objective balanced way; “especially as we live in a very tense political situation, and it was difficult to think about ways to write that all people could accept” (Research and Teaching Assistant, ANNU).

Due to the conflict within the region over the past decades, the state of historical and archaeological research has been insufficiently developed and the course team felt under pressure to resolve this problem with confidence. Considering these circumstances, it was necessary to identify this transparently as an area of concern, and to lay out the evidence as fairly and accurately as possible. For example, in terms of the tensions between land rights and the naming of occupied territories, the team choose one of the several possible ways of referring to areas of the land, or the people within it, explaining their choices, e.g., "Palestinian" and "Canaanites," etc. From a chronological perspective, the course covered a broad period of time extending from the Late Bronze Age to the earliest Islamic periods. In order to add depth to the course, therefore, it was necessary to focus on some periods more closely than others, and learners were encouraged to complement their learning by researching and exploring some of the more superficially covered periods.

A Commitment to a National Cause

No significant incentives initially existed for the Discover Palestine team to get the MOOC project off the ground from an institutional perspective, (although ANNU teaching staff are now offered points to support promotional opportunities within the institution, including a decreased teaching load). Rather, the initial driving force was through a genuine commitment of the staff in this being their professional role coupled with a strong sense of “national duty.” As the Director of ELC shared:

> In my experience studying my PhD in the UK, I had met many people who did not know anything about Palestine and that made feel sorry and unhappy and this motivated me to introduce my country in an academic way, and thanks to the Internet this is possible.

And further, “We believe in the human dimension of life, and people need to know each other - wherever they live”(Lecturer, Department of Tourism and Archaeology).

Indeed, the course team committed extra hours on top of their day-to-day roles and responsibilities to take the online training course about MOOC design and how to develop the multimedia resources.

A significant amount of effort was involved for not only delegating, planning, designing, and creating the course content and associated resources, but thereafter in promoting the course and experiencing the “delivery time,” including the engagement of learners and facilitation of the online interaction.

> MOOCs are time consuming but offer an opportunity to be part of the open international community. Designing and delivering a MOOC is an interesting journey, full of challenges and excitement. To be sure, many worthy experiments will fail or have a different outcome than desired. But if failed experiments were an obstacle to doing world-changing research, we academics would probably choose a different job. (Head of Geography Department, ANNU)

It was also expressed that "whilst international students, and staff were able to discuss issues online and [t]his technology makes people from different countries and backgrounds closer and encourages them to cooperate on their understandings of Palestine" (Research and Teaching Assistant), managing the differences in time created a barrier for conducting any "live learning sessions." This felt challenging for the course team, who, on the whole, were more used to facilitating synchronized learning.

Teacher Presence

The Discover Palestine MOOC set out to serve a "massive" student population and was "open" in the sense that the ANNU course creators did not charge learners a fee for participating in the experience, although no course credit was offered to online students either.

In managing the course delivery, the team experienced a particularly steep learning curve in being responsive, managing the larger numbers of students, and the methods required for engagement and course facilitation.

> We urged the participants to express their views freely, especially when dealing with geopolitical issues. We also expected learners to read about the set subjects, view the available videos, and discuss their content with each other and with the tutor as well. (Head of Geography Department, ANNU)

A time-consuming task was in managing intercultural dialogue around content considering international relations, especially as the team were working with a diverse community of learners (and in English).

> We have learned that it is not easy to understand different peoples' perspectives. We faced the challenge of having participants from different backgrounds and we wanted to be sure we met their needs, and understood their meanings and perspectives.... We have learned that we should have an international expert to support us. (Lecturer, Department of Tourism and Archaeology)

The need for extra support was with specific regard to being able to discuss the accuracy of resources shared, and the challenge to find Palestinian and international resources to feed into the discussion. The team acknowledged that it would be valuable to draw on more strategic support:

> I learnt that the university should coordinate its work with the Ministry of Education; the Ministry of Foreign Affairs, Consulates and Embassies in Palestine to support us in projects such as this, in addition to creating new stakeholders inside and outside Palestine. (Head of Geography Department, ANNU)

However, what came as more of a surprise for the Discover Palestine team was that whilst the main thrust of the course was about sharing new narratives of Palestine, to educate and inform a wide and more internationally diverse audience about Palestinian history, culture, architect, art, and culture, many Palestinians in exile and also local people from Palestine participated. The course was announced through the university website (https://elc.najah.edu/node/304), via Facebook, and also through the university broadcasting channel. In addition, the MOOC can be found through searching on the Internet, and on the mooclist (https://www.mooc-list.com/). Thus, Palestinian people heard about, and saw the importance and relevance of taking the course too.

> We appreciate just how many people need to know more about Palestine since they have not had the chance to visit Palestine as their parents or grandparents left after the Nakba in 1948 to different places in the world. The surprise and tension for us at the same time was that two people from Israel also registered for this course. A further surprise was that one participant came to volunteer at ANNU after finishing the course. (Lecturer, Department of Tourism and Archaeology)

As a consequence of the above, the Discover Palestine course is now offered as a free blended university course, in English, for all honors students each semester at ANNU, in order to increase national awareness.

The following figures show the learner distribution by subject area, academic level and gender for the first three cycles of the course. Table 1 then presents the distribution of learners by country, illustrating the geographical reach of the Discover Palestine MOOC.

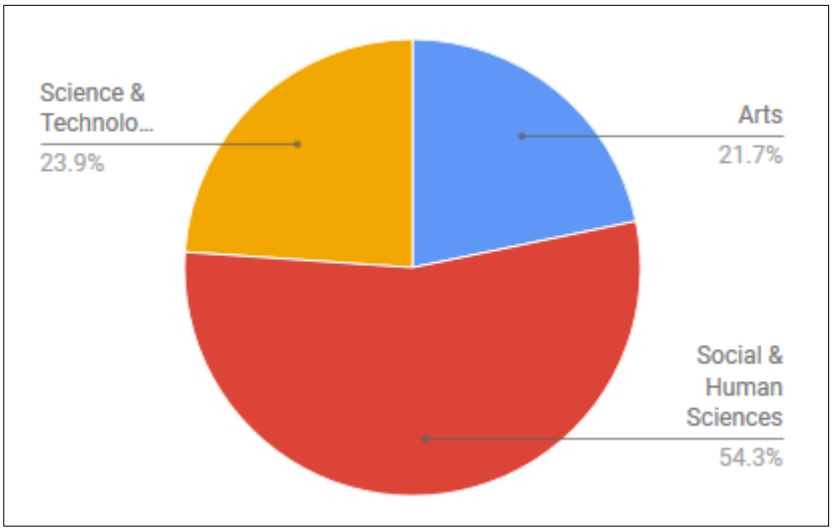

Figure 1. Learner distribution by subject area.

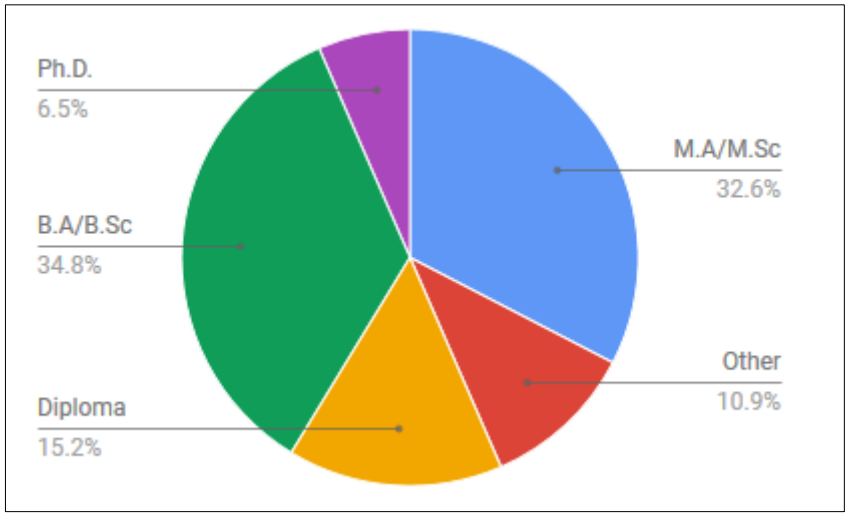

Figure 2. Learner distribution by academic level.

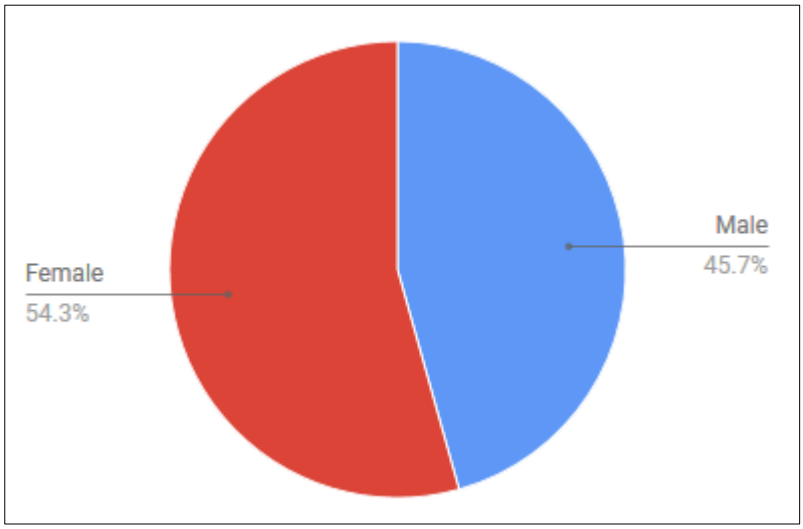

Figure 3. Learner distribution by gender.

Table 1

Learner Distribution by Country 2015-2016

Country	Palestine	United States	United Kingdom	Spain	India	Italy	France
No.	76	30	26	12	11	10	7
Country	Malaysia	Netherlands	Canada	Morocco	Sweden	Australia	Germany
No.	6	6	4	4	4	3	3
Country	Hungary	Indonesia	Jordan	Mexico	Argentina	Brazil	Colombia
No.	3	3	3	3	2	2	2
Country	Israel	Norway	UAE	Afghanistan	Bulgaria	Chile	China
No.	2	2	2	1	1	1	1
Country	Croatia	Greece	Iceland	Ireland	Mauritius	Pakistan	Philippines
No.	1	1	1	1	1	1	1
Country	Portugal	Romania	Serbia	Slovenia	Somalia	Sudan	Switzerland
No.	1	1	1	1	1	1	1
Country	Thailand	Vietnam	Yemen				
No.	1	1	1				

Discussion

Generative Learning

In designing their first MOOC, this case study has illustrated the shift in understanding about the informing pedagogy and ways to better integrate the insights of social-constructivist pedagogical theories (Poplar, 2014). What became evident for the Discover Palestine team was how, through the open discussion of learning experiences, an important opportunity was made possible for communities of learners, both local and global, to take part in the sharing of historical facts and cultural practices. Indeed, many of MOOC students reported that the course was better than anything available at the "brick-and-mortar campuses" to which they had access.

The MOOC learning space prompted the storytelling and generation of new insights about Palestinian culture and history, which will continue to be available on the course website as well as through individual learners' own blogs and social media accounts. Downes (2012) discusses this type of knowledge-growth and the power of networks of connected and connective knowledge over time. However, only limited research has explored the impact of MOOCs and what they can contribute to historical research generation (Gallagher & Wallace, 2016). It was interesting to note how the Discover Palestine MOOC thus offered an unanticipated generative repository for oral history sharing, bringing a number of benefits for adding content to less detailed archival knowledge, as well as serving as an opportunity to invest in new and rich ways for Palestine to tell "its" story.

In terms of resources, the course team still question how much content learners can / should try to digest considering all the periods of history and archaeology in Palestine which they would wish to promote, and how otherwise the course can be reduced to that which is essential. However, what the team now appreciate more fully is the power of constructivist and connectivist approaches to facilitate emergent, self-organized patterns of collaborative learning (Downes, 2012), wherein groups of people learn with, and from one another, and where this can lead in extending and expanding upon ways of knowing:

> Of course but there was no resource, the people on the course became the best resources, the open resources through the Internet were also very important resources. (Director of ELC, ANNU)

In addition, each subsequent offering of the Discover Palestine MOOC, emerges from, and is built on the previous. In this way, the course content itself is shaped through the development of evidence informed by connectivist learning principles of diversity, openness, and interactivity (Milligan, Littlejohn, & Margaryan, 2013) and without the necessary mediation of a centralized authority (Anders, 2015).

It is evident that a number of key roles and partnerships can help support ventures such as these not least for ANNU in supporting the initial commitment and willingness of academic staff to take risks and pursue new modes of teaching and learning for the betterment of society. Further, it is important to add how the ANNU Strategic Management Team as stakeholders were keen to support the Discover Palestine MOOC, and give the staff their approval. This now includes:

- The senior university team who have supported the course and kept abreast of issues;

- The Office of International Affairs in An-Najah National University; and
- The Palestinian Ministry of Foreign Affairs, The Ministry of Education, and the importance of national recognition considering the content and the aim of the MOOC.

Further, OpenMed has continued to help validate the ANNU venture with the Discover Palestine MOOC having been reviewed and included in the Compendium of good practice[v], which as a consequence also served to empower the staff. Having such support has given the team the confidence to continue and also the ability to critique and reflect upon their practices.

> I think through the OpenMed project I am exposed to more understanding and experiences which now empower me and I am more confident, especially after including our experience in *Discover Palestine* as a case study in the Compendium, and how it was evaluated externally. But we are still learning. (Research and Teaching Assistant)

And further,

> Now we are working on designing and delivering another two MOOCs, one is Genetics and Society in Arabic, and the other is Conservative Energy in English. I will be the team leader again and use my previous experience from *Discover Palestine* and learn from the derived lessons to make the two new ones better. Also, my involvement in the OpenMed project continues to provide me with up-to-date knowledge and new skills, and has empowered me in my facilitator role and consideration of use of resources in open learning for our MOOCS. I believe that these new courses will be much better due to this. (Director of ELC, ANNU)

What is of note is how the team now have the confidence to promote MOOCs for Arabic learners as well as MOOCs for international learning communities and have developed the course twice since the first delivery, mainly in decreasing the "required" reading materials and instead adding in more content and links through the generative learning resources. They have also decreased the number of assignments. Further, the educational practices of connectivist pedagogy, with emphasis on socially-intensive and interactive learning experiences, have supported the team in reviewing their role less as instructor, and more as interlocutor and facilitator.

Conclusions

ANNU already had extensive experience in blended e-learning courses. However, living under Israeli occupation for more than 50 years, was an incentive for the E-Learning Center along with colleagues from the Department of Geography and Department of Tourism and Archaeology, to build on a cross-institutional course, and design a MOOC. The Discover Palestine MOOC is promoting new narratives for the country, to a wide and diverse number of people around the world, embracing Palestine's history, archaeology, geography, arts, cultural heritage, and geopolitical developments of Palestine's cause.

In addition, Discover Palestine has brought together a learning community which transcends nationality, religion, colour, background, and level of education. It has opened up a space and place for all learners to contribute in open discussion freely, and to access resources and information in a range of rich media formats, including text, photographs, pictures, videos, and lectures. Further, the content

is developed through the community of learners who have shared additional resources and contributed readings, adding to the open education resources.

The team have experienced a number of challenges in terms of managing diverse learner needs and interpreting global perspectives in as fair and evidenced way as possible. Nonetheless, the Discover Palestine MOOC has offered the course team opportunity to reflect upon how online communities help foster learning, and how social networking can help both online and in-person community building. Whilst a steep learning curve, it has not put the team off, and another two MOOCs are currently under design.

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Creating and Collaborating: Students' and Tutors' Perceptions of an Online Group Project


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Abstract

Although collaboration skills are highly valued by employers, convincing students that collaborative learning activities are worthwhile, and ensuring that the experience is both useful and enjoyable, are significant challenges for educators. This paper addresses these challenges by exploring students' and tutors' experiences of a group project where part-time distance learners collaborate online to create a website. Focus groups were conducted with students who had recently completed the project, and discussion forums were used to gather feedback from tutors who supported students and marked their group work. The research showed that students' attitudes towards the group project on completion were generally favourable. Findings highlighted key aspects for successful online group projects and for motivating students to participate fully. These included: the design of authentic tasks, with skills development relevant to the workplace; careful attention to how the group work is assessed; and enabling students to develop websites they could be proud of. Frustrations for students were associated with the lack of engagement of fellow students and with limitations of the tool provided for building the website. Tutors found marking the work a time-consuming and complex process. Tutors were also unconvinced of the value and fairness of assessing students partly on a group, as opposed to an individual, basis.

Keywords: collaboration, online learning, group projects, authentic learning, assessment

Introduction

Educators and employers agree that the development of group working skills is a key aspect of higher education. Being able to work effectively with others is relevant to many areas of employment, so enabling students to develop these skills is crucial (Universities UK, 2016; UK Commission for Employment and Skills [CES], 2016). In addition, the advantages of collaborative learning activities are well recognized by educators (McConnell, 2006; Hrastinski, 2009). Collaboration is seen as a key part of social constructivist and situated learning approaches (Brown, Collins, & Duguid, 1989; Huang, 2002). It fits with ideas of learning as participation, where the learner becomes an active member of a community (Lave & Wenger, 1991; Sfard, 1998). As Brown et al. (1989) have pointed out, "if people are going to learn and work in conjunction with others, they must be given the situated opportunity to develop these skills."

However, students often do not understand why group work is important (Roberts & McInnerney, 2007), they may be reluctant to participate, and some even find the prospect daunting. Past studies have shown that students' negative perceptions of group work are affected by: challenges in communication, in particular handling difficult or absent group members (Ozturk & Hodgson, 2017); logistical decisions about leadership and timing of work (Allan & Lawless, 2003); and the dependence of their grades on other students (Payne, Monk-Turner, Smith, & Sumter, 2006; Myers, et al., 2009).

Successful group working can be particularly difficult to achieve in a distance or online learning setting. There are additional challenges for students in communicating and interacting with other team members whom they may not know in person. Distance learning students often expect that all their work will be done independently (Smith et al., 2011); they assume that they will be in control of how much they communicate with other students and of their own study schedules. This can result in resistance to participation in online group work. Group work activities should therefore be engaging, and the tasks should have real-world relevance so that students can understand the value of the work (Herrington, Reeves, & Oliver, 2010).

This paper reports research to investigate perceptions of an online group project in a module presented at the UK Open University where students collaborate online and produce a website. The work provides a valuable and unique contribution as it considers not only the views and experiences of students, but also of the tutors who support the students and mark their work. The research is aimed to discover which aspects of the group project worked well and which aspects were problematic, with a particular focus on how the group work is assessed. The research findings will help to inform online educators who aim to design group projects that are authentic, engaging and fairly assessed.

The research questions addressed in this paper are:

- What aspects of online group projects do students find enjoyable/motivating/rewarding?
- What aspects of online group projects do students find difficult/demotivating/frustrating?
- What are tutors' opinions on online group projects, and what are their biggest challenges?
- What are the key aspects for ensuring group projects are engaging to students and fairly assessed?

Background and Literature Review

The following discussion is organized around three key themes:

1. Collaboration — how students interact with each other;
2. Task — what students are required to do, and to produce; and
3. Assessment — how marks are allocated.

Collaboration

Collaborative technologies have advanced over the past couple of decades and have made a significant impact in higher education, and particularly in online learning. Educators now have a wide choice of tools that can facilitate online group interactions, and students are already familiar with interacting online for personal purposes. Higher education is exploiting these changes by incorporating online communication tools into both formal and informal learning activities (Donlan 2014; Kear et al., 2014; Selwyn, 2009; Tess, 2013).

Asynchronous tools, such as online discussion forums, enable students to communicate at any time that suits them; forums, in particular are a popular way of supporting online group work (Oliveira, Tinoca, & Pereira, 2011). Wikis support collaborative writing, as well as other aspects of online collaboration (Lin & Reigeluth, 2016). Synchronous tools, such as Web conferencing, that support real-time audio, video and text interactions can also be valuable (Kear et al., 2010; Thorpe & Edmunds, 2011). These can enable decisions to be made much more quickly than using forums; however, scheduling real-time online meetings is often problematic for students, particularly those studying part-time.

Several studies have explored the dynamics in online groups (for example, Brindley, Walti, & Blaschke, 2009; Smith et al. 2011) and proposed patterns of interaction that occur in successful online group work. For example, *negotiation, discussion*, *agreement*, *research*, *conception,* and *production* are examples of patterns experienced by harmonious or cohesive groups identified by McConnell (2006). Building on this, Oliveira et al. (2011) stressed the importance of groups negotiating the problem and their collective intent to harmonize. Conversely, patterns seen in less successful groups, included: *struggle*, *changing of minds*, and *change of direction* (McConnell, 2005).

These studies also identify the importance of the sequencing of different stages of work, such as negotiation, discussion, and production, and the time spent on each of these. Timing is a crucial factor in any type of group work (McGrath, 1990); however with online groups, timings become more complicated. When groups are working to assessment deadlines, and members are relying on each other to complete interdependent tasks, uncertainty about when tasks will be completed can be a significant source of frustration (Allan & Lawless, 2003).

Task

Group projects generally require members to work together to create a final output or product. In an online learning setting, where building something physical is impractical, the output of group work typically takes the form of a report or wiki page, or a digital artefact, such as a website. Brindley et al. (2009) make a number of recommendations for designing successful group projects, and many of these relate to the task: clarify expectations and instructions for the task; choose a task which is best performed by a group; allow enough time for the task and the necessary collaboration; and achieve a

balance between structure and autonomy for students. In addition, the task should be relevant to real-life, and to the students' education and work context(s) (Thorpe & Edmunds, 2011).

Other authors have also focussed on ensuring that tasks are authentic (Amory, 2014). Herrington et al. (2010) state that tasks should have real-world relevance, require students to identify their own approaches, be complex (and therefore sustained over a period of time), and provide the opportunity to collaborate and reflect. Lombardi (2007) points out that students are motivated by solving real-world problems, and that learning activities should "match the real-world tasks of professionals in practice as nearly as possible." Such authentic approaches to learning highlight the importance of multiple perspectives, collaboration, reflection, integrated assessment, and creation of *polished products*. Authentic learning activities should support skills in analysing, evaluating, and creating.

Assessment

Assessment is a particularly sensitive issue in group work; one of the reasons students are often unwilling to participate in group projects is that the marks they achieve can be dependent on other students (Payne et al., 2006). It is therefore important to "analyze multiple forms of evidence to measure student performance, including observations of student engagement and artifacts produced in the process of completing tasks" (Lombardi, 2007).

A major consideration in the assessment of group work is whether students will be awarded marks individually or as a group. Roberts and McInnerny (2007) claim that assigning group grades—without distinguishing between individual members of the group—is unfair and should not be used. Strauss et al. (2014) highlight the specific challenges in assessing group work, and make the point that awarding individual marks to group members depending on their contributions can be very difficult to implement. It can also be perceived by some as unfair, especially when the group is made up of a diverse body of students. Webb (1995) identified undesirable group processes, such as social loafing, absent group members and controversy and conflict within a group, which can adversely influence the outcomes of group assessment.

Another aspect to consider in assessing group work is whether both the product and the collaborative process will be assessed. If the quality of the group product is a main focus, then the group output should be assessed (Webb, 1995). However, if the learning outcomes also relate to students' group working skills, then methods must be found for assessing the quality of the collaboration (Naismith, Leet, & Pilkington, 2011).

A benefit of an online group project, compared to a face-to-face one, is that when students are using online tools to collaborate there is typically a record of the interactions taking place. It is possible to observe the details of discussions, who initiated ideas, how decisions were made, and the timings of completed tasks - even after the project has ended. This enables the collaboration to be assessed.

The Module Context

The context for the research presented in this paper is a Level 2 undergraduate module called *Information and Communication Technologies,* presented by the UK Open University. This is a successful module that has run since 2010 with between 400 and 700 students per year. It incorporates a group project that has been progressively adapted over the three preceding modules. Retention figures since the module began suggest that the dropout rate is not significantly affected by the inclusion of the

group project (retention figures are significantly higher than other Level 2 modules in the same program). In two out of the six years that the module has run, however, the steepest drop-off in assignment submissions is for the group project.

The module is studied over a period of 31 weeks and students are required to work in groups of between five and eight students starting at around week seven. Students are placed into groups by their tutor, where each tutor typically has enough students to form between three and five groups. Tutors support students throughout the whole module and also mark their assignments. By the time students reach the group work they will have had: one-to-one contact with their tutor, either via email, discussion forums, or phone; received feedback on their first assignment; and had the opportunity to attend a face-to-face or online tutorial (although the majority of students choose not to attend tutorials).

Most of the group work occurs in weeks 11 to 16. The tutors' role during the group work period is much more hands-off than is other parts of the module. Once students are in groups, the students are expected to discuss their approach to the tasks and solve any problems within their group without tutor input. Tutors are, however, still available during this period and they do get involved if a group is struggling.

The assessment requires student groups to produce a wiki resource and a website. The work students undertake with the wiki has been researched previously (Kear et al., 2014). The current paper focuses on the website development, which is a more technically challenging task. Students are required to work with a software tool—WordPress—that is widely used for developing websites. Students need to include a number of prescribed technical features, as well as producing the content for the website. They therefore gain website development skills appropriate in the context of an IT module and with real-world relevance.

Groups are given a specific "client" in order to make the task authentic. Examples have included a walking club, a canal boat holiday company, and a community theatre. How the group organizes themselves, for example whether they have a group leader and how they make decisions, is left to the group to decide. Groups are provided with a number of online tools: WordPress to carry out the Web development; a forum to facilitate group discussion; and a wiki for documenting the decisions made by the group. Some groups choose to use other tools in addition to these. The WordPress software provided to students is a cut-down version hosted internally for the module. Using this restricted version allows all students to develop their technical skills, whilst ensuring that students with no previous experience with the software can cope with the fundamental technical requirements. Students are asked to include various items, for example a calendar and a map, but the *plugins* that enable these to be embedded are provided and have been thoroughly tested. Students are restricted to the plugins provided and cannot import new ones. They are told what type of content they should include, but they have the freedom to be creative and include images and content of their choosing.

A key learning outcome of the module is to "work effectively as part of a group in a distance setting where collaboration is undertaken via computer-mediated communication." This means that the process of collaboration, as well as the final product, should be assessed. The marks are split evenly between the product—the final website—and the collaboration process. In addition, marks are split between individual marks—allocated for a student's own contributions to both the product and the collaboration process—and group marks—marks that group members receive equally. As groups are required to collaborate to produce a shared product, the group marks are intended to motivate students and reward these aspects. Students are informed that only contributing group members will be awarded

the group marks; the assignment guide says: "Any group member who makes no contribution, a negligible contribution, or whose contribution is too late to be useful will not be awarded any [group] marks." The proportion of marks allocated to each of these elements is illustrated in Table 1.

Table 1

Proportion of Marks Allocated to Product and Process and on a Group and Individual Basis

	Marks for product (website)	Marks for process (collaboration)
Individual marks	30	30
Group marks	20	20

Evidence from end-of-module surveys and from previous research (Kear et al., 2014) suggests that, once students have taken part in the group work on this module, they recognize the value and many of them enjoy the experience. However, a small number of students still opt out altogether and some contribute very little.

Method

Data Gathering From Students

Because the research gathered feedback from students studying the module, permission was needed from the Open University's Student Research Project Panel, which is responsible for approving research involving Open University students. Once approval was received, invitations to take part were sent to 400 students. The invitation email explained the purpose of the research and clearly stated that students' contributions would be anonymous and would not affect any other aspect of their study.

Twenty-eight students responded. Whilst this was a low response rate (7%) it was not felt to be unusually low in a distance learning context, where most students are in full-time employment. Students were being asked to participate in focus groups and contribute a significant amount of their time. This is in contrast to online surveys, which take less time and can be completed when convenient to the student.

Students were consulted as to their availability and divided into six online focus groups. Twenty-five students subsequently took part in the focus groups with attendance ranging from two to six participants in each group. Three responded to the questions by email, as they were unable to attend at the times when the focus groups were eventually scheduled. The focus groups (and email responses) all took place in the month after students had completed the group work. They were held using the Open University's audio-visual conferencing system, OULive (a version of Blackboard Collaborate), with which students were familiar from their studies.

The students attending a given focus group were not from the same project group and did not know each other beforehand. One member of the research team, who was an experienced facilitator of online synchronous sessions, led all six focus groups. Each focus group lasted between 30 and 45 minutes. The

focus groups were recorded using the recording facility provided within OULive. No video was used, as experience has shown that Open University students tend to prefer audio and text chat interaction.

A number of open-ended questions were used to structure the focus groups; however, students were encouraged to talk about whatever aspects they felt were important.

The questions used were:

- Did you enjoy the group project?
- Did you find it rewarding?
- What do you think was your group's biggest challenge?
- Did you find any particular aspect frustrating?
- Did it go better or worse than you expected?
- Do you feel the marks for this assignment fairly reflected *your* contribution and the group's overall?
- How did your group go about negotiating tasks and responsibilities?
- Do you feel that the technical tasks were fairly divided among group members?
- Do you feel that organisational responsibilities were fairly divided among group members?

Coding of Student Data

Transcripts were made of the audio from all six focus groups in order to facilitate the analysis of the data. Additional data that were analysed were: chat transcripts from three focus groups (when students used this facility); and individual email responses from the three students who did not take part in focus groups.

A thematic analysis approach was adopted (Bryman, 2015). In the first stage of analysis, three researchers (all current or former members of the module teaching team) independently coded the text from one of the focus groups to identify emergent themes. The researchers then met to compare the results of this process, identifying where there were differences and where there was agreement on the text extracts used and the codes/themes that had been allocated. From this initial discussion, a draft set of codes and subcodes that represented the aspects of interest from the data were agreed upon. The researchers then independently coded a second focus group, again meeting subsequently to discuss differences and agreements. From this discussion a revised version of the coding set was produced, which involved omitting, adding, and merging codes. Using this final coding set (see Figure 1, below), one of the researchers then coded all the student data.

Data Gathering From Tutors

The experiences and perceptions of tutors were gathered through a discussion forum. This was a forum that tutors used to discuss the module, and through which they were therefore used to engaging with one another and with the module team. The purpose of the research was explained to tutors and two

discussion threads were set up. One thread asked questions relating to tutors' views of their students' experiences of the group work:

- Do students enjoy the group project? Do they find it rewarding?
- What do you think are their biggest challenges? What do they find particularly frustrating?
- How do groups go about negotiating tasks and responsibilities?
- Do you feel that the tasks and responsibilities are fairly divided among group members?

A second thread asked questions about tutors' own experiences of supporting students and marking the group project:

- What is your experience of supporting and marking the group project?
- Do you feel that students' marks fairly reflect their individual contributions and how well each group performed overall?
- Do you think that the group project is a valuable experience for students?

Ten tutors (out of a total of 27) responded. Responses varied in their level of detail: two tutors provided brief, bullet point answers and the remaining tutors provided full, reflective accounts.

Coding of Tutor Data

The tutor data was coded using the codes and subcodes established during the analysis of the student data, with two new subcodes added under the *TUTORS* code (see Figure 1, below).

Results

In total, 10 main codes were agreed upon through the process described earlier. Each of these codes (black text in Figure 1) had a number of subcodes (white text in Figure 1). Each code also had an *other* subcode to include comments that could not be classified under any of the existing subcodes but that provided useful insight.

Some codes had more text extracts associated with them than others, and some extracts were assigned more than one code/subcode. For example, a comment about the challenge of dealing with absent group members could be encoded *FEELINGS—Challenge* and *PARTICIPATION—Absent*.

Figure 1. Codes and subcodes used for student and tutor data.

(Note: the sizes of the ovals do not reflect the number of comments received, or any measure of importance.)

In the subsequent analysis of the student data, it was helpful to look at the balance of negative and positive comments for some subcodes to get a sense of how students felt about certain aspects. In other cases, it was more appropriate to identify the key points that students were making around a particular subcode. The same approach was subsequently used for the analysis of the tutor data to identify where there were agreements, and where there were differences between student and tutor perceptions.

Broadly speaking, students who took part in the research were positive about the group project. When asked whether they enjoyed the project, the majority said they did. Twenty-four of the comments (coming from 17 students) that were coded FEELINGS—*Enjoyment* were positive; 6 comments (from 5 students) were negative. Comments relating to *Enjoyment* and *Reward* were split fairly evenly between comments that referred to the collaboration process and to the website development task. Interestingly, almost all the comments that related to *Challenge* were about the collaboration, whereas most of the comments about *Frustration* were about the task. These findings will now be explored in more detail using the key themes of collaboration, task, and assessment, as introduced earlier.

Collaboration

There were more positive than negative comments about whether the collaboration was an enjoyable experience. Nine out of the 27 students explicitly said they enjoyed the collaboration processes involved in the group project, whereas four students explicitly said that they didn't. (The remaining 14 did not comment directly about this.)

Several of the specific responses, and interpretations of these responses, follow: "So I sort of went into this thinking, "Ah this is going to be terrible," but it was actually a really positive experience for me [...]."

The positive points raised by students about the collaboration included: it was enjoyable interacting with other students; it was nice not to feel isolated; it was fun; it was enjoyable to share knowledge and get feedback; and that there was some real-world relevance to working in this way—as part of a team: "It was lovely that the collaboration actually worked and its sort of part of the modern world, collaborative work, and think it was a very good lesson to learn."

For those students who did not find the collaboration an enjoyable experience most comments indicated that there were problems with relationships within the group: "From a personal experience I enjoyed using the WordPress site. However, we had major issues with our group that meant, no, it wasn't rewarding or enjoyable.

Tutors agreed that most students enjoyed the group project, and one tutor identified a correlation between the level of engagement and how much students enjoyed it: "For those that engage, I think most enjoy the work. For those who don't engage, this is a chore."

When students were asked what they felt the biggest challenges were, the vast majority of comments referred to the collaboration aspect of the project rather than to the Web development task. For example, they experienced challenges in: working with strangers; ensuring everyone met deadlines and issues around timings in general; getting started, but also maintaining momentum; and dealing with absent members and personality clashes. Whilst these are not unexpected issues to arise in group work, there was a noticeable lack of comments about the challenge of the task itself. This is surprising given that students had been asked to demonstrate a significant level of technical competence with a new piece of software, and with minimal instruction on how to use it. The collaboration was also a focus of tutor discussions; almost all the tutor comments about the major challenges students faced were associated with getting other group members to cooperate, contribute, and meet deadlines.

Despite the challenges, students also talked about the collaboration process being rewarding. There were comments from several students that showed they had benefited from the experience: "It was interesting and in some ways it's developed us because I hadn't really worked in a group before that and so it kind of gave another aspect on studying."

Again, these sentiments were supported by tutors who felt that, whilst there were always some students who were glad to get it out of the way, most found it a rewarding and valuable experience.

Tutors also expressed feelings of challenge and reward with respect to their own experiences in supporting students through the collaborative project. Tutors expressed concern about groups that were slow to get going, and talked about the struggle of supporting some students, such as those with rigid time constraints or those who found communicating difficult.

Despite the overall positive experiences, students also discussed the problems they had encountered during the collaborative project. There were problems with group members who were absent, either from the beginning of the project or part way through. In most cases, though, there was an active core of two or more group members who were able to continue with the work. Dominant personalities were discussed as a problem by several students, and examples were given in which different team members were pulling in different directions.

A few students expressed anxiety about the group work. One student commented that this could have been the reason for one group member's lack of participation: "We had one group member who didn't

take part a great deal but, again, with all the dominant personalities that were there it was like she was scared to speak up."

A final observation from a student regarding the collaboration was that group members tended to work individually on separate Web pages rather than collaboratively across all pages: "It just didn't feel like we were building a website together. I felt we were still building a group of pages."

Task

An interesting finding regarding the task was that students wanted to feel proud of their final product. Students' and tutors' comments showed that students felt proud of what they achieved: "We did get it done and it looked really remarkable in the end." (Student comment) and "I have no doubt that students find the learning experience rewarding and tend to be very proud of their end artefact" (Tutor comment).

Students suggested that final products be made visible to all students on the module: "I would have liked to have seen all of the groups' pages just to get a feel at the end for how we did and compare that to other groups whose sites we hadn't seen."

However, some expressed disappointment with their group's final product, and would have liked more emphasis on quality of graphic design. Others commented that they felt restricted or frustrated regarding the content they were able to include in the website. The version of WordPress used was referred to as being too "cut down" or "limited." In fact, of the 28 student extracts that were coded *Frustration*, 16 of these referred directly to WordPress and the features that had been made available for them to use: "Because it was a cut down version we ended up quite frustrated in that we couldn't actually make the site look as nice as we wanted."

Some of the comments received from students who had prior website development experience related to the apparent lack of authenticity of the task set, such as: "adding a Twitter feed onto the page. Adding, you know, Facebook interaction because that's what [...] a business would do."

Tutors agreed that the more technically-experienced students tended to complain more about the tools and limited functionality available to them. The less technical students had the opportunity to learn new skills, and generally found the task itself more rewarding. Tutors also reflected that the more technically-confident students took on more of the technical tasks, though sometimes not by choice. Although the authenticity of the task was questioned by some students in terms of the technical functionality of the tools, this was not highlighted as a concern by tutors. In general, they considered the task to be a useful exercise for students, and one that developed real-world relevant skills. However, it is clear that reducing the flexibility of the task and tools had a negative effect on some students' motivation, even though it was helpful for other students. This balance needs careful thought in the future design of group projects.

Assessment

Comments regarding the division of work amongst group members provide an insight into how fair students felt the project was. There was an even balance between positive (14 comments from 10 students) and negative (13 comments from 9 students) comments relating to how fairly the work was divided between group members. While there was little expansion on the positive comments, an

example of a negative comment is: "I know I sound bitter but nobody in my group was prepared to [do] any of the technical aspects so that fell to me."

On this matter, tutors' views were more united than those of students'. Eight out of the 10 tutors commented on whether they felt that the work was fairly distributed, and all 8 felt it was not. Tutors highlighted that one or two students (often the more technically confident ones) did more work than others.

There were also significant differences between the opinions of students and tutors on the fairness of marks, including the use of group marks. Again, students' comments were split between positive (18 comments from 16 students) and negative (14 comments from 8 students). Tutors, however, were more negative about this, with only one tutor saying they felt group marks were fair and 6 tutors commenting explicitly on the difficulties and frustrations of awarding the same group mark to all group members. Particular reference was made to the fact that the group marks do not reflect differences between students who make "minimal contribution" and yet enough to qualify for the group marks, and "the superstars who actually made the collaboration work."

The positive comments from students showed that they felt their individual input had been recognized and was reflected in the mark they received. Some of these comments, however, were more related to the fact that students were simply pleased with their mark, rather than being pleased that group marks were used. One student added that they found the inclusion of a group mark "odd" but he was nonetheless happy with his mark. Likewise, another said he would prefer no group mark element despite being pleased with his mark. Although some students expressed concern about the mark they personally received, and the effect the group had on this mark, others were more concerned about the marks others were receiving, and whether these were fair.

A small number of comments directly referred to worry and frustration about their own marks possibly being affected by others. For example: "Since we can't control or have any ownership of what other people are doing if we don't do their bits for them and they don't do them and we get marked down for it then that doesn't seem reasonable."

There were also concerns about what mark others were getting, and the transparency of the marking: "I would have liked to know whether or not these two people that did not contribute or decided to contribute later in the assignment got zero, because that was the condition of the marking scheme."

Finally, with respect to the assessment, nine out of 10 tutors discussed their experiences of marking the group project. All tutors that took part are experienced tutors who have marked assignments for many years; however, seven out of the nine said they found marking group work challenging, frustrating, or tedious. Only two of the nine did not find the marking of group work onerous. Marking was viewed as challenging largely because information needed to be drawn together from several sources (the website, the forums, the wiki) and collating and considering the different components was difficult. Another challenge was differentiating between students—and allocating marks fairly across a group—both at the high achieving and low achieving ends of the spectrum. One strategy identified separately by two tutors was to keep on top of the process from the start of the group project. One said it was important to keep on top of forum postings from the beginning in order to understand the composition of groups. Another created a spread sheet for recording salient contributions made by individual students and to make notes on group dynamics.

Discussion

In this section, the findings from the research are discussed in relation to the four research questions, and to the research literature presented above.

What Aspects of Online Group Projects do Students Find Enjoyable/Motivating/Rewarding?

Students valued the opportunity to work with other students. For distance learners this was an unusual experience and it made them feel less isolated. Most students enjoyed the experience of collaborating and interacting with their peers. They also appreciated that team working is relevant to the modern workplace, so the group project was an authentic experience in that respect. As other researchers have identified, authentic tasks and contexts are a key factor in successful online learning (Herrington et al, 2010; Lombardi, 2007; Amory, 2014).

Most students were pleased and proud when the website came together and looked impressive. This appeared to be a strong motivation for students—to produce something that looked good, and that they could share with others. Similarly, Lin & Reigeluth (2016) found that groups collaborating via wikis were "confident and excited when sharing their learning outcomes." Although the website task was challenging, both technically and in terms of the collaborative process, many students found this to be an added motivation. They gained a sense of achievement from overcoming the obstacles.

What Aspects of Online Group Projects do Students Find Difficult/Demotivating/Frustrating?

The most difficult aspect of the collaboration was coping with absent group members: those who disappeared partway through, did not meet deadlines, or generally did not pull their weight. Payne et al. (2006) identified these issues in group projects generally, and they are even more difficult to deal with in online group projects.

A related point was that students were generally working cooperatively, rather than collaboratively. According to Oliver et al. (2007), collaborative learning takes place when "students have a common goal, share responsibilities, are mutually dependent and need to reach agreement through open interactions." Sometimes, as observed here, group tasks end up being completed cooperatively, with tasks and responsibilities divided so that students work alongside each other, rather than working together (Smith et al., 2011).

Another problem was when there were personality clashes in the group, or when one person was very dominating. Conflict within a group can cause the group to fragment or members to drop out (McConnell, 2005; Ozturk & Hodgson, 2017). Findings by Smith et al. (2011) suggest that interpersonal problems may be more of a problem in online groups than in face-to-face ones. For some students, the prospect or experience of the collaboration caused anxiety. This is a worrying aspect to emerge from the research. If a group project causes less confident students to feel anxious—and thus to withdraw from the work—their assessment and progression will be affected.

The aspect of the group project that students found most frustrating, particularly students who were technically confident, was the cut-down version of the WordPress software. Students felt unable to make their website visually appealing, with features they thought would be present in a real scenario (e.g., social media links). In this respect they thought that the task they were set and the tool provided to accomplish it were not authentic. This finding highlights the importance of finding the right balance

between (1) structuring/controlling the task and tools and (2) providing enough autonomy to motivate students (Brindley et al., 2009). As a student commented in Thorpe and Edmunds (2011), if there is too much structure you "lose some of that learning experience … things you can apply to your own work context."

What are Tutors' Opinions on Online Group Projects, and What are Their Biggest Challenges?

A surprising finding from the research was that tutors were considerably more negative than students about having group marks. Many tutors considered that the group work was distributed very unevenly. This was particularly the case for tasks which were more technical: these often seemed to be left to the more technically confident students. Tutors therefore concluded that group marks are unfair (Roberts & McInnerney, 2007).

Most tutors found marking the group project difficult and time-consuming, mainly because information needed to be tracked, gathered, and integrated from several online spaces. As Lombardi (2007) points out, this is necessary for fair assessment. Although some tutors had developed strategies for this, it was nevertheless seen as tedious. Tutors also found it challenging to differentiate between students' contributions in a way that seemed fair. Again, this is consistent with previous research (Strauss et al. 2014).

What are the Key Aspects for Ensuring Fair and Effective Assessment of Online Group Work?

Assessment can be a strong motivator for engagement in online learning, but the assessment needs to be as fair as possible, from the perspectives of students and of tutors. As Huang (2002) points out, it is important to evaluate the learning process, and not just the end result. For a group project, this means that the process of collaboration as well as the product should be assessed. When students are collaborating via online tools it is possible to use the online records to assess their collaborative process; however, this is not easy to do, and it takes considerable time. Hopefully, in the future, tools and utilities can be developed to support tutors/markers in this endeavour. This could be a fruitful topic for future research, particularly given the increasing awareness of approaches based on "learning analytics" (Sclater, Peasgood, & Mullen, 2016).

A specific issue that was considered in this research was whether it is fair to have group marks: marks that are allocated equally to all participating members of the group. Prior research suggests that reliance on group marks is ill-advised (Roberts & McInnerny, 2007; Payne et al., 2006). The current research found that most of the students were not overly concerned about the group marks, although some thought they were potentially unfair; they would have liked to know whether non-contributing group members were actually awarded the group marks. Tutors were more adamant that the group marks were unfair because some group members contributed much more than others to the work. This suggests that, if group marks are used, they should be kept at a modest level as a proportion of a student's overall mark. The tutor comments suggest that allocating 40% of marks as group marks is too high. The authors agree and are considering removing the group marks altogether in future group projects that they design.

Conclusion

A limitation of the research is that it is based on a small, self-selected sample of students and tutors. It is possible that the students who participated in the research were those who were more engaged with the group work. The sample may therefore not be representative of the cohort as a whole. However, the research has provided rich, in-depth qualitative data illustrating these students' and tutors' perspectives. This will hopefully contribute to future improvement of online group projects, with corresponding increases in student achievement and satisfaction.

Although the online group project was challenging, the students' attitudes towards it on completion were generally favourable. Those that took part in this research appeared to understand the value of the activities they had undertaken, and found the experience rewarding. However, there were difficulties and frustrations caused by aspects of the collaboration and of the Web development software. Much of the frustration was caused by limitations imposed by the module team to make the task amenable to all levels of students.

The research findings highlight that a key requirement for successful online group projects is to motivate students to participate fully. If students engage with the activities, they generally find them enjoyable and rewarding. But if they fail to engage, there are significant difficulties for other students in the group. Related to these points, it is important to assess students' contributions fairly, taking into account their individual contributions to the collaborative process, as well as to the group product. Careful consideration also needs to be given to the balance between individual marks and group marks (if used).

One way to encourage participation is to make the project as authentic as possible. If the task set and the context used seem authentic, students will see that they can develop skills that are relevant to the workplace, and they will be encouraged to participate. A further motivating aspect would be enabling students to showcase the products they develop together. For a visual and interactive product such as a website, this would further enhance students' sense of achievement and pride.

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OER Awareness and Use: The Affinity Between Higher Education and K-12

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Abstract

Educators within Higher Education (HE) and K-12 share in the need for high quality educational resources to assist in the pursuit of teaching and learning. Although there are numerous differences between the two levels of education, there are commonalties in the perceptions of the purpose, practical uses, and challenges that abide in the use of Open Educational Resources (OER). Observations made while producing podcasts and videos for OER awareness, use, and championing, form an exposition of the merits of OER for HE and K-12. Benefits include cost-savings in acquiring resources for teaching and learning as well as user-generated content, instructor creativity, and contextualized and responsively timely learning opportunities. Additionally, the teaching culture of K-12 has historically supported the sharing of learning activities and learning resources. At all levels of education, OER awareness requires a deeper understanding of the changes to teaching and learning borne by open educational practices.

Keywords: K-12 OER, HE OER, OER benefits, open educational practices, open pedagogy, OER awareness

Introduction

Prior to the development of open educational resources (OER) within higher education (HE) and the K-12 system, the copyright restricted educational publishing system complemented the rise of public education. However, educational practices are changing and in 2013, to further the OER movement, the governments of Alberta, British Columbia, and Saskatchewan provided OER development grants to assist higher education institutes to increase awareness and use of OER. I received such a grant (*Multiply K-12 OER)* through the Alberta government OER initiative (ABOER) to develop OER podcasts, videos, and transcripts to assist in teaching OER for K-12 to education graduate students. While I currently work in higher education, my background includes teaching within K-12 for over 20 years and this combination allows a dual perspective of the current landscape of Canadian OER. During the media project, I was able to observe and compare the OER perspectives of higher education professors and instructional designers with those of K-12 educators. This paper sets out these observations from OER scholars, communication exchanges with graduate students, and from a broader K-12 audience who reacted to the ABOER media project at practitioner conferences. In this paper, I offer a reflective perspective and conceptual exploration of the commonalties, differences, and challenges that I have observed between OER for higher education and K-12.

OER and Higher Education

In 2012, as part of the Paris OER Declaration, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) published the following OER definition:

> Open Educational Resources (OERs) are any type of educational materials that are in the public domain or introduced with an open license. The nature of these open materials means that anyone can legally and freely copy, use, adapt and re-share them. OERs range from textbooks to curricula, syllabi, lecture notes, assignments, tests, projects, audio, video and animation (para.1).

Additionally, because of the open license, OER frequently involves Wiley's (2014) 5 Rs: the right to retain, reuse, revise, remix, and redistribute openly licensed content. To meet licensing needs, Creative Commons (CC), which is one of several public copyright licensing available, was developed to reverse how copyright permissions previously had been established (Lessig, 2008). Rather than asking for copyright permissions, CC licensing declares what type of reuse is possible (i.e., permission to use the resources is granted through the type of CC license) thereby eliminating the need to seek permissions for use and thus expedite the process of legally reusing, revising, remixing, or sharing. With the permissions delineated in the license selected and appended by the creator, any user can immediately understand how the learning object may be accessed and attributed, thus moving from a read-only (RO) culture to a read/write (RW) iterative and generative process oriented culture (Lessig, 2008). Although into its second decade, CC licensing is still establishing its presence within all levels of education (Batson, Paharia, & Kumar, 2008) and its effects continue to grow, as in 2015 worldwide there were over one billion CC licenses (Creative Commons, 2015b). The interplay of CC licensing and changes to digital participatory technologies have nurtured the development of OER (Conole, 2012; Hegarty, 2015) so that collectively these three forces have ushered in a

new era of what it means to produce, publish, use, and share content (Creative Commons, 2015b). These changes have also nurtured adjustments to teaching described as open practices or an open pedagogy (Conole, 2012; Cronin, 2017; Hegarty, 2015). Since the establishment and spread of CC licensing, the educational awareness and use of OER has been directly and deliberately influencing all levels of education.

Prior to the use of OER in higher education, few alternatives for educational resources were available. Educational publishers would publish discipline focused textbooks and due to the niche market monopsony - a small number of highly motivated buyers that needed the specific textbooks but had no say in the decision as to which textbook was to be purchased - the ability to have high profit margins existed (Koch, 2006) and over time this situation has created a broken market (Senack, 2016). Although faculty at higher education were aware of the high costs of these educational resources (Koch, 2006), self-publishing, in whole or in part, required substantial resources, time, and effort directed away from teaching or conducting research (Roediger, 2004) with research dominating faculty pursuits (Macfarlane, 2016; Caster & Hautala, 2008). As Issitt (2004) notes "the negativity of textbooks in terms of use and status as both literary objects and vehicles for pedagogy is profound" (p. 683) and further reinforces faculty priorities upon other pursuits. Consequently, control of content; publication and revision cycles; availability of additional resources including exams; and, with the advent of digital technologies, online resources, have all long rested with the publishers and not with individual faculty members. Additionally, the developments in digital technologies have encouraged publishers to expand into digital educational offerings including claims of improved learning and personalization (Levin, 2016) and list their strengths in developing exams, classifying and organizing content, sophisticated instructional design, institutional relationships, and pedagogical knowledge (Bailey, David, Henry, & Loureiro, 2014). All further evidence that authoring educational resources, in whole or in part, may not change radically and that the previously lucrative educational market (Koch, 2006) will continue forward albeit with digital influences now part of the offerings.

Unlike the compulsory education that inscribes the K-12 system, students attend college or university as a choice, not a legal requirement. Many adults tend to highly desire an education (Veletsianos & Moe, 2017) and forfeit full or better employment upon the completion of their studies, so they are sacrificing time and potential current earnings for a belief in the various benefits of formal post-secondary education. Such students have a strong belief in the social capital of education, and as adults, they are seeking the best opportunities for their learning context with OER translating to financial savings (Jhangiani, Pitt, Hendricks, Key, & Lalonde 2016; Creative Commons, 2015a). Additionally, benefits to adult learners include the currency of OER content compared to a copyright restricted textbook as well as OER allowing for the application of open teaching practices (Cronin, 2017). Considered the next phase in using OER (Ehler, 2011), Open Educational Practices (OEP) occur when students and an instructor participate in the revision or iterative cycles of enhancing content through the contributions of many intelligent people invested in open learning and teaching activities.

With the advent of OER, the rather stable and previously unchallenged textbook business model has begun to change. Open access textbooks highlights only one part of the movement toward openness as other transformations include open data, open research journals, and a teaching-learning philosophy that inheres participatory technologies integral to openness (Batson, Paharia, & Kumar, 2008). As these branch

activities illustrate, the open movement inclusive of OER used within higher education is more than saving student textbooks costs.

Although this emphasis on cost-saving on textbooks continues to be of primary concern for HE, the awareness and use of OER other uses are occurring. In 2016, a research report by BC campus published the results of faculty use of OER at 17 higher education British Columbia institutes including research-intensive, teaching intensive, colleges, and other institutes. Although it is commonly acknowledged that OER use in higher education relates primarily to OER textbooks, only 35% of the 78 faculty respondents noted the use of OER textbooks, with videos (63%) and images (47%) as the two most frequently OER noted in this study (Jhangiani et al., pp. 15-16). The drive toward affordable textbooks certainly has a place within higher education as Senack (2014) noted the cost of textbooks in the USA have increased by 1041% since 1977, including 82% between 2002 and 2013 alone (as cited by Jhangiani et al., 2016, pp. 6). However as the BC Campus research indicated, textbook costs savings is one part of the impetus behind the use of OER at college and university campuses.

At research intensive institutes, the teaching of students is intended to absorb one third of a professor's responsibilities and the BC Campus research shows that faculty either new into their career or at the end are most interested to investigate and use OER (Jhangiani et al., 2016). Due to the composition of the sample, the two wing effect was not statistically significant, yet it does prick attention and from this author's perspective it may be suggestive that early career faculty have a dearth of instructional materials and thereby seek out teaching materials some of which happen to be OER. Being younger they may have been exposed to OER as a student and are also closer to the financial costs of obtaining a degree. In contrast, late career faculty members may have an abundance of materials and knowledge, of both subject and andragogy, and may view OER as a means to contribute to both areas of expertise and to the broader learning community. Of additional note is that this study also found that faculty with a higher personality trait of openness to experience were the individuals who also scored higher on the adapting and creating of OER (Jhangiani et al., 2016). Another key finding from the BC study indicated that the three main reasons faculty reported accessing OER included "for ideas and inspiration, to supplement existing coursework, and to prepare for teaching" (Jhangiani et al., 2016, p. 5). An earlier study found that academics will pursue OER development and sharing if they have protection from litigation and criticisms, receive incentives, and are encouraged to further their discipline (Lee, 2008). The use of OER within higher education flows from numerous impulses that originate within the individual, the broader influences of faculty members upon the teaching and learning environment, and the institutional support for innovations to teaching.

OER in K-12

Similar to higher education, rising financial costs are given as an impetus for further support for K-12 OER. Annually, American taxpayers paid over 9 billion dollars in support of K-12 textbooks and educational resources (Bliss, Tonks, & Patrick, 2012) and within Canada, taxpayer support is also substantial. The history of Canadian book publishing has been substantially influenced by the development of K-12 textbooks beginning with a French alphabet primer printed in 1764 (Rollans & De la Chenelière, 2010, p.

8). Over time the role of provincial and federal governments played a significant role within K-12 educational publishing. As Rollans and De la Chenelière (2010) describe:

> The [K-12 educational publishing] industry's main markets are education ministries, school boards and schools: arguably a near-monopsony, where a small group of customers — the provinces — shape the market. These customers have the market strength to stimulate or discourage publishing through their buying practices, the availability or lack of direct subsidies, and other measures. They can also regulate publishing through stipulating, for example, authorship and printing requirements, approvals processes, and market access (p. 12).

This long and complicated history among the public sector, publishers, and the Canadian institution of K-12 education with its numerous and highly invested stakeholders, speak to the complexity of publishing K-12 textbooks, in the past and now within the digital age.

Although large educational publishers such as Pearson have dominated the educational landscape within Canada and the USA (Bailey et al., 2014, para. 4) such publishers are seeing a shift in revenue from textbooks to digital resources and services (Geist, 2016). In the USA PreK-12 market during the years 2008 -2012 spending on basal textbooks dropped by nearly 10 % with a cotemporaneous seven per cent increase in the area of courseware and supplements (Bailey et al., 2014, para. 4). Although these are American figures, the Canadian K-12 educational publishing industry since its inception has had strong connections to British or American parent offices (Rollans & De la Chenelière, 2010) and the USA trends have an influence within the Canadian context. These figures suggest that no longer are K-12 teachers needing only textbooks but seek access to provincially mandated curriculum resources such as high-quality videos and various other digital learning objects (e.g., handouts, assessment rubrics, graphic organizers, and exams). Educators want textbooks but also desire a variety of resources (Rollans & De la Chenelière, 2010) to support individualizing and personalizing the content covered in the textbooks. Consequently, the shift in educational publishers' revenue reflects the costs of resources by school boards, which are primarily funded by public dollars, now being distributed to various learning formats rather than an older educational model with its sole focus on textbooks.

Canadian K-12 education is a provincial responsibility and whenever there are K-12 curriculum changes (currently occurring in Ontario, BC, and Alberta) a concomitant spike in educational publishing for K-12 occurs (Rollans & De la Chenelière, 2010). Historically, this spike in publishing involved 2-3 publishers creating new textbooks to support the provincially mandated curriculum, with smaller provinces using textbooks written for a neighbouring province or versioned for that province (Rollans & De la Chenelière, 2010). For example, in the province of Alberta for each subject taught within K-12 [i] the provincial ministry would create a list of approved resources from which school jurisdictions would select and purchase class sets for schools. Publishers would have a consultation process and editorial boards composed of various levels of K-12 educators assisted the content curation and shaping its delivery. Occasionally, teachers were hired or given releases to work with publishers during the creation of a textbook, and frequently those employed by educational publishers had once been classroom teachers. Publication cycles involved several years or longer if pilot offerings of a textbook occurred. Revisions were also part of this cycle and it was not uncommon for students to use expensive textbooks with dated content, a situation that this author

encountered numerous times within her K-12 teaching career much to the chagrin of skeptical students and disappointed parents.

As all taxpayers know, supporting public education involves high costs and alternatives to maintaining or improving the system regularly appear. Consequently, the K-12 system is now beginning to view OER as a means to achieving sound spending of public dollars (Wiley, Hilton, Ellington, & Hall, 2012) that also supports the movement toward 21st century learning and more flexible models of delivery (Blomgren, 2017b; Kimmons, 2015). Despite these positive financial changes evoked by the initial use of OER and in a manner similar to HE, the costs of educational resources including textbooks have been and will continue to be a concern for K-12 educators.

However, cost is only one of the advantages that K-12 OER holds. In addition to financial efficiencies, five additional benefits have been identified (Bliss et al., 2012). At a macro level, collaborations and partnerships with outside non-profit agencies (Creative Commons, 2016), such as the Society for the Prevention of the Cruelty to Animals (SPCA), are possible with OER. Involvement in local issues related to environmental concerns or citizen science as part of community engagement, mark distinct benefits to the use of OER for K-12. Improving the quality of resources, support for independent learning, and the fifth advantage of knowledge sharing distinguish three further benefits of OER use (Bliss et al., 2012). In the *Multiply K-12 OER* podcasts, OER experts also identified enhancing the professional stature of teaching (Blomgren, 2017a, Kimmons, 2016). As OER for K-12 continues to develop, the benefits of OER will likely continue to grow and thus promises this nascent area of educational studies numerous practice-based and theoretical possibilities. Because of this infancy, the Multiply K-12 OER media project filled an identified awareness niche and this area continues to require further attention by the stakeholders of K-12 education.

In the process of making podcasts and videos to support the graduate studies of in-service K-12 teachers, 14 OER experts were interviewed and six practicing teachers participated in an OER awareness workshop. From these opportunities, OER commonalities and differences between higher education and K-12 were discussed and challenges were also identified. From these interviews, it became apparent that K-12 teacher use of OER can be viewed from several vantage points including implications for individual students and teachers, for an entire class of learners, and for teacher colleagues.

Differentiating and Personalizing Instruction

Broadly speaking, within the K-12 system, recent years have seen stronger strides towards both differentiating and personalizing instruction. Differentiating instruction involves thoughtful selection of applicable teaching methods and approaches so students have different access points into the content and are therefore able to demonstrate their learning in multiple ways according to their abilities (Alberta Education, 2010). An aspect of differentiation involves the individualization of programming by taking differentiated group approaches and further changing them to meet the very specific individual learning needs. Such needs are frequently documented in an individual educational program plan or an instructional support plan that relate to a student's psychologically documented learning profile such as a student's reading ability (Alberta Education, 2017). Both individualization and personalization occur for the specific individual (Bray & McClaskey, 2012). The movement to personalized learning "begins with engagement; is active and effortful; is assessment rich; and is meta-cognitive and transformative" (Calgary Board of

Education, 2012, p.3). Personalization therefore requires a "highly intentional and responsive teaching and learning experience that intensely attends to *each* [sic] student's learning so that *all* [sic] students can participate, progress and achieve" and it is "the result of a complex interplay of interactions around the instructional core" (p. 3). Differentiation, individualization, and personalization as educational practices may be addressed in various ways but the ability to apply the 5Rs to curriculum content commands attention as a multivalent approach to meeting these ongoing classroom changes to K-12 educational delivery.

Teacher Creativity

The study of creativity as an aspect of K-12 teaching has not been broadly studied (Jeffrey, 2006). Unlike widely heralded creative acts in the sciences and popular culture, teacher creativity is fleeting, classroom confined, and coded as commonplace (Rejskind, 2000). Teacher creativity may ebb and flow but when present, it enriches the learning environment through the four attributes of *relevance* of the learning to the student, *ownership of knowledge* by the student, *control of the learning processes* through self-motivation , and *innovation* where by something new is realized or gained (Jeffrey, 2006, pp. 3-4).

These attributes, although described in slightly different words by the K-12 teachers interviewed in the ABOER media project, were all given as potential benefits of OER use by K-12 teachers. Although the terms applied varied with the individuals, the creative potential for teachers to adapt, revise, and share out such resources were consistently identified and it was also noted these practices could then be used with and by students. Because of the nature of K-12 teaching, digital tools and resources have enhanced the creative choices and abilities available, and with deeper OER awareness and district or provincial supports, the creative contributions of teachers, including those made by students, could not be easily matched in a copyright restricted educational landscape.

Contextualizing Curriculum

With OER, the ability to contextualize provincially mandated curriculum becomes more accessible, transparent, and flexible. Aligning curricular goals to the interests of a group of students heralds a common practice of K-12 educators and the initial days with a class frequently involves methods to understand the general interests of the students. Such knowledge is also adjusted when transitory events, such as a major earthquake or world events, allow teachers to select content or make curricular connections that support these in-the-moment interests thus making assignments more appealing, engaging, and relevant. From their professional practices, teachers have experienced that the ability to localize and contextualize curricular content nurtures engagement, comprehension, and appreciation of the unique natural and human elements of where the teacher and students live. Because of contextualizing "a new understanding of cognition is thus implied. Rather than being cast as a locatable process of phenomenon, cognition has been reinterpreted as a joint participation, a choreography" (Davis, Sumara, & Luce-Kapler, 2000, p. 74).

Although publishers attempt to provide accurate content in areas such as ecology, a relatively small area of the biology curriculum, accurately portraying the multiple and unique aspects of the montane forest, a relatively small ecosystem in contrast to the boreal forest would likely not be financially sound. Because most K-12 Canadian textbooks are produced by publishers located in highly populated southern Ontario by people who live and work there (Rollans & De la Chenelière, 2010), the impetus to have something like the

montane forest well-discussed in a textbook is relatively weak in comparison to other content related decisions. This example of the need for place-based learning highlights how the older model of educational publishing has become challenged by the OER movement. Invariably, not all of the content that could be included is included in a copyright restricted environment, and in a country like Canada with its vast and diverse geography and social forces, regional and local content is not adequately represented by textbook companies. This ecological example can be extended to the remaining disciplines taught within schools, and of great import to meeting the Call to Action of the Truth and Reconciliation Commission to indigenize Canadian education at all levels (Truth and Reconciliation Commission [TRC], 2015; University of Regina, 2015). OER allows for teachers who know their groups of learners best to adjust and contextualize the delivery of the curriculum.

Although publishers have historically worked with the various provincial governments to create updated textbooks and other educational resources to support curricular changes (Rollans & De la Chenelière, 2010), there is a substantial time lag involved. In the digital age, content becomes continuously outdated and new contributions emerge more rapidly and ever more frequently. In the age of citizen science and participatory technologies (Dunn, Urban, Cavelier, & Cooper, 2016; Lamb, 2016), the ability for educators to revise, remix, reuse, and redistribute local and current content is a strength of K-12 OER that cannot be duplicated by publishers.

The current K-12 curriculum changes within Alberta and British Columbia reflect the directions of a globalized world with its concomitant political and social changes. In 2016, the K-12 ministry, Alberta Education, published its curriculum *Guiding Framework* that summarizes the connections among education, pluralism, and diversity as follows:

> (T)he curriculum endeavours to develop an understanding of the need for civic responsibilities, …support for social justice for all people and groups . … Through the provincial curriculum, students value diversity and recognize differences as positive attributes. … Students as ethical and engaged citizens, develop respect for democratic principles and processes for decision making. (p. 8)

Teaching about and for diversity requires K-12 educators to be locally adaptive and inclusive of changes occurring within the communities where they teach. This allows for the narratives of small populations and those who have historically lacked access to publication of content, such as First Nations, Metis, and Inuit communities, to indirectly or directly participate in the creation of curricular resources (TRC, 2015). Local concerns related to environmental sustainability, the far north, agriculture, forestry, or social justice issues can be more easily addressed through OER and its practices that thereby allow a teacher to reinforce the general tenets of a discipline to the fecundity of the individual, local case (Kimmons, 2016). This is not to say that broader issues from further afield will not be taught but the silences within the curriculum based in a copyright restricted, textbook centric educational model no longer need be silent.

Learner-Generated Content

OER also allow for learner-generated content and artifacts of learning to become models from which future students may learn or study, a strength of OER for all levels of education. A collective effort, such as building

a wiki, enables students to participate in the shaping of content and contributing through the benefits of participatory technologies (Blomgren, 2017c). Because K-12 learning objects range from a singular image to a textbook, as Benkler (2005) notes the variety of open resources logically inhere various levels of coherence and develop over time with potentially multiple voices, such as in a wiki project. Summarized educational research describes learning as:

> (T)he mindful and effortful involvement of students in the individual and social processes of knowledge and skill acquisition through interaction with the environment. *Learning thrives in contexts that view learners as central participants*, [emphasis added] encourage engagement and activate learners' prior knowledge and evolving understanding of themselves as learners (Istance & Dumont, 2010, as cited in Alberta Education, 2016, p. 8).

Using OER requires students to be participatory in their own learning (Alberta Education, 2013; Petrides, Jimes, Middleton-Detzner, Walling, & Weiss, 2011) and in the future learning of students yet to come. Like any substantial educational change, there are challenges and pitfalls to avoid, mitigate, or accept as an experience not to be repeated. OER practices are no exception to the vagaries of implementation and change but with the confluence of digital technologies and education, the broader stream of changes are shaping the current and future educational resource landscape.

K-12 Teacher Colleagues

At a collegial level, OER encourages educators to exercise the 5 Rs (reuse, revise, remix, redistribute, and retain) of an open educational practice (Wiley, 2014). Such practices are furthered when educators understand Canadian copyright law, fair dealing, and the licensing possibilities through Creative Commons. Educational practices are expansively shifting due to the numerous digital tools that easily allow for locating, curating, reusing, revising, and resharing of resources. This movement is from scarcity-based/inertial frameworks towards abundance-based/enabling frameworks (Batson, Paharia, & Kumar, 2008, p. 91). Nearly a decade ago these authors stated that "open educational resources (OER) are so abundant that the scarcity-based assumptions of educators are challenged" (p. 90). Now, within the age of resource abundance, of both copyright restricted and OER, K-12 teachers need to acquire open education literacies (Ehlers, 2011; Kimmons, 2014) to take advantage of the digital tools and participatory shifts that shape the learning and teaching landscape.

Prior to the 1990s and the flourishing of the open movement, K-12 educators would assist one another through various ways. A common metaphor is that of the binder or some other compendium that held the accumulated teaching resources that a teacher or a group of teachers had assembled to supplement and support the mandated textbooks[ii]. These resources in a pre-digital age of scarcity were integral to teaching and represented hours of searching, locating, acquiring, and reusing, with or without revisions. Such compendiums were part of surviving the first few years of teaching and other educators would supply them to be kind or because they were directed to do so by the school's principal. Teachers would also assemble, informally or formally, to collectively create lessons, units, tests, and major exams, and such a collective model of resource building continues to be part of the professional practice of teachers. Because of the nature of their work, most K-12 teachers do not want to write a textbook or even a chapter for a book but instead apply their creativity and skill to producing smaller learning objects such as lesson or unit plans

and the accompanying assessments (Kimmons, 2014). Overall, the K-12 professional ethos is one of trust and helpfulness, and differs from a higher education context which can be competitive, individualistic, career-oriented, and focused on personal goal achievement as part of the tenure-track career path faculty within higher education (Greene, O'Connor, Good, Ledford, Peel, & Zhang, 2008; Macfarlane, 2016).

But times are changing, as Starr-Glass (2011) notes and invokes Boyer's (1996) model of scholarship and efforts to revitalize higher education through the scholarship of learning and teaching. Through participatory technologies, a "scholarship of sharing" (Boyer, 1996, as cited by Starr-Glass, 2011, p. 4) is digitally possible "in which sharing means active engagement with current students, the scholars of the future. Teaching and its scholarship have become a shared enterprise, a communal act" (p. 4).

Critique of OER

Skeptics of OER question the quality of such resources and contend that the content and approaches have not been vetted through the processes inherent to the publishing industry. This concern is viable and should cause all levels of educators to pause and reconsider how quality OER resources are created and maintained which come at the cost, both personal and financial, of whomever revises or remixes a resource (Kimmons, 2014; Wiley et al., 2012). However, as Kimmons (2015) states: "though accurate, up-to-date content is an essential element of quality, K-12 teachers need resources that can be differentiated for students' diverse learning needs and that can be easily integrated into institutional and state [provincial] requirements of teachers, through meaningful standards alignment and the provision of appropriate supplementary materials"(p. 5). In his 2015 study, Kimmons had middle school and high school teachers evaluate textbooks and compare commercially prepared textbooks, open textbooks, and open/adapted textbooks. Applying a textbook evaluation survey, the participants rated the open textbooks 22% higher overall than the conventional textbooks with the open/adapted textbooks receiving a further 16% above the open textbooks (Kimmons, 2015, p.10). Although research of K-12 OER is nascent and still developing, Kimmons' study suggests that OER quality is highly competitive with that produced within a copyright restricted environment. This finding echoes faculty surveyed in the BC Campus study whereby a "majority of faculty perceive OER to be comparable or superior in quality to traditional, proprietary materials" (Jhangiani et al., 2016, p. 5).

As discussed previously, it is the confluence of digital participatory technologies and CC licensing that have been the combined catalyst for the growth of OER and these combinatory elements will not be subsiding. Positioning for or against OER is a simplistic view of the present and ongoing need for educational resources. As Cronin (2017) aptly states "recognition of the complexities and risks of openness, as well as the benefits—for individuals as well as institutions—should inform both policy and practice" (p. 28).

Conclusion

Education at all levels has been substantially changed with the progression from resource scarcity to resource abundance and these changes have affected various forms of copyright and user rights. In the 2014 Horizon Report (Johnson, Adams Becker, Estrada, & Freeman, 2014) K-12 OER widespread adoption was viewed as a 3 to 5 year trend although in the USA some states such as Utah were strongly ahead of this

projection. Further support for K-12 OER came through the United States Department of Education (2015) #GoOpen initiative that announced materials produced with federal grants would require open licensing thereby allowing K-12 educators and districts throughout the nation open access to the resources produced. However, in contrast, the status of Canadian K-12 OER is not as developed and varies widely from province to province. Currently, the historical educational leaders of Ontario, British Columbia, and Alberta have not established clear policy directives nor technical support in the way of developing repositories even within their own provincial boundaries, with the exception of TeachBC (https://teachbc.bctf.ca/). Overall, there is a substantial Canadian void. As the educational market will always continue to be potentially lucrative, companies such as Amazon are currently beta-testing a new platform that would enable easy uploading, searching, and downloading of OER materials created by K-12 teachers (Molnar, 2016). The profitable market of educational resources will be a contested space.

Ranging from personalization of learning to expression of creativity, the process of creating the ABOER Multiply K-12 OER media project provided a variety of insights, some of which have been previously articulated through OER research and exploratory efforts within higher education. Overwhelmingly, as the producer of the podcasts and videos, I found that there was a range of understanding for OER awareness and use, and these two foci guided the development of the media and transcripts that are now housed on the Blended and Online Learning and Teaching (BOLT) Multi-Authored blog. These CC licensed media were created to support OER awareness and use, and thus enhancing the conceptual shift toward an open pedagogy.

Rather than simply being for or against OER, educators at all levels need to be deeply aware of the various and connected implications of the OER transformation. Within higher education, the momentum has begun to include more than the cost-savings for students with the use of OER textbooks toward a broader sense of open educational practices. For K-12 educators, the greater awareness for the implications of OER requires a complex understanding and response that is broader and deeper than the concept of free resources. Although OER differences exist between HE and K-12, both levels have begun to acknowledge that open educational resources have the potential to revitalize and guide all levels of education toward substantially participatory and inclusive possibilities.

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[i]In Alberta, the provincial curricula is detailed in the Program of Studies for courses delivered in K-12.

[ii]The binder metaphor has been discussed in Professional Development offerings by Verena Roberts and Rhonda Jessen to describe the sharing culture that inheres the K-12 work environment.

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A Collaborative Approach to OER Policy and Guidelines Development in the Commonwealth: The Case of Botswana, Cameroon, and Sri Lanka




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Abstract

Access to relevant learning resources is an important aspect in ensuring inclusive and equitable quality education and lifelong learning opportunities for all as outlined in the sustainable development goal 4 (SDG4). The Commonwealth of Learning (COL) has identified the development of open educational resources (OER) as a potential answer to these challenges. A total of 29 provincial/regional OER policies and guidelines were developed in Sri Lanka, Botswana, and Cameroon closely involving 608 provincial/regional policymakers from the general education system. The innovation of this project lies in the collaborative approach adopted for OER policy/guideline development where a maximum number of policymakers at the provincial/regional level have been included in the policy development process. Key applications of the approach are mass-sensitization of policymakers, identification of champions in each province or region to drive the OER agenda forward, and the development of policies/guidelines tailored to the specific needs of a particular jurisdiction. The paper will also highlight the success factors, challenges, and the follow-up activities of the project.

Keywords: open educational resources, OER, OER policy development, Sri Lanka, Botswana, Cameroon

Introduction

The Incheon declaration introduces the sustainable development goal 4 (SDG4) - Education 2030 agenda towards inclusive and equitable quality education and lifelong learning for all where

> inclusion and equity in and through education is the cornerstone of a transformative education agenda, and we therefore commit to addressing all forms of exclusion and marginalization, disparities and inequalities in access, participation and learning outcomes. No education target should be considered met unless met by all. We therefore commit to making the necessary changes in education policies and focusing our efforts on the most disadvantaged, especially those with disabilities, to ensure that no one is left behind. (UNESCO, 2015, p.7)

Education stakeholders in developing countries of the Commonwealth are increasingly challenged with the quality of learning outcomes for each learner. According to the UNESCO Institute for Statistics (2010), the quality of learning outcomes for each learner depends on many factors among which are the possession of required textbooks and other didactic materials. Textbooks are considered relevant in improving learning outcomes especially in large class sizes, where often, there is insufficient instructional time. The Global Education Monitoring Report (UNESCO, 2016) observed that, expenditure of a country on learning material is a good indicator of its commitment to providing a quality education for all. Further, it recognizes that the provision of textbooks is critical from both the teachers' and students' perspectives. However, Fredriksen, Brar, and Trucano (2015) highlight that many developing countries do not have the resources to provide sufficient access to learning materials in the general education sector. Considering these challenges, there is a need to identify alternative resources that can supplement the existing textbooks. A review of some literature on textbook provision reveals that OER can offer a cost effective and high-quality solution to this necessity (Cape Town Declaration, 2007; Camilleri, Ehlers, & Pawlowski, 2014; Adala, 2016).

The 2012 Paris OER Declaration defines open educational resources (OER) as

> teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. (UNESCO, 2012, p.1)

The *Open Educational Resources in the Commonwealth 2016* report (Phalachandra & Abeywardena, 2016) indicates that the majority of teachers within the Commonwealth perceive OER to be a good solution to improve quality and minimize costs. As stakeholders continue to equip schools with new learning technologies while Internet connectivity continues to improve, especially in developing countries, OER have a real potential to increase access and equity in education.

The Commonwealth of Learning, or COL (www.col.org), is an intergovernmental organization created by Commonwealth Heads of Government to promote the development and sharing of open learning and distance education knowledge, resources, and technologies. Hosted by the Government of Canada and headquartered in Burnaby, British Columbia, Canada, COL is the world's only intergovernmental organization solely concerned with the promotion and development of distance education and open learning. COL actively helps developing nations improve access to quality education and training. In this

regard, COL's Kuala Lumpur Declaration (Commonwealth of Learning, 2016a) recommends the mainstreaming of OER use by developing strategies and policies at governmental and institutional levels to enhance quality while potentially reducing the cost of education.

In the lead-up to the 2014 Regional Focal Points Meeting, COL's Focal Point for Sri Lanka (Commonwealth of Learning, 2015a), Botswana (Commonwealth of Learning, 2015b), and Cameroon (Commonwealth of Learning, 2015c), had identified top priorities for their countries where COL can further support the national agenda in the next six years. As a follow up, COL, through the *Open Educational Resources for Skills Development* project, looked to focus on the areas of: (i) improving the content and quality of textbooks; and (ii) upgrading of primary and secondary curriculum in these countries through the use of OER, with the support of the respective Ministry of Education (MoE).

Sri Lanka

The MoE in Sri Lanka has provincial ministries of education representing the nine provinces which are Central, Eastern, Northern, North-Eastern, North-Western, Sabaragamuwa, Southern, Uva, and Western. While the MoE is responsible for preparing national strategic plans for the general education sector based on national policies, the provincial ministries of education have the autonomy to adopt policies to suit the unique needs of each province in line with national education policies and current reforms (Ministry of Education - Sri Lanka, n.d.).

In Sri Lanka, there are approximately 4 million primary and secondary learners spread across 10,000 plus schools island-wide (Ministry of Education Sri Lanka, 2016). Based on the *Education First Sri Lanka* report (Ministry of Education Sri Lanka, 2013), the government handles 30 million copies of textbooks a year at a cost of Rs. 3,000 million to provide free textbooks to learners up to General Certificate of Education (G.C.E.) Ordinary Level under the "free education policy." In this regard, OER-based textbooks can be considered as a potential substitute, which could aid in reducing the cost of free textbooks while maintaining a high standard of quality and interactivity.

In 2016, with the guidance of the MoE and in collaboration with the Open University of Sri Lanka (OUSL), COL supported an ambitious project to advocate, sensitize, and develop OER policies for the nine provincial Ministries of Education in Sri Lanka (Karunanayaka, 2016; Karunanayaka & Abeywardena, 2016). The aim of the project was to provide direction in the use of OER for increasing access to quality learning materials and to support quality teaching and learning in the general education system.

Using Sri Lanka as the model, similar projects were initiated in Botswana and Cameroon to develop provincial OER policies. However, further to advice from the MoE in Botswana and Cameroon, the word "policy" was replaced with "guideline" to allow the execution of the project with minimum bureaucratic interference. Also, Botswana and Cameroon have "regions" as opposed to "provinces." Therefore, the project set out to develop "regional OER guidelines" within these two countries.

Botswana

Botswana is faced with a continued decline in student performance, which has been attributed to poor quality education. According to Mphale and Mhlauli (2014), students' academic performance has been declining at an alarming rate since 2010; one of the factors contributing to decline in academic

performance is the quality of teaching and learning resources available. According to UNESCO, Botswana is the only country in Sub-Saharan Africa to have adequate provision of textbooks close to a 1:1 ratio for all subjects and all secondary grades (UNESCO, 2016). However, the average cost for a set of textbooks from grades 9 to 11 is USD 99.60 and the government needs a budget equivalent to 1.8% of the Gross National Product (GNP) to maintain this level of access (Fredriksen, Brar, & Trucano, 2015). Given this scenario, adopting OER would enable students and teachers to access a larger pool of quality resources for use as supplementary content to prescribed textbooks. This will translate into immediate positive utilization of the ICT infrastructure currently being provided to the schools through both government and private sector participation projects.

In Botswana, the Ministry of Education and Skills Development (MoESD) is the headquarters of education where national administrative responsibilities and policy formulation is undertaken. There are 10 regional operations offices around the country undertaking administrative responsibilities of the MoESD. The 10 MoESD regional operations offices are in the Kgatleng Region, Kweneng Region, Southern Region, Kgalagadi Region, Gantsi Region, North West Region, Chobe Region, North East Region, Central Region, and South East Region. While the MoESD is responsible for developing national policies, the regions are responsible for ensuring that these policies are implemented within their administrative jurisdictions (Tladi, 2016).

An advocacy program was conducted by COL in Botswana with the objective of providing direction for the use of OER to increase access to quality teaching and learning material in the general education system. The project developed OER guidelines for the 10 regional offices in Botswana with the consent and support from the MoESD.

Cameroon

On account of its bi-cultural French/English heritage, Cameroon's educational system is diverse and multi-faceted. Efforts to supply schools in Cameroon with textbooks and course books are constantly challenged with the recurrent economic downturn due to the falling prices of raw materials in the world market. A 2015 World Bank report shows that the average course book-to-learner ratio in Cameroon is 1:12 (Fredriksen et al., 2015). Disparities are greater in the three northern regions of Cameroon where accessibility to some areas over the last three years has been jeopardized by terrorist attacks. Only 11% of learners in these areas have access to at least one textbook, while 17% of classrooms operate without a single textbook in French or English. The 2013/2014 statistical yearbook of the Ministry of Basic Education (2014) reported that in most classrooms, each French/English reading book is shared amongst 19 learners and each mathematics book is shared amongst 17 learners. The 2015 World Bank Report (Fredriksen et al., 2015) also noted that the price of course books is very high and undoubtedly hinders a vast majority of parents from purchasing textbooks for their children.

To potentially address these issues, COL worked with the Ministries of Basic Education (MINEDUB) and Secondary Education (MINESEC) of Cameroon to launch a national advocacy and sensitization project that introduced OER to policymakers in the 10 regions of the country: Adamawa, Centre, East, Far North, Littoral, North, North West, West, South, and South West. Regional OER guidelines were developed by each regional delegation for mainstreaming OER into the general education system locally (Nkwenti, 2017).

This paper details the collaborative approach adopted for OER policy/guideline development where a maximum number of policymakers at the provincial/regional level have been included in the policy development process. The paper also highlights the success factors, challenges, and the follow up activities of the project.

Methodology

The policy/guideline development in each country was done in four stages. The first stage was to prepare a country specific OER policy/guideline template. A consultant was hired from each country who had a unique knowledge of the education system in general, the specific requirements of each province or region as well as an in depth understanding of how OER can be implemented in these jurisdictions. The consultant then drafted the policy/guideline document taking into consideration the literature; existing policy documents such as the COL's Institutional OER Policy Template (Commonwealth of Learning, 2016b), the Government Policy Development Template (Butcher, 2012), and national education policies and reforms. The drafting of the document followed an iterative process which benefitted from peer review and expert feedback before finalizing. The first version was compiled in English. However, the document was translated into French in Cameroon to accommodate the Francophone regions.

The second stage concentrated on conducting advocacy meetings with the provincial/regional policymakers. The first step in this process was to brief the MoE regarding the project with the aim of gaining their full cooperation. COL officially informed the secretaries to the MoE in each country regarding the consultant, the nature of the project, and the expected outputs of the project which are to:

- Prepare a draft OER policy/guideline template that caters to the requirements of the provinces/regions;
- Sensitize and seek collaboration for the project from the key stakeholders at the MoE;
- Build awareness among key stakeholders in the provinces/regions on the concept and potential impact of OER;
- Advocate the necessity and benefits of a provincial/regional OER policy/guideline for education;
- Initiate the process of drafting OER policies/guidelines for each province/region;
- Identify champions in each province/region who will draft the OER policies/guidelines;
- Provide on-going online support/follow-up to champions leading up to a final draft policy/guideline;
- Produce a project report to be presented to the MoE that will facilitate the adoption and implementation of the policies.

Following the correspondence from COL, the consultant met with the officials of the MoE to formulate a plan of action for the project. The MoE would then issue an official letter to all provinces/regions

instructing them to extend their full cooperation to the success of the project. Based on the advice of the MoE, the consultant scheduled field visits to each of the provinces/regions as shown in Appendix A.

To facilitate the field visits and the sensitization process, COL had provided the consultants with high-quality material on OER creation, use, and policy development in the forms of printed books, toolkits, PowerPoint slides, and videos. The consultant used these materials along with the OER policy template created to conduct the advocacy and sensitization of the key policymakers at each province/region. All staff of the provincial/regional offices were invited to participate in the meetings.

One champion had been identified from each province/region during the field visits to be the contact person for stage three. During this stage the consultant coordinated with the champion to follow-up on the progress with respect to the development of the provincial/regional OER policy/guideline draft. Virtual support was provided via email, skype, and phone to the champions who were tasked with gathering the feedback from the policymakers in the province/region and finalizing the draft document.

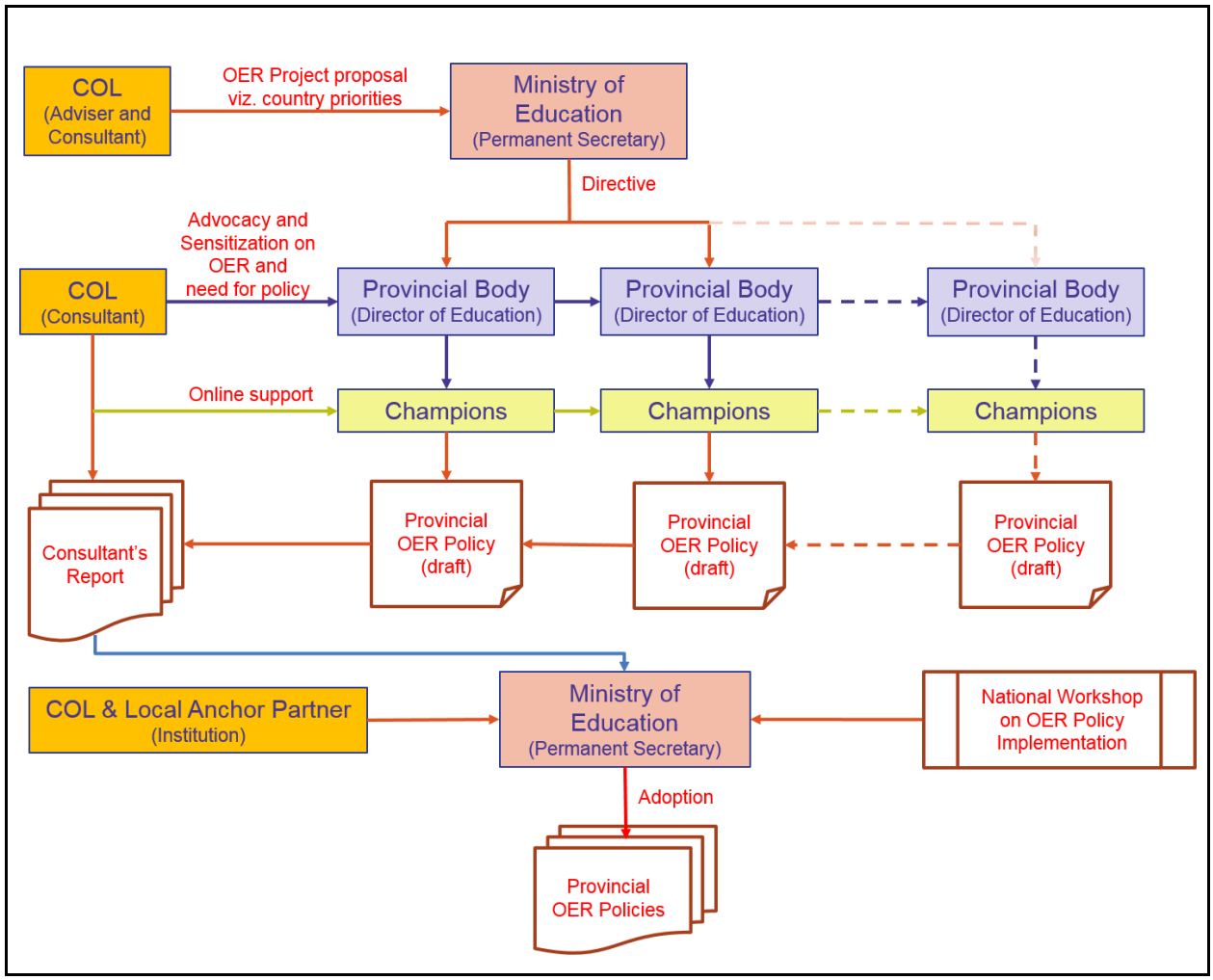

Figure 1. Collaborative approach to provincial/regional OER policy/guidelines development. Adapted from "A bottom-up approach to OER policy development," by I.S. Abeywardena, 2017, Proceedings of the Creative Commons Global Summit 2017, Toronto. Licensed under CC-BY 4.0 International license.

The final stage was to collect all the draft provincial/regional OER policy/guideline documents and prepare a project report which outlined the process, efforts, and lessons learned. This report was shared with the MoE for further action regarding adopting and implementing the policies/guidelines developed. Figure 1 illustrates the model used for developing OER policies using the collaborative approach.

Results

The key outputs of the project are (i) provincial/regional OER policy/guideline templates; (ii) advocacy and sensitization of key policymakers in the education sector in three countries; (iii) development of draft provincial/regional OER policies/guidelines tailored to the local context; and (iv) project reports which were shared with the MoE highlighting the way forward with respect to adopting and implementing the policies. Table 1 summarizes the key outputs of the project.

Table 1

Key Outputs of the Project

Country and project duration	**Number of provinces or regions**	**OER policy or guideline template**	**Number of policymakers sensitized**	**Number of policies or guidelines developed**	**Final project report**
Sri Lanka (5 months)	9	http://oasis.col.org/handle/11599/2360	58	9	http://oasis.col.org/handle/11599/2386
Botswana (4 months)	10	http://oasis.col.org/handle/11599/2438	157	10	http://oasis.col.org/handle/11599/2437
Cameroon (3 months)	10	http://oasis.col.org/handle/11599/2673 (EN) http://oasis.col.org/handle/11599/2674 (FR)	393	10	http://oasis.col.org/handle/11599/2672
Total			**608**	**29**	

The key takeaways from the project based on the feedback provided by the participants are summarized in Table 2.

Table 2

Key Takeaways From the Project Based on Participant Feedback

Aspect	**Feedback**
Concept of OER and its significance	● OER, Creative Commons, Open Licensing, and the 5Rs are new concepts for many policymakers in the education sector. ● Having access to free and open resources as OER is very beneficial to the school education system. ● OER will be used as supplementary resources to the material provided by Government. ● Creation and use of supplementary resources are taking place in certain jurisdiction without the proper underpinning technological and theoretical knowledge. ● It is important to raise awareness about these concepts, and motivate teachers to engage in OER creation and sharing. ● Access to OER can help mitigate poor student performance and contribute towards improving the quality of student results. ● OER provide teachers with an opportunity to reduce dependence on the prescribed textbooks. ● There is a need to embrace the spirit of sharing to change the world because people will change when they have the knowledge.
Need for an OER policy	● The need for an OER policy is accepted and its significance is realized. ● OER can be used to cut down the cost of education financing. ● Proper guidelines from the central Ministry of Education is needed for adoption and implementation. ● There is a need to involve other stakeholders such as writers, writers' associations, and publishers in OER initiatives. ● OER sensitization must filter down to the teacher training institutions to ensure that this valuable knowledge and skills are part of the teacher training curriculum.
Challenges	● Technical infrastructure and facilities in schools need to be upgraded. ● A more conducive "school climate" and teaching-learning environment is required. ● Increasing teacher motivation to engage in innovative teaching-learning processes and material development is crucial. ● Schools and teachers need to be encouraged to promote the spirit and habit of sharing locally produced content for the benefit of students. ● Time constraint is a severe challenge faced by all, including teachers and policymakers.

Suggestions	● Existing ICT initiatives, facilities, and resources to be used to promote OER creation, sharing, and use by teachers. ● The central Ministry of Education needs to coordinate and regulate a set of minimum connectivity standards/specifications for schools. ● Schools with good connectivity should assist others with access to OER content by downloading and sharing. ● Schools should consider allowing students to bring mobile devices, such as smartphones and tablets, to school which they could use to access and take advantage to freely available online resources such as OER. ● Raising awareness and skill development of teachers is required. ● OER can also be used for self-development of staff through continuous knowledge acquisition and lifelong learning. ● Encouraging teachers to create OER in their native languages is very important. ● Providing guidance, support, and motivation for teachers is needed. ● Collections of already developed materials should be properly catalogued to increase access. ● Creating "interest groups" of school teachers and others at provincial/regional level would be useful. ● OER integration can be linked with existing initiatives at school/provincial/regional levels (e.g., LMS, e-Studios, Open Schools) ● A proper monitoring and evaluation system needs to be put in place.

Discussion

Based on COL's publication *A Government Policy Development Template to Progress Effective Implementation of Open Educational Resources* (Butcher, 2012), a few key stages are to be followed when developing a national OER policy. One of the key stages is a consultation process with key stakeholders. When considering the national consultation process, usually only a few top level stakeholders participate in these meetings (Commonwealth of Learning, 2017a; Commonwealth of Learning, 2017b). Therefore, this process largely isolates the actual implementers of the policy in these provinces and regions during the development stage. Furthermore, the implementers of the policy would not be as sensitized about OER as the top-level stakeholders participating in the consultation process. In turn, this results in a lack of ownership by the policy implementers.

The Collaborative Approach to OER Policy Development

The innovation of this project lies in the collaborative approach adopted for OER policy/guideline development where a maximum number of policymakers at provincial/regional levels have been included in the policy development process. A key application of this approach is the mass-sensitization of policymakers where 608 key officials have been sensitized in the three countries (Table 1) on the concept of OER and the impact it would have in the general education system. The identification of champions in each province or region also helped to establish a key contact person who would drive the OER agenda

forward in the province/region. In the long run, this will be immensely beneficial to the MoE with respect to implementing the OER policies and mainstreaming OER. Further, self-motivated individuals would proceed to pilot OER within their capacities due to the new found knowledge and skills.

Another key application of developing OER collaboratively is that the policy/guideline documents can be tailored to the specific needs of a particular province or region as summarized in Table 2. These might be different and more sensitive than the needs addressed in an overarching national OER policy. For example, in Sri Lanka, there are two main mediums of instruction, which are Sinhala and Tamil. The Sinhala schools are predominantly based in the Southern region while the Northern region comprise of Tamil speaking schools. Furthermore, there are cultural differences which are linked to the two languages in addition to the historical nuances which have been imposed due to a three decade long civil war. By allowing provinces to have an independent OER policy, they are able to address the unique needs of the schools, teachers, and students. Another example is Cameroon where there are Anglophone and Francophone regions. The development of regional OER guidelines allowed the policymakers to customize the policies to suit the cultural and language context in their jurisdiction. Feedback from the far north region reads:

> After diligently reading through the document, your proposals are pertinent. We think that the document will contribute in resolving the problem of lack of school textbooks in our educational system if it is adopted. While encouraging you, receive our sincere congratulations for the initiative. From the Regional Delegation of Secondary Education, Far North. (Nkwenti, 2017)

Success Factors

The project can be considered quite large-scale given that it covered three countries and 29 provinces/regions. The geographical isolation of some of these provinces/regions, political volatilities, natural disasters, cultural nuances, and language barriers, among others, challenged the project from the inception. However, the project successfully developed 29 provincial/regional OER policies/guidelines while advocating and sensitizing a large pool of policymakers on the potential impact of OER. One of the key factors behind the successful completion of the project is the cooperation and patronage received by the MoE. The directives issued by the MoE enabled the consultants to achieve the objectives of the project with a high success rate. Another factor which contributed to the success is the field visits; the physical presence of the consultant at the provinces/regions and the use of printed and digital OER to sensitize the participants, allowed them to relate OER to the needs of their jurisdiction. However, the major success factor of the project was the passion, persistence, and perseverance of the consultants who truly believed in the potential of OER for increasing access and equity in their countries.

Challenges Faced

In Sri Lanka, one of the major challenges was the busy work schedules of officials in the provincial Ministries of Education and Departments of Education. Although they were very aware of the importance of OER for the future of the general education system in the country, certain other official matters took priority. Another factor which compounded this was the natural disaster situation declared in Sri Lanka due to severe flooding and the blast in a military complex that affected hundreds of schools. Due to these barriers, the project faced some delays and limited participation in Sri Lanka.

In Botswana, the preparations for its 50th anniversary celebrations interfered with scheduling of the field visits as the government officials were preoccupied. Lack of communication was another issue encountered due to the poor connectivity of the rural regions. This hindered the online support provided to champions during the finalization stage of the guidelines. The large size of the country made travel to all 10 regions extremely challenging, physically and logistically. Lastly, a restructuring of the ministries in Botswana during the project made the final compilation of the report somewhat challenging. This restructuring exercise resulted in separation of the MoESD into two new ministries: one for Basic Education and another for Tertiary Education, Research, Science, and Technology. The OER initiative was then assigned to the Ministry of Basic Education. This move has therefore created a need for re-sensitization of the new leadership at this ministry on OER.

In Cameroon, travelling to the different regions was an arduous task due to the nature of roads and unstable flight schedule. The consultant's vehicle regularly suffered breakdowns due to the nature of the roads. Further, two regional delegates did not circulate the information about the scheduled field visit on time, even though they received notice two weeks earlier. This resulted in delays in an already tight schedule. The bilingual nature of the country required that the regional OER policy template and the PowerPoint presentations be translated into French. This proved to be very challenging because the consultant had to contract the services of a translator.

Follow-up Activities

A National Workshop on Provincial OER Policy Implementation for the nine provinces in Sri Lanka was conducted in February 2017 by COL in partnership with the MoE and the OUSL. The workshop resulted in finalizing the implementation plans for the nine policies and increasing capacity in OER for 42 policymakers in the general education system. Echoing the thoughts by the Minister of Education, the Secretary stated that they consider OER to be a viable method for guaranteeing 13 years of education for all Sri Lankan children and to achieve the Prime Minister's vision of digital textbooks by 2020. Once implemented, the policies will potentially affect 4 million learners in 10,000 schools in Sri Lanka. The workshop also resulted in the National Colleges of Education pledging to make OER a part of the curriculum for training teachers. Based on the success of this follow-up model, similar national workshops on regional OER guideline implementation are due to be organized in Botswana and Cameroon.

Conclusion

In 2016, the Commonwealth of Learning (COL) undertook an ambitious project to develop OER policies and guidelines for nine provinces in Sri Lanka and 10 regions in Botswana and Cameroon each. The project was conducted by local consultants with the assistance of the MoE within the scope of the general education system. The consultants travelled to each province/region in the country and interacted with key policymakers to advocate the use of OER and sensitize them on how OER can supplement existing textbooks for increased access and equity. Further, the policymakers collaboratively developed draft OER policies/guidelines, taking into consideration the unique cultural, social, political, and language requirements of their province or region. Champions were identified from each region to gather feedback on the process and finalize the draft policies to be submitted to the MoE.

The innovation of this project is the adoption of a collaborative approach to OER policy development. Traditionally, OER policy development is conducted through a high-level consultation consisting of a limited number of stakeholders. As a result, the officials who are responsible to implement the policies at the provincial/regional level have little ownership of the process and minimal knowledge of the potential impact OER can make in their respective jurisdictions. Through the collaborative approach, we were able to develop 29 provincial/regional OER policies/guidelines in three countries within a duration of approximately six months. Furthermore, we were able to sensitize 608 provincial/regional policymakers on the benefits of using OER as supplements to the school curriculum. Additionally, the development of provincial/regional OER policies/guidelines, independent of an overarching national policy, allowed the local policymakers to contextualize the policies/guidelines according to the cultural, social, political, and language needs. The identification of provincial/regional champions allowed for quick feedback and finalization of the draft policies/guidelines to be presented to the MoE for adoption and implementation. The champions also act as enablers to mainstreaming OER in the long run.

This project makes a significant contribution to the body of knowledge in terms of OER policy development for the general education system within Commonwealth countries. The collaborative approach adopted is a much more inclusive approach to OER policy development and results in increased ownership and mass-sensitization of key stakeholders across countries. Based on the success of the follow-up National Workshop on Provincial OER Policy Implementation held in Sri Lanka, similar implementation workshops are planned for Botswana and Cameroon.

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Appendix A

Field Visit Schedules

Table A1

Field Visit Schedule for the Nine Provinces of Sri Lanka

Province	**Date and time**	**Venue**
Northern	20/04/2016 2.00-4.00 p.m.	Provincial Department of Education-NP, Jaffna.
North-Central	22/04/2016 10.00 am- 12.00 noon	Chief Ministry-NCP, Anuradhapura.
Central	18/05/2016 11.00 am – 1.00 pm	Provincial Department of Education CP, Kandy.
North-Western (Wayamba)	18/05/2016 2.30 pm – 4.30 pm	Provincial Department of Education -NWP, Kurunegala.
Sabaragamuwa	24/05/2016 12.00 noon – 2.00 pm	Provincial Department of Education -SaP, Ratnapura.
Southern	29/06/2016 2.00 – 4.00 pm	Provincial Department of Education -SP, Galle.
Uva	04/07/2016 2.00 – 4.00 pm	Provincial Department of Education -UP, Badulla.
Western	04/08/2016 7.30 – 9.30 am	Provincial Department of Education -WP, Greenpath, Colombo 7.
Eastern	08/08/2016 1.00 – 3.00 pm	Provincial Department of Education -EP, Trincomalee.

Table A2

Field Visit Schedule for the 10 Regions of Botswana

Region	**Date and time**	**Venue**
Southern	13/09/2016 0830 – 1200hr	Kanye Education Centre
Kweneng	14/09/2016 0800 – 1200hrs	Molepolole Regional Office

North East	15/09/2016 0930 – 1200hrs	Francistown Ntshe House Regional Offices
Chobe	16/09/2016 0800 – 1300hrs	Kasane Education Centre
North West	19/09/2016 1000 – 1300hrs	Maun Education Centre
Gantsi	20/09/2016 0800 – 1130hrs	Gantsi Education Centre
Kgalagadi	22/09/2016 0800 – 1200hrs	Kang NonFormal / BOCODOL Centre
South East	26/09/2016 0800 – 1300hrs	Gaborone NDB Building Offices
Kgatleng	03/10/2016 0900 – 1200hrs	Mochudi Education & Media Centre
Central	05/10/2016 0900 – 1200hrs	Serowe Regional Offices

Table A3

Field Visit Schedule for the 10 Regions of Cameroon

Region	**Date and time**	**Venue**
East	14/10/2016 9 am – 11 am	Conference Hall, Regional Delegation MINESEC .
South	17/10/2016 10 am – 12 pm	ENIEG Conference Hall EBOLOWA.
Centre	18/10/2016 10 am - 12 pm	Conference Hall, Regional Delegation MINEDUB.
West	20/10/2016 11 am – 1 pm	Conference Hall, Regional Delegation of MINESEC.
North West	21/10/2016 9 am - 11 pm	Conference Hall, Regional Delegation of MINESEC.
South West	24/10/2016 9 am – 11 am	Conference Hall, Regional Delegation MINEDUB.
Littoral	25/10/2016	Conference Hall, Regional

	9 am – 11 am	Delegation MINEDUB.
Far North	31/10/2016 9 am – 11 am	Conference Hall, Regional Delegation MINEDUB.
North	01/11/2016 9 am – 11 am	Conference Hall, Regional Delegation MINEDUB.
Adamaoua	03/11/2016 9 am – 11 am	Conference Hall, Regional Delegation MINESEC.

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Connecting OER With Mandatory Textbooks in an EFL Classroom: A Language Theory–Based Material Adoption

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Abstract

Systemic functional linguistics (SFL) theory focuses on developing language learners' meta-linguistic understanding of the interrelation among linguistic form (grammar/vocabulary), meaning, and context. Guided by SFL when using a mandatory textbook and open educational resources, this study investigates how exposure to this blended teaching and learning context may impact English-as-a-foreign-language (EFL) learners' adjustment to materials used in their learning, as well as their learning practices. By drawing on the written documents of four students written, and on interviews conducted with these students over an academic semester in an EFL writing course, this qualitative study, through content analysis and discourse analysis, shows that the SFL theory-based material adoption did a good job of supporting EFL students in their internalization of language knowledge from both open educational resources and traditional textbooks, while also enabling students to use materials flexibly instead of passively following along with the content in the mandatory textbook. The flexibility of the students participating in the study was particularly reflected by their ability to construct principled knowledge informed by SFL and to independently apply such knowledge to effectively navigate literacy practices (e.g., critical construction and deconstruction of discourses).

Keywords: material adoption, mandatory textbook, OER, systemic functional linguistics, language teaching

Introduction

In many language classrooms, student learning is primarily reliant on the way in which the teacher delivers textbook[i] content (Tomlinson, 2003). Such reliance is particularly salient in English-as-a-foreign-language (EFL) contexts, where limited language-learning opportunities are found outside the classroom or where there exists traditional cultural worship of the authority of textbooks (Kwak, 2017; Wang & Farmer, 2008; You, 2004). However, in the current, globalized English context, to effectively participate in diverse communicative contexts EFL learners are expected to have knowledge of English that is sophisticated enough to assist them in constructing and/or deconstructing diverse modes of discourses in multiple dimensions: not only grammar and vocabulary, but also how grammar and vocabulary are used to realize the meaningful content of discourses (Macken-Horarik, 2012; Paltridge, 2001; Yasuda, 2015). This means that textbooks used in the classroom should deliver effective information that can help students understand how to create and unpack content. But a perfect textbook that could achieve this task does not exist; thus, the agency of teachers in balancing and synthesizing materials[ii] (i.e., both textbooks and supplementary resources) is crucial. As Donato and McCormic (1994) claim, the value of materials is ultimately dependent on how a teacher mediates those materials; without this mediation, the content of materials will always be statically embedded.

Fortunately, in this Web 2.0 world, the widely-available open-educational resources (OER), such as free research articles, Web-based practices, and reading materials, provide an optimal avenue for teachers to reflect upon pedagogical issues in their classroom and to collect supplementary materials, even in contexts where teacher education is constrained (Blyth, 2014; Hilton, 2016; Mushayikwa & Lubben, 2009). While these materials are rich in Web content and provide diverse perspectives on language teaching and learning, teachers still need to carefully curate and organize them (Kwak, 2017). In particular, given the linguistic challenges prominent in most EFL classrooms, in which students have difficulty in making appropriate linguistic choices in achieving meanings, the use of mandatory textbooks and OER has to be supported by an effective language theory that can prepare students for meeting the expectations of international English language communities (Ariza & Hancock, 2003; Zhang, 2017). However, due to cultures that emphasize the use of mandatory textbooks, the use of OER in many EFL contexts (e.g., China) is still in its infancy, and few empirical studies, let alone theory-based action research, have emerged (Kwak, 2017; Wang & Farmer, 2013). Therefore, in EFL contexts, there is an imperative need for focusing on the triadic interaction among the mandatory textbook, OER, and a language theory; at the same time, it is also important to investigate how EFL students can adjust to such a blended learning environment and be effectively supported in managing their academic discourse (Gibbons, 2006; Paltridge, 2001).

Literature Review

Textbook or OER Use in a Language-Teaching Context

Research in relation to language learning materials has been limited to analyses of their content (Römer, 2004; see also Mukundan & Ahour, 2010). Little attention has been focused on the relation between the agency of EFL teachers and the way they use materials (Blyth, 2014; Menkabu & Harwood, 2014). For example, Kwak's (2017) ethnographic study in a Korean university showed that the use of OER supported the language learning of EFL students and also assisted teachers teaching in the classroom. Similarly, Allen's (2008) case study of 12 foreign language teaching assistants using teaching materials in a U.S. college showed that these teachers used different teaching practices, which points to the importance of a teacher's role in relation to the materials used (e.g., teachers whose first language is not the language they teach relied more on external materials). Echoing Allen, Menkabu and Harwood (2014) used interviews and observations to investigate the use medical English teachers make of teaching materials in a classroom at a Saudi Arabian university, and concluded that the way in which each teacher adapted materials differed because of various factors (e.g., teacher knowledge, time constraints, and their own conceptualization of language learning and teaching). In sum, the few studies that looked at textbook use in language-teaching contexts highlighted the teacher's role by describing the interaction among teachers, students, and materials.

However, to be linguistically and culturally appropriate (in written or spoken discourse), language users have to simultaneously demonstrate appropriate links among grammar, vocabulary, and contextually-appropriate meaning, which calls for a theory-based intervention that addresses interactions among teachers, students, and materials (Kwak, 2017; Paltridge, 2001; Schleppegrell, 2001; Zhang, 2017). In addition, given the availability of OER, it is surprising that few studies have focused on how teachers use OER to enhance their language teaching in EFL contexts (Blyth, 2014). Therefore, it is crucial to add to the literature on material use by highlighting how a theory-based use of materials impacts the adjustment of EFL learners to a blended learning environment, as well as their language learning practices (Menkabu & Harwood, 2014; Paltridge, 2001).

A Systemic Functional Linguistic Perspective on Material Adoption in Language Classrooms

By providing students with explicit knowledge about the triadic relationship among vocabulary/grammar, meaning, and context, a systemic functional linguistics (SFL)-based curriculum for material use emphasizes the development in students of regulatory skills in constructing or deconstructing English discourse (Bawarshi & Reiff, 2010; Halliday, 1994; Harman, 2013; Paltridge, 2001). Its emphasis aligns well with the language classroom's need to effectively use materials as learning and teaching resources.

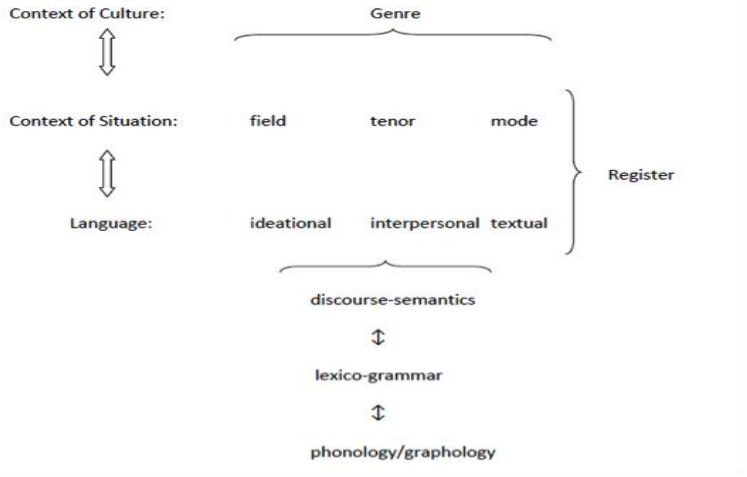

Figure 1. Context, meaning, and linguistic realization. Adapted from *Genre: An introduction to history, theory, research, and pedagogy* (p.33), by A. S. Bawarshi & M. J. Reiff, 2010, West Lafayette, IN: Parlor Press. Copyright 2010 by Parlor Press.

As shown in Figure 1, SFL explicitly provides a multi-layered explanation of language, unveiling the myth of authentic language use. To be more specific, learners, while constructing or deconstructing discourse, have to know the three register variables: (1) what the discourse is about (*field*), (2) who the discourse is positioned with (*tenor*), and (3) how the discourse is conveyed (*mode*). Connecting with the three variables, SFL further explains the emergence of the three meanings (i.e., the content) of discourse:

1. *ideational meaning*, as a semantic realization of field, concerns the language users' representation of the main gist of language activities and the logical relationships among them;

2. *interpersonal meaning*, as a semantic realization of tenor, concerns the manner of interaction among discourse participants or their evaluative stance toward the subject of the discourse; and

3. *textual meaning*, as a semantic realization of mode, concerns the way of organizing information in a coherent way.

With even more micro-layers, SFL also provides linguistic categories at the level of lexico-grammar (vocabulary/grammar) to more explicitly show how the three meanings are constructed or deconstructed. These key categories help highlight particular language features in realizing ideational meaning. For instance, with the assistance of the category *participant*, non-human nouns or nominalized nouns are identified as achieving part of the ideational meaning in an academic context, while pronouns do the same in spoken discourse. Similarly, in relation to interpersonal meaning, the lexico-grammatical categories *mood* (the order of subject and predicate) and *appraisal resources* (the category that deals with evaluative stance) have also been identified as demonstrating features of

interpersonal meaning in our communication. For example, *declarative mood* (the order of subject followed by predicate) predominantly occurs in academic writing. *Attitude* (words that indicate a language user's attitude), *graduation* (words denoting or connoting the different semantic degree, such as an intensifier), and *engagement* (words denoting or connoting the source or certainty of information, such as a citation or different reporting verbs) have also been differently distributed in written English and spoken English (e.g., more engagement resources used in written English than spoken English). For textual meaning, categories include *cohesive devices* (e.g., conjunction words, lexical repetition) and *theme patterns* (e.g., the repetition of the first element in a sentence that carries ideational meaning). Take the following sentences as an example of these categories:

> Learning a foreign language can help us know a foreign word. In addition, it can also help us know a different culture.

In the two example sentences, the cohesive device *in addition*, and the repetitive themes *learning a foreign language,* and *it,* among others, help connect the two sentences (for other cohesive devices or thematic patterns, see Halliday, 1994). These categories offer students an explicit way of constructing meaning or deconstructing the content of diverse channels of discourse, echoing the expectations of international English communities and indicating the plausibility of applying SFL to a classroom that lacks knowledge of how to effectively use teaching and learning materials.

Although not specifically focused on material use, recent studies show that teachers who implemented SFL-based teaching better supported their students' language performance, especially in the context of English-as-a-second-language (ESL). For instance, in the ESL context, by using SFL as an instructional tool, Gibbons (2006) showed that students gained meta-linguistic knowledge about language use in different contexts (e.g., academic register versus spoken register). For example, students used discipline-specific words (e.g., technical words) in talking about a physical phenomenon. In a more recent study, Symons, Palincsar, and Schleppegrell (2017) demonstrated how SFL-based categories (e.g., participant) helped fourth-grade ESL students overcome their knowledge constraints to effectively interact with their teacher in terms of the ideational meaning of texts. Swami (2008), one of the few studies in the context of EFL, showed that the explicit teaching of SFL-related constructs enabled students to better structure their writing (e.g., students' skills in connecting textual meaning with cohesive devices, and connecting passive voice with interpersonal meaning, were improved). Similarly, Yasuda's (2015) SFL-based reading and writing instruction revealed that the SFL-based constructs enabled EFL students to attend to both meaning and linguistic choices while gaining in-depth knowledge about reading and writing (e.g., students' use of nominalization to achieve objectivity in texts). In sum, these studies illustrated the usefulness of SFL in facilitating language teaching, making it a potential mediating tool for connecting material use to language teaching. Nonetheless, given the compatibility of SFL with language teaching as well as the importance of materials in language-teaching contexts (especially EFL contexts), there is almost no empirical research that harnesses SFL theory in the teaching of EFL through textbooks or OER.

Given the limited literature on using materials in language-teaching contexts as well as the power of SFL, this study is guided by the following research questions, which link together questions of SFL-based learning, the use of different materials in teaching and learning, and the context of EFL learners:

1. How does SFL-based use of materials impact the adjustment of EFL students to material-based learning; and

2. How does SFL-based use of materials impact the language learning practices of students, if at all?

Methodology

Research Context in China

Similarly to many other EFL teaching contexts, English-language teaching in China requires the use of textbooks approved by its ministry of education (Kwak, 2017; You, 2004). The mandatory books used in Chinese EFL contexts are generally edited by domestic Chinese experts of the English language. For instance, in the mandatory textbook used for written English learning, the basic content includes a reading text with the purpose of fostering reading comprehension in readers. In addition, there are instructions for language practices, which cover the structure of a genre (e.g., argumentation or exposition) and key linguistic features. However, due to a lack of teacher education, teachers generally focus on vocabulary or how to maintain structural accuracy (You, 2004; Zhang, 2017).

As the author of this paper and also as an English writing instructor in a top-rated university in China, I came back from the United States with years of research experience in ESL and EFL contexts. Particularly, given my empirical experiences with SFL, I was determined to transform the style of language learning generally imposed on students, taking it away from its traditional focus on learning vocabulary or how to maintain structural accuracy from one designated textbook. In China, when I received the designated textbook from the university, I found part of the designed book compatible with my beliefs that emphasize teaching language as social semiotics. For example, the textbook emphasizes how to produce written language in an academic register, how to modulate tone, and how to create fluent texts. However, given the limited pages of a textbook, it is to be expected that knowledge about certain areas needs to be extended. For example, though the textbook provides exercises on transforming spoken texts into written texts, teachers need to explain why spoken language and written discourse are different.

I began my writing instruction with the basic structure of academic writing (e.g., the structure of argumentative writing: introduction, pro-argument, counter-argument, and conclusion). To complement the textbook, I also collected as many OER as possible, including sample texts available online, additional exercises available online, and other open-access journal articles that matched the reading level of my students. A snapshot of the curriculum I developed is listed as follows:

Table 1

A Blended Curriculum: Designated Textbook and Sample OER

Students' meta-linguistic knowledge	**Designated textbook: Learning content**	**Explanations of the features of academic language: OER**
Language in relation to academic contexts: contextual variables and meaning realization	In the mandatory textbook, there is only one exercise on revising spoken text into written text. No detailed explanations are provided.	OER was sent to students that includes how and why contextual variables differ between spoken text and academic writing. Sample links: https://www.youtube.com/watch?v=5shQbMJLa8k
Ideational meaning in academic contexts and linguistic realization	In the mandatory textbook, there is a section on how nominalization participates in constructing ideational meaning. No detailed explanations are provided.	OER provides information on how the types of verbs are used, as well as logical relationships (logical errors). Sample links: https://www.ntid.rit.edu/sea/processes/relationships/intro https://www.youtube.com/watch?v=RdSB137pFrs https://unilearning.uow.edu.au/academic/3b.html
Interpersonal meaning in academic contexts and linguistic realization	In the mandatory textbook, there is a section on how to use modal verbs to modulate tone. No detailed explanations are provided.	OER provides on how reporting verbs can be varied and how reliability of text content can be controlled through appraisal resources. Sample links: http://writesite.elearn.usyd.edu.au/m2/m2u1/index.htm https://wenku.baidu.com/view/852944225901020207409cef.html

Textual meaning in academic contexts and linguistic realization	In the mandatory textbook, there is a section on grammatical resources (e.g., conjunction words) in constructing fluent texts. No detailed explanations are provided.	OER provides more information on other cohesive resources (e.g., lexical cohesion) and the use of theme in constructing information flow. Sample Links: http://www.elc.byu.edu/classes/buck/w_garden/classes/buck/transitions.html http://www2.ivcc.edu/rambo/eng1001/transitions.htm http://writesite.elearn.usyd.edu.au/m3/m3u5/m3u5s3/m3u5s3_13.htm# https://www.youtube.com/watch?v=yRSTp3BJT3c

As shown in Table 1 above, my curriculum integrates the designated textbook and OER, in which SFL-based OER provides explicit knowledge on why and how certain language components can be learned from the textbook. The blended learning content was further facilitated through mediated teaching in class, in which the interaction among context, meaning-making, as well as the ways in which these are linked with lexico-grammar in English discourses, was explained in plain language (or the students' first language).

Participants

Participants were recruited from an academic writing course on argumentative writing taught by the author in the Chinese university. Although all students agreed to be involved in the project, four students were selected as focal participants because they were willing to share their writing samples and have in-depth talks with the researcher about the triadic relationship among materials, meta-linguistic knowledge, and their writing practices. In addition, they, like many other EFL writers, had been exposed to traditional teaching that primarily relied on one mandatory textbook and focused on structural accuracy or vocabulary learning. This group was made up of one male and three female students pseudonymously named Alex, Barbara, Charlie, and Debra. They were all born and raised in China, and spoke Chinese as their first language and English as a foreign language. In addition, while these four students had experiences with OER, they perceived OER as only being useful for providing examples of complex sentences or accumulating more advanced vocabulary than what was available to them in their textbook.

Data Collection Procedures

Data includes monthly semi-structured interviews. The questions developed for the interview were informed by both research questions in this current study as well as relevant literature (e.g., Colpaert, 2006; Kwak, 2017; Schleppegrell, 2001; see the appendix to this paper for sample interview questions). Interviews were conducted over one academic semester in the students' first language, Chinese. During the interviews, students were encouraged to talk freely about their experiences in the classroom, especially the triadic interaction among the mandatory textbook, OER, and theory learning.

Interviews were immediately transcribed and analyzed by the researcher; the transcription was confirmed by the participants prior to a further analysis. Other documents were also collected from the classroom to further anchor the validity of the data collected in the interviews. The documents were mainly about the students' reading and writing practices, such as their use of the knowledge gained from the mandatory textbook and OER to conduct independent text deconstruction or construction. In addition, the students' written reflections (in English) on their in-class and out-of-class learning activities (e.g., analysis of texts, academic writing) were also collected. In sum, three main sources of data were cemented to answer the two interrelated research questions: (1) the students' adjustment, and (2) the students' actual learning practices as a result of the blended learning environment.

Data Analysis

Data analysis was iterative; follow-up data was continuously supplemented to illuminate the researcher's questions (Dyson & Genishi, 2005). Primarily, the data collected from interviews and from the participating students' written reflections (in English) on their learning activities was analyzed via qualitative content analysis (Dyson & Genishi, 2005). Themes were identified in the students' interviews and reflections in relation to the research questions. The students' written documents (i.e., their text analysis and their academic writing samples) were analyzed through discourse analysis, and codes were informed by the core constructs of SFL (Rampton, Roberts, Leung, & Harris, 2002). The author's analyses were then rated by two experienced qualitative researchers who agreed with the analysis. Participants were also invited to read and comment on the analysis, and also agreed with the researcher's analysis.

Findings

Research Question 1: Student Adjustment to a New Learning Environment

Initially, the four students all demonstrated similar reliance on the mandatory textbook, which developed out of their years of experience with the textbook playing a predominant role in their learning. As Alex said,

> I am used to using one textbook and conducting an in-depth analysis of its content… like in my reading class now…Supplementary materials or OER are fine… but I just need one textbook that covers everything I have to learn. It is reliable.

In a similar vein, Charlie said,

> In my previous learning experiences, I just mainly relied on one textbook for learning…although we have other resources that the teacher gave us… But it [using a mandatory textbook] makes me feel like a student…

Alex's and Charlie's interview excerpts show that at the beginning of the semester the students apparently favored the policy of having one mandatory textbook in class. Their conceptualization of the necessity of mandatory textbooks seemed to be either shaped by the cultural context they were in (i.e., that the content of the mandatory textbook represents a powerful and reliable resource in their first-language culture, as expressed by Alex) or arose out of their own perception of the link between the existence of a designated textbook and their identity as a student who is receiving formal education (e.g., Charlie). What was common, however, was that all four students were open to OER, though they initially regarded the resources as an ancillary mode of learning in the classroom.

Despite their alignment with the mandatory textbook, the students still felt the need for effective outside resources but had limited understanding of what that would look like. As Barbara noted:

> Obviously, there is limitation of using just one textbook… As English major students, we cannot learn everything from one textbook… It is necessary for us to learn beyond the textbook… but I just have a phobia of making selections by myself.

Similarly, Debra said:

> It is not that I am lazy and do not reach out to read more… There are lots of free resources… It is like I do not know what to do… there is so much information that I do not know what to read or what is the best for us…

As illuminated in the above two excerpts, the students were in a complex situation: they were torn between their respect for the mandatory textbook and their need for more knowledge in order to be advanced language learners. Their complex scenario was aggravated by their lack of effective guidance in selecting additional materials (e.g., OER). However, this scenario seemed to galvanize the students' expectations of their teacher's principled guidance for the addition of materials in class.

Their need for additional resources was also triggered by their interest in the most appropriate way to understand and use language. As Barbara said:

> In the traditional classroom, we basically used one textbook, learning vocabulary and grammar… but learning this is obviously not enough… We still cannot effectively communicate… In addition, there are some exercises in the mandatory book… but what is the significance [of these exercises]? … Why we need to do them? There is need for additional resources for clarification.

As Barbara's excerpt shows, at the college level, these EFL students had knowledge demands that exceeded the textbook. It was not enough to simply follow along with the content of the textbook; they desired to be guided beyond the textbook and understand why they have learned what they have from the textbook. In other words, the students' need to go beyond the mandatory textbook was particularly

motivated by their need to be a critical language learner who must understand why they were learning about a particular language component.

In the theory-based blended classroom, the students began to experience the usefulness of SFL via the OER, and were obviously also challenged in the process of learning SFL from OER. As Alex noted:

> I did not expect these resources in a writing course… I had expected to just to write… [to learn about] structure… or language accuracy… It felt difficult to digest them [the OER resources] at first… but gradually I started to understand them bit by bit… These resources pushed me to understand more about the role of language in writing beyond sentence accuracy.

With a similar thought, Charlie said:

> Unlike other OER I had before—basically some interesting reading materials or more challenging reading materials… —I had no way to really know how to decode the OER… This time… I had been doubtful too… but it turned out it can really help me analyze texts and transfer practical knowledge to my own writing.

The above interview excerpts show that while the students' initial doubts about the use of OER in their classroom emerged out of their previous learning experiences (e.g., Alex's prior belief about writing as the process of producing structurally accurate sentences, Charlie's belief about the role of OER in enhancing reading comprehension), gradually these doubts diminished due to their experience with the practical role of OER that was focused on developing their meta-linguistic understanding of the English language. For example, Charlie's gradual alignment with SFL was a result of her positive use of linguistic knowledge in unpacking sample texts used in the classroom.

Teacher agency in reorganizing the content of the textbook in alignment with the curriculum also prompted students to adapt to the theory-based blended context:

> Alex: I think my embrace of OER was also because of the appropriate selection of materials… The OER were not dense in theory… I know what is going on without having to know too many technical terms… It lessens my cognitive load.

> Charlie: The reading materials are well selected… were overall well suited to my understanding level… Some confusion was easily clarified in class when the instructor also used multiple methods to explain… in Chinese…or in more accessible expressions.

In other words, the students' moderately doubtful attitude towards OER gradually disappeared and they become more aligned with the necessity of using OER, because of the teacher's careful selection of materials that fitted in with the learning level of the students. In addition, mediated instruction in and out of classroom illuminated the importance of the teacher's knowledge base in the blended learning classroom.

Accompanied by the students' enhanced alignment with the theory-underpinned learning contexts, the students also refreshed their understanding of language learning and use:

> Barbara: Now I see how the OER provides multiple sources of reading, practicing online, and offering me pleasant experiences of learning the lived aspects of language… how context, meaning, and linguistic features are connected to each other, rather than in isolation liked I experienced before.

> Charlie: It is like we do not need to read too many resources… It is like through minimal learning resources we achieve the maximally effective knowledge in doing independent learning, because we know a theory that explains not just how to make correct sentences, but how to make meaningful writing through attending to the relation among meaning, words, grammar, and academic texts.

In other words, the students' experiences with the appropriate quantity of OER helped refresh their conceptualization about writing, No longer were they concerned with producing writing in a decontextualized way; instead they learned how to synergize linguistic features, meaning, and academic register together to create meaningful and authentic English writing. Their new understanding was different from their original understanding at the beginning of the semester, which further marks their active adaptation to the theory-based blended learning environment.

Most importantly, over the semester the students gradually established an appropriate conceptualization of the relationship between the mandatory textbook and OER.

> Alex: Of course, it is good if we have a textbook that has everything we need for our learning. But this is obviously impossible… We cannot be over-reliant on textbooks; we also cannot diminish the value of other materials… They must have value… It depends on how we select them and use them through appropriate guidance.

> Charlie: Indeed, a mandatory textbook and supplementary textbooks have to be concurrently used… So we can absorb more knowledge in and out of class… Of course… we need teachers to have appropriate knowledge… relying on students is impossible… We are just language learners and not experts… so a classroom has to be managed by a teacher with good knowledge of textbook use to achieve the optimal learning effect.

As shown in these two interview excerpts, over the semester the students came to realize the roles of mandatory and supplementary textbooks: they had given up on their idealized notion of an all-encompassing single mandatory textbook. Instead, for them, a mandatory textbook could not possibly contain everything they need. At the same time, the students also gained a new perception about their classroom learning, favoring a combination of the teacher's role, theoretical guidance, mandatory textbook, and OER.

Overall all, the students well adjusted to the blended learning environment in which SFL, mandatory textbooks, and the OER interact with each other. In particular, the students' adjustment to the role of blended learning that was different from their previous in-class learning was facilitated by two important factors: (1) their experience with the convenience of harnessing SFL in understanding texts, and (2) the appropriate mediation of these resources by their teacher. The students' adjustment ultimately also helped them conceptualize the complementary relationship among mandatory textbooks, OER, and writing as a meaning-making process.

Research Question 2: Students' Actual Practices Following Exposure to a Theory-Based Blended Learning Classroom

The adjustment of the students to this theory-based blended environment was also mapped to their writing (their writing of academic texts) and text deconstruction (their analysis of academic writing samples). In text deconstruction, the students were asked to decode a writing sample based on SFL-based concepts learned in class and the OER provided for after-class reading. Sample texts were selected from free online materials published by an authoritative publishing house. Following decoding, students were also asked to reflect upon their experience in regard to their future writing. For text construction, students were given the freedom to write on a topic they like and infuse their newly gained meta-linguistic knowledge into their writing. Overall, the students' four papers provided ample evidence of their active use of knowledge from the classroom, as they constructed argumentative writing that was acceptable both in terms of linguistic competence and meaning construction as expected in international English language communities.

Table 2

Charlie's Understanding of the Interpersonal Meaning in the Blended Learning Environment

Reflections on a writing sample, which she coded with SFL-based interpersonal categories	**Writing during the early half of the semester**	**Writing following exposure to the blended curriculum**
I have found mood of sentences is basically declarative.	Too many questions were used to engage readers (a way of arguing a point in spoken discourse).	Declarative mood was used in her writing to refute a point, including when she made counter arguments, instead of asking readers questions.

Verbs that reveal the relationship between evidence and claim should vary based on the evidence.	The semantic pole was either positive or negative. There was no trace of explicit knowledge of adjusting the semantic load of verbs.	Modal verbs, including *may*, *could*, and *will*, were used.
Modal verbs have to be used appropriately.	There was monotonous use of verb *show*, although the evidence followed may be weak.	Verbs started to appropriately vary according to the strength of evidence, such as *implicate*, and *suggest*.
Argumentative texts are not absolutely objective; authorial attitude is all over, especially through some non-adjective phrases.	There was almost no trace of using appraisal resources in showing authorial attitude.	Adverbs are used to show her evaluative stance. For example, *undoubtedly,* is used to show her dis-alignment with a counterargument, before she refuted it.

In Charlie's early writing, she struggled, particularly, with how to effectively enact interpersonal meaning in her writing. For example, she had not used modal verbs in her early writing: claims following evidence in her writing were mostly either positive or negative, even though the evidence she presented was not strong enough and needed a soft tone. Through exposure to the theory-based blended learning environment and the instructor's guidance, Charlie gradually learned the importance of projecting interpersonal meaning and orchestrated the relationship between linguistic features and interpersonal meaning in her later writing (see Table 2). For example, she became skilled in using modal or reporting verbs (e.g., the verbs *may*, *implicate*) to show the credibility of claims that were supported by weak evidence. In addition, she also used non-adjective appraisal resources (e.g., the word *undoubtfully*) to strengthen her follow-up refutation of a counter-argument (see Table 2), which shows her mastery of knowledge in implicitly and appropriately projecting her negative authorial attitude toward a counter-argument. In other words, over the semester, she came to understand the demands posed by academic writing discourse and learned to use her knowledge of coding and decoding materials, as evidenced by her transfer of this knowledge from text deconstruction to the construction of linguistically appropriate texts.

Barbara, Alex, and Debra, unlike Charlie, seemed to have trouble in all three dimensions (see Table 3). Table 3 shows how the other three students shuffled between reading-based knowledge to the

construction of their own writing. The transfer from reading to writing, though not perfect, demonstrated their ability to use SFL-based knowledge from the theory-based classroom, making up for their previous knowledge that was characterized by a focus on sentential accuracy. For example, these three students, who had been instructed on language accuracy, had not been aware of the choice of participants in constructing the content of a language activity (i.e., ideational meaning); their use of too many inappropriate participants (i.e., the overuse of *I* as sentence participant) had jeopardized their authority as academic writers when making claims in their writing. However, in this classroom, their choice was more inclined to impersonal participants, meeting the requirements of academic writing. In addition, their knowledge of interpersonal meaning was further enhanced by their understanding of reporting verbs in relation to the strength of evidence, which was almost never taught to them before. In terms of textual meaning, they also gained enhanced knowledge of cohesive devices in understanding how sample texts were constructed, and how to appropriately use the knowledge in regulating their own writing; this shows that they overcame the constraints of their early writing practices in which they had limited awareness of the importance of coherence in academic writing.

Table 3

Alex, Barbara, and Debra's Understanding of Writing as a Meaning Making Process in the Blended Environment

Reflections on a writing sample, which the students coded with SFL-based interpersonal categories	**Writing during the early half of the semester**	**Writing following exposure to the blended curriculum**
Ideational dimension: The three students coded participants "cell phone" and emphasized the adoption of non-human participants, and coded logical relationship by marking some logical connectors. They also reflected upon the importance of the explicit use of logical connectors, such as *however* and *because*.	Ideational dimension: Logical relationship is implicit or inappropriate. The three students overused "I" as participant	Ideational dimension. Logical relationship between sentences was more explicit through logical connectors (e.g., *as a result*, *therefore*). Logical fallacy was overcome.
Interpersonal dimension: The three students coded mood type, types of reporting verbs (e.g., *suggest*, *show*), and attitudinal words (adjective and non adjective). They also reflected upon the linguistic features of their early writing and emphasized the importance of following their new knowledge.	Interpersonal dimension: The three students had inappropriate use of questions to refute a counterargument, instead of evidence-based refutation.	Interpersonal dimension: There was appropriate use of reporting verbs to enhance readability of their essay, along with appropriate citation. Mood of sentences has been regulated in response to

	In addition, they failed to use appropriate reporting verbs or modal verbs.	written register: the use of declarative sentences in writing. In addition, the choice of non-adjective words in projecting authorial attitude (e.g., the use of *admittedly* as a modifier to a counterargument shows their partial alignment with the counter-argument).
Textual dimension: The three students coded cohesive types and theme patterns; for example, they coded lexical cohesion by coding the multiple use of "cell phone." In addition, students reflected that the use constituted lexical cohesion and constant theme pattern, and should be used in their own writing.	Textual dimension: Dim knowledge of cohesive devices was exemplified.	Textual dimension: The three students appropriately used diverse cohesive devices that overcame constraints from their previous knowledge.

In sum, along with their adjustment to this blended learning classroom, the four students also gradually internalized knowledge related to SFL, which they drew from the mandatory textbook, OER, and the teacher's explicit instruction. Their knowledge about SFL and positive language performance beyond their previous performance further supported the necessity of the inclusion of an SFL-based theory for the process of English language material selection and adoption.

Discussions

One of the findings from this study is that by being exposed to a blended teaching and learning context, the students involved in the study constructed a refreshed understanding of the value of mandatory textbooks: there is no perfect textbook, and the way in which the teacher used OER to enhance their understanding of the content of a mandatory textbook was more important than the textbook itself. In other words, through highlighting the agentive role of the teacher (e.g., the use and their mediation of these OER and the mandatory materials) in influencing student perception of a mandatory textbook, this study complements existing research on language textbooks/materials that emphasized the innate value of textbooks and mostly focused on analysis of the textbook content itself, without taking the actual use of materials into consideration (e.g., Römer, 2004; Tomlinson, 2003). In addition, the teacher's efforts in linking the textbooks to OER also disrupts the stereotypical impression that teachers generally use mandatory textbooks and have limited space for innovating their teaching in most EFL classrooms (e.g., Wang & Farmer, 2008; You, 2004). The finding thus echoes the call from researchers that classroom learning can be diversified and enhanced in terms of

learning resources (e.g., the use of OER) so as to prepare students for meeting the challenges of international English language communities (e.g., Blyth, 2014).

Another finding of this study shows that, when guided by SFL, the mixture of OER and the mandatory textbook seems to effectively transform students into learners who have effective meta-linguistic knowledge of language (the interaction among grammar/vocabulary, meaning and context) and who are able to regulate their own language learning, positioning themselves as linguistically and culturally sensitive language users. In contrast, while research is limited, there has been some research on the agency of teachers in selecting materials (e.g., Allen, 2008; Menkabu & Harwood, 2014), which found that the selections teachers made were not guided by a particularized language theory that fits in with the language needs of their students (e.g., Kwak, 2017). In this study, from the perspective of SFL-based guidance, the teacher used SFL-based materials along with the textbook, to help students scratch the surface of language and effectively unpack/construct the content of English texts (e.g., sample academic writing texts). In other words, this study also answers the international demand for developing theory-based OER education (e.g., Ariza & Hancock, 2003) and shows how the adoption of both a mandatory textbook and supplementary OER can be effectively guided by SFL to maximally transition students into advanced language learners who can meet the demands of academic English literacy (e.g., Blyth, 2014), thus further illustrating the mediating power of SFL in language classrooms (e.g., Gibbons, 2006; Symons, Palincsar, & Schleppegrell, 2017; Yasuda, 2015).

Conclusions and Implications

Despite the innate constraints of case studies in making generalizations (Yin, 2013), the case study on an SFL-based blended learning context has yielded two important findings. First, in a mandatory textbook-based classroom, OER that aligns with the current need of students can effectively supplement the knowledge base of EFL students and help them gain an in-depth and extended understanding of the content of mandatory textbooks, as well as knowledge about English discourses, transforming them from passive readers of textbooks to flexible material users. Second, when guided by the language-learning theory of SFL, the study also illuminates that the selection of OER, or the reorganization of the content of the mandatory textbook, could effectively help students achieve a better understanding of the expectations of international English communities, as well as enable students to become self-regulated in the process of language learning.

Implications of this study include the following aspects. First, in educational contexts where textbooks are mandatory and constrained by content arrangement, using supplementary materials available online seems to be a good option for refreshing students' knowledge bases and meeting the challenges of English communities in regard to language use (Albirini, 2006; Mushayikwa & Lubben, 2009). Indeed, in this Web 2.0 world, many resources are free and provide an optimal channel for teachers to collect useful materials and enhance their textbook-based teaching in the classroom (Hilton, 2016). In particular, when providing supplementary materials found online, teachers should bear in mind the

principle of coherence: the chain of materials (in-class and supplementary) should center on a principled learning theory so that students do not feel disoriented (Kwak, 2017). In other words, while OER are available, students are also reliant on teachers in combining and collecting these resources to achieve the maximal learning effects (Donato & McCormic, 1994).

Secondly, since language use varies according to contexts, students need to gain effective meta-linguistic language by means of learning through textbooks or OER. This suggests that SFL be promoted among pre-service and in-service teachers so that they can design SFL-curricula when using textbooks and OER to facilitate student socialization into international language communities. Indeed, in international language communities, language is not merely required for smooth communication, but also reflects learner identity (Hyland, 2002). By intersecting the SFL-based knowledge and textbook content, students can be prepared for diverse challenges in our globalized communities (Paltridge, 2001; Schleppegrell, 2001).

Most importantly, the study also suggests the importance of including principled teaching and learning strategies in the process of online or distance education, particularly through highlighting language as an important gateway of improving student understanding of texts in different disciplinary subjects. Indeed, in spite of the popularity of online or distance education, teachers often struggle with what and how to teach (Kwak, 2017). In response to this, Colpaert (2006) called on teachers to narrow "the gap between technology and pedagogy" (p. 494). Given the complexity of academic discourse, and SFL's focus on language form and language meaning, and its explicit explanation on features of cross-disciplinary subjects, such as science and history (Schleppegrell, 2001), it would be optimal if teachers could use SFL and design online or distance education curricula that could help learners approximate semiotic resources specific to different disciplinary subjects and prepare students for academic success across disciplines (Blommaert, 2008).

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Appendix

Sample Interview Questions

(1) How did your previous teachers use textbooks?

(2) How did you practice writing?

(3) How did your current writing teacher use textbooks?

(4) What was your understanding of learning through textbooks?

(5) What was your experience with language theories?

(6) Have you experienced with online or distance education?

(7) How you do feel about the blended learning/teaching this semester?

(6) How do you think what you are learning is different from what you learned before?

(9) What is your understanding of interpersonal meaning through OER?

(10) What is your understanding of textual meaning through OER?

(11) What is your understanding of ideational meaning through OER?

(12) Based on this semester experience, how do you understand the relationship among mandatory textbook, OER, and SFL?

[i] The term *textbook* refers to traditional hardcopy resources required by an educational institution.

[ii] The term, *materials*, used in this paper, refers to both the traditional hardcopy textbook and supplementary teaching and learning resources, such as open educational resources.

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Instructional Delivery and Students' Experiences with Distance and Online Learning of Undergraduate Mathematics in Nigeria


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Abstract

This paper examines the students' experiences with instructional delivery (ID) of distance and online learning of undergraduate mathematics in two major Nigerian universities. Purposive sampling was used in the study to select mathematics students from University of Lagos Distance Learning Institute (DLI) and the National Open University of Nigeria (NOUN). Data were collected through mixed-methods and a one-sample binomial test was employed to analyse the quantitative data. Furthermore, narrative and content analyses were done to explore how respondents make sense of their experiences of learning mathematics through the distance and online mode. Among others, the results of the study suggest that the abstract nature of mathematics was not appropriately addressed in the course content and that the absence of helpful and visible tutors for the subject complicated the challenge of understanding abstract mathematics even further. Among the many challenges, the abstract nature of mathematics and the absence of qualified tutors points to the need for improvement in the design, development, and provision of mathematics course materials and programmes for distance and online mathematics learning.

Keywords: instructional delivery, distance and online learning, undergraduate mathematics

Introduction

In recent years, distance and online learning have become major topics in education, in part because of their increasing popularity as a means for broadening access to higher education for many students (Tapfumaneyi, 2013). Where many universities and colleges are creating more online and distance education programmes, the original single mode Open and Distance Learning (ODL) institutions are expected to be leaders in instructional design (ID). New challenges are also emerging, such as how ODL institutions can enhance their distance and online delivery in an environment that is becoming more and more diverse, thus creating new areas for research investigation (Bertini, 2016). Prior studies have identified lack of instructors' competence to deliver quality instruction to establish meaningful educational experiences for the learners as one of the basic barriers of distance and online learning (Harrington & Loffredo, 2010). The overall aim of this paper is to examine students' experiences in ID in an undergraduate mathematics course at two ODL universities in Nigeria.

The quality of educational provision in most distance and online learning institutions remains a concern despite an increase in the use of online tools (Jones & Long, 2013). According to Evrim, Correia, and Thompson, (2011), students enroll in distance and online mathematics with varied experiences which affect their views and methods of approaching the subject. The traditional approaches to distance and online delivery have not contributed much to success in mathematics courses and programmes, something which has led to the introduction of more multimedia tools for distance and online services and tutorials to improve access and success in these gateway subjects (Juan, Huertas, Steegmann, Corcoles, & Serrat, 2008; 2008; Yushau & Khan, 2014). Surprisingly, most studies on distance and online ID have not focused on mathematics students' experiences, especially at the university-level (Mayes, 2011; Jones & Long, 2013). This paper helps to contribute to the literature on ID and students' mathematical experiences at the university-level, particularly within the ODL environment.

The growth witnessed in distance and online education worldwide has affected distance and online learning of mathematics positively, and hence, driven the revision of ID in institutions of higher learning. However, there is still a gap in our understanding of students' experiences with ID in distance and online learning of undergraduate mathematics. In this paper, we discuss ID in an ODL environment and its effect on students' experiences of learning university-level mathematics using the Nigerian ODL context as our focus[i]. We will then provide answers to the following questions, specifically:

1. How does the use of ID through course materials affect students' experiences in distance and online learning of undergraduate mathematics?

2. How can undergraduate mathematics students' experiences with ID be understood and/or explained?

3. What are the possible proposals to enhance ID and students' experiences with distance and online learning of undergraduate mathematics?

Background

The increasing adoption of distance and online learning is considered a major and fundamental educational advancement in Nigeria (Osipita, 2016). Information and Communication Technology (ICT) was interestingly included in the policy guidelines establishing distance and online learning in

Nigeria (Federal Republic of Nigeria, 2004). It was recommended that ICT should be used in ID of ODL academic programmes and students should have adequate access to it. However, there is no plan on how ICTs will be made available for both the learners and ODL institutions. The Distance Learning Institute (DLI) of University of Lagos (a dual mode), and the National Open University of Nigeria (NOUN; a single mode), are two of the designated ODL institutions in the country. The aim of designating these universities was to provide opportunities to people who cannot get away from their work for full-time, conventional learning (Jimoh, 2013). These institutions primarily employ print materials in delivery of instruction to the students and are presently and actively using online resources (Garrett, 2016). Notwithstanding the improvements observed in the using of online resources in Nigeria, their impact on the distance and online learning of mathematics specifically are yet to be established. This is not entirely consistent with the mission and vision delivery of ODL in Nigeria. In view of this, a gap is created in the learning of mathematics through this mode.

Tapfumaneyi **(**2013) examined the contribution of ODL as a catalyst for social, economic, and sustainable development in Africa. The study identified "hard science (mathematics inclusive) progammes as too "practical" to be offered through the ODL mode of delivery" (p. 563). Some other available studies have shown that when ID is well-structured with the new technological tools, it provides more effective experiences than is obtainable in face-to-face classroom learning (Jimoh, 2013; Jones & Long, 2013). Nevertheless, some researchers have identified lack of consistency in policy implementation, lack of instructors, and poor developed instructional materials as problems affecting distance and online ID in Nigeria (Osipita, 2016; Edu, Sule, & Nsor, 2016). Distance and online education system in Nigeria take the form of dual and single modes where print (course materials) and face-to-face interactions or classes are heavily relied upon and dominate the course delivery (Ayo, Odukoya, & Azeta, 2014). Osipita (2016) also stated that "the distance education delivery system appears similar to traditional education because distance learners still need to attend classes irrespective of their places of residence and work" (p. 4). These cases demonstrate that the problems of ID with appropriate technology are not entirely solved in the distance and online systems of ODL in Nigeria. In view of these challenges, the present study sought to understand students' experiences of learning mathematics through this mode.

In Nigeria, DLI, though established in 1973, was accredited in 2008 as a dual-mode institution to offer distance and online education by a supervisory agency of university education—the National Universities Commission (NUC). The institution has its study centres spread within university of Lagos. NOUN on the other hand was approved in 2001 as a single-mode university and has its study centres located in different parts of Lagos and other locations in Nigeria. The students in these institutions register and attend the centres nearest to them. Both institutions (DLI and NOUN) offer mathematics education degree programmes to students who failed to secure admission to conventional institutions (Ayo et al., 2014). Academic activities such as application, admission, registration, result checking, and to some extent, learning, are done online. The process of learning involves students collecting the course materials from the institutions, studying and interacting with the facilitators either online or face-to-face, and participating in organised weekend lectures and face-to-face examination (Edu, Sule, & Nsor, 2016). One of the major problems facing ODL programmes in Nigeria is that its practices stem from conventional teaching and learning and ID application involves variations and copies of face-to-face methods of teaching and learning (Tapfumaneyi, 2013). Ohene and Essuman (2014) made assertion that course materials could, in some cases, constitute a barrier to distance and online learning if they are not specifically and well-modified for effective learning. It is against this background that this paper

investigates current experiences of the students learning mathematics in both DLI and NOUN, to contribute to the scarce empirical research in this area in Nigeria.

Conceptual Framework

The conceptual framework is developed based on the purpose of this paper, and seeks to answer the question: What are the students' experiences with ID in an undergraduate mathematics course in Nigeria?

The Commonwealth of Learning (COL) maintains that one of the policies guiding distance and online delivery is that the teacher is replaced by mixture of course materials and instructors. They pointed out that it is expensive to engage instructors in learning activities aimed at meeting the learners' educational needs (Commonwealth of Learning, 2005). This shows that the instructional material should be able to carry out the task of an instructor to a reasonable extent. To achieve this, Ohene and Essuman (2014) advocate coordinated teamwork among instructional designers, educators, online media developers, and graphic designers, working together to create a good environment for learning. For the course materials to have an effective impact on students' experiences, the instructors should understand their needs while designing the materials.

Researchers have outlined characteristics of good instructors such as: communicating the delivery of content to the students; facilitating learning and supporting students learning, both academically and technologically; assessing students and giving quality feedback promptly; guiding and counselling students regularly in their study and private matters; and recognising the students uniqueness and autonomy in learning (Bertini, 2016; Hathaway, 2014). It has been shown in studies that these characteristics are not adequately seen in most of the distance and online instructors (Young & Duncan, 2014). Therefore, it is very important to ascertain how the characteristics affect ID and students learning experiences in distance and online education.

Vilardi and Rice (2014) examined mathematics achievement in traditional instruction and technology-assisted course delivery methods. The results show that "students are learning in the technology-assisted classroom, but not at the same level as their traditional counterparts" (Vilardi & Rice, 2014, p. 23). On the other hand, Jones and Long (2013) found in their study that there was no significant difference in the mean scores of students learning mathematics through on-site or online mode, thereby concluding the possibility of students achieving equity in mathematics while learning through the both modes. Research in ODL institutions in Nigeria indicate that the delivery is characterised with the use of manual, analog, and traditional methods (Ayo et al., 2014). This largely affects the delivery quality of mathematics through distance and online learning modes. However, the results of our study on students' experiences with ID in distance and online learning of mathematics in Nigeria specifically, provides empirical evidence of various challenges characteristic of ODL in Nigeria, especially in the delivery of hard sciences, taking mathematical literacy as a special case.

The foundation of the study is based on Experiential Learning Theory (ELT). The theory is chosen because of its emphasis on the interaction between the students and the learning environments. The assertion of the ELT (Kolb, 1984) is the idea that the process of learning is represented in a cycle of concrete experiencing, reflective observation, abstract conceptualisation, and active experimentation. Kolb stressed that students exhibit different preferences of learning within a cycle.

The concrete experiences of students favour specific examples and learning support that allow peer group learning. These learners prefer receiving feedback from peers, hence, recognise their instructors as helpers. Reflective observation emphasises that a learner prefers observing before acting and relating with all available learning materials to be able to understand ideas and situations from different points of view (Kolb, 1984). Students in this cycle view instructors as experts and exhibit the habit of avoiding interaction with peers. The students at the abstract conceptualisation stage develop theories, conduct systematic close examination of situations, and theorise ideas for solving problems. This active experimentation advocates that learners are concerned with solving practical problems through group discussions, devising methods of evaluating situations, and are interested in what works (Kolb, 1984; Barker, Robinson, & Kolb, 2012). It can be inferred that ELT presents a holistic model of the learning experience with students at the centre and supports a multi-lateral model of adult development that seems necessary for our paper (Kolb, Boyatzis, & Mainemelis, 2000, p. 2).

The theory is learner-centred and allows students to manage and control their individual learning while the instructor facilitates the learning. It has been used as a framework by some researchers in ID a distance and online mode (Harrington & Loffredo, 2010). The indicators expressed in this theory make it more helpful in exploring students' experiences in ID of mathematics at the university. However, there is very little research on ID using ELT as framework in distance and online education in Nigeria, hence, the choice of this theory in this study.

Distance and online students in different locations may need a different combination of experiences but the total experiences for every learner should be equal in value (Jones & Long, 2013). Consequently, the students regulate their intellectual mind to adapt to new experiences. Experience is a continuously vital component in learning because it involves the learner deliberately using experiences. Carver, King, Hannum, and Fowler (2007) stated that experiential learning provides an already existing framework in which to develop a new model for online learning, featuring the individual either alone or in creative interaction. Emphases were made in the activities that lead to effective distance and online learning using affective, symbolic, perceptual, and behavioural learning environments. Murphrey (2010) speaking in favour of ELT opined that "one of the most important and powerful aspects of experiential learning is that the images in our brains come from the experience itself" (p. 213). It is necessary for ODL institutions to apply this theory in distance and online course delivery to advance the students learning experiences.

The relevance of ELT has made its application in generating data to answer the three questions raised in this paper necessary. The theory also guides the analysis and discussion of the findings.

Methodology

This paper examined students' experiences with ID in an undergraduate mathematics course at two ODL universities in Nigeria. The explanatory sequential mixed-method design as described in Creswell (2014) was employed to provide insights into the operation of two ODL institutions on undergraduate mathematics learning through distance and online programmes. This design provided for the collection and analysis of quantitative, followed by gathering and analysis of qualitative data. Consequently, the qualitative data in this study was used to complement and better interpret the results of the quantitative data. As a multiple case study, purposive sampling was used to select an informative sample of 60 third year mathematics education students at both universities (DLI n=30 and NOUN n=30). This purposive

sampling method was used to ensure that only third year students studying mathematics in distance and online modes were selected. The motivation for using these category of students was because they have had two years of experience in the programmes and are not novices in administration of distance and online programmes in their institutions.

The instruments, largely closed-ended questionnaire with a limited number of open-ended questions, together with semi-structured interviews, were developed in which some aspects were in line with Ramsden's (1991) course experience questionnaire (CEQ). The instruments were revised and adjusted to suit Nigerian ODL systems and approval was obtained from appropriate university authorities. The questionnaire—formulated on a 5-point Likert scale of strongly agree, agree, neutral, disagree, and strongly disagree—was administered to DLI students on their centre meeting days which takes place once in two weeks; while a Short Message System (SMS) was used to invite NOUN students to complete the questionnaire since they did not have a specific day for centre meetings. Appropriate transport arrangements were made for the participants to facilitate our meetings. In addition to the questionnaire, a total of 10 students that completed the questionnaire in the two ODL institutions were conveniently sampled and interviewed. The interview questions were adapted from the core items of the questionnaire. This was done to obtain additional information regarding students' experiences with ID of mathematics in the ODL institutions studied. The interviews were recorded, with permission from the interviewees, for the purpose of capturing the participants own words for proper analysis. The participants were assured that their participation was voluntary and that there would be no penalty for withdrawal or non-participation.

The triangulation of quantitative and qualitative data helped to improve the reliability and validity of the results. The reliability coefficient of 0.72 was determined using Cronbach's alpha technique. In addition, a pilot study was conducted with mathematics students (n=8) to test the survey (questionnaire) instrument and two of those students were also interviewed. The pilot results indicated that the students understood the questions and the key constructs of the study.

Mixed methods data analysis was done through a Parallel Analysis (PA) as proposed by Teddlie and Tashakkori (2009). This allows quantitative analysis to be conducted independently of the qualitative analysis. A one-sample binomial test was used to analyse the quantitative data because the data was fixed at n=60, the responses were independent of each other, and the data was ordinal. The qualitative data was transcribed word-for-word, coded to generate categories and subcategories, and thereafter themes were developed and analysed using the narrative approach (Elo & Kyngäs, 2008).

Results

The results of the students' responses to each of the questions in this paper were explored. The number of the students that agree or disagree on each of the questionnaire items necessitated re-grouping the 5-point Likert scale into agree (consisting of strongly agree and agree; A), disagree (consisting of strongly disagree and disagree; D), and neutral (N). The interest was not whether or not the respondents agree to the items under consideration, but to understand how ID helps in shaping the mathematical experiences of the learners; and as a result the responses were dichotomised into agree and not agree leaving out those that were neutral. This allows for the binomial distribution in the non-parametric form to be considered appropriate for the analysis. The p-values were also used to establish whether the percentage responses of the participants were related. The results are presented in Tables 1 and 2.

Table 1

Responses of DLI and NOUN Students as Related to Course Materials

N	Questionnaire item	A (%)	D (%)	N (%)	M	SD	B.T (p-value)
1	The abstract nature of mathematics is not simplified in the design of the course materials.	23 (38.4)	26 (43.3)	11 (18.3)	2.95	1.24	.775
2	I have access to course materials online over the Internet.	45 (75.0)	9 (15.0)	6 (10)	3.92	1.20	.000
3	The contents covered in the mathematics course materials are adequate for the period the student is required to complete the course work.	26 (43.3)	19 (31.7)	15 (25.0)	3.10	1.05	.371
4	ODL course materials in my institution meet students' mathematical and experiential needs for personal mathematics interest.	31 (51.6)	14 (23.4)	15 (25.0)	3.30	1.06	.017
5	ODL course materials in my institution meet students' mathematical and experiential needs for requirements for degree award and certification.	48 (80.0)	3 (5.0)	9 (15.0)	3.90	0.84	.000
6	I usually feel so bored when I study mathematics concepts that I quit before I finish what I planned to cover in the course material.	19 (31.7)	32 (53.3)	9 (15.0)	2.65	1.12	.000
7	When the mathematics course material is difficult to understand, I give up or study only the easier parts.	17 (28.3)	34 (56.7)	9 (15.0)	2.48	1.23	.025
8	Even when the mathematics course materials are not interactive enough, I manage to continue working to understand and finish them.	46 (76.7)	5 (8.3)	9 (15.0)	3.78	0.92	.000

**Binomial test*

Items 2, 4, and 5 with $p<.05$ indicated that the provision of course materials is considered the lifeblood of ID for their degrees and certification. The findings are consistent with the results of previous studies by Lee (2014) and Ku, Akarasriworn, Glassmeyer, Mendoza, and Rice (2011) which indicated that students pay more attention when the online course materials are presented with clear guidelines and expectations. Item 8 with ($p<.05$) shows how determined and resilient the students are in learning in this mode. Furthermore, items 6 and 7 seemed to have significant biases, indicating students' persistence in learning mathematics through this mode. The preference in item 1 is more evenly spread (p-value well above 0.05), expressing no significant difference between those that agree and those that disagree. Hence, the result suggests that the abstract nature of mathematics is not completely dealt with in the design of the course materials. The p-value above 0.05 witnessed in item 3 shows existence of insignificant difference between the participants that agree and those that disagree. This indicates that

the content of the course materials may not be explanatory enough to meet the participants' mathematical needs.

Table 2

Responses of DLI and NOUN on How ID Can be Understood and/or Explained

N	Questionnaire item	A (%)	D (%)	N (%)	M	SD	B.T (p-value)
9	Learning mathematics through a distance and online mode in my institution is frustrating.	19 (31.7)	28 (46.7)	13 (21.6)	2.82	1.37	.243
10	Many mathematical problems cannot be solved through distance and online learning.	33 (55.0)	22 (36.7)	5 (8.3)	3.20	1.36	.178
11	I enjoy learning mathematics through distance and online.	20 (33.3)	25 (41.7)	15 (25.0)	2.83	1.30	.551
12	I have reliable access to Internet for my school needs.	30 (50.0)	15 (25.0)	15 (25.0)	3.23	1.21	.037
13	The following can help to improve the students' experiences further in distance and online learning of mathematics in my institution: Access to my mathematics tutors/ lecturers.	50 (83.4)	5 (8.3)	5 (8.3)	4.25	1.04	.000
14	The following can help to improve the students' experiences further in distance and online learning of mathematics in my institution: Using different forms of media – print, audio, video, etc.	50 (83.3)	6 (10.0)	4 (6.7)	4.22	1.06	.000
15	Face-to-face remains the dominant method of teaching and learning of mathematics in my institution.	31 (51.7)	18 (30.0)	11 (18.3)	3.40	1.39	.086
16	Learning of mathematics through the distance and online mode is not efficient.	28 (46.7)	19 (31.7)	13 (21.6)	3.20	1.27	.243

**Binomial test*

In Table 2, items 12 to 14, $p<.05$ suggested that access to efficient internet facilities, flexible teaching and learning, different forms of media, and access to mathematics tutors in ID cannot be underestimated. This provides support for Jimoh's (2013) view on the importance of variety of media in distance and online learning environment. The $p>.05$ in items 10 and 15 signified that the students have diverse experiences with ID. Whereas, the results in items 9, 11, and 16, $p>.05$ show the need for improvement in ID to remove frustration in learning mathematics and increase efficiency and enjoyment through this mode (Edu, Sule, & Nsor, 2016).

Emerging Issues from Qualitative Data

Semi-structured interviews were conducted to collect qualitative data in this study. The aim was to give the interviewees (participants) the opportunity to elaborate on their experiences with ID in learning of

undergraduate mathematics in Nigeria. The interviews were conducted with a sample of the students that completed the questionnaire from both DLI and NOUN. They were recorded with the permission of the students and transcribed word-for-word to generate narrative data. The participants' own words were used to bring out the understanding of ID in undergraduate mathematics.

The quantitative analysis results in Tables 1 and 2 described the general picture of the students' experiences with ID while the qualitative analysis provided deep understanding of their experiences and answers the third question in this paper. The emerging themes, sub-themes, and the categories are summarised in Figure 1.

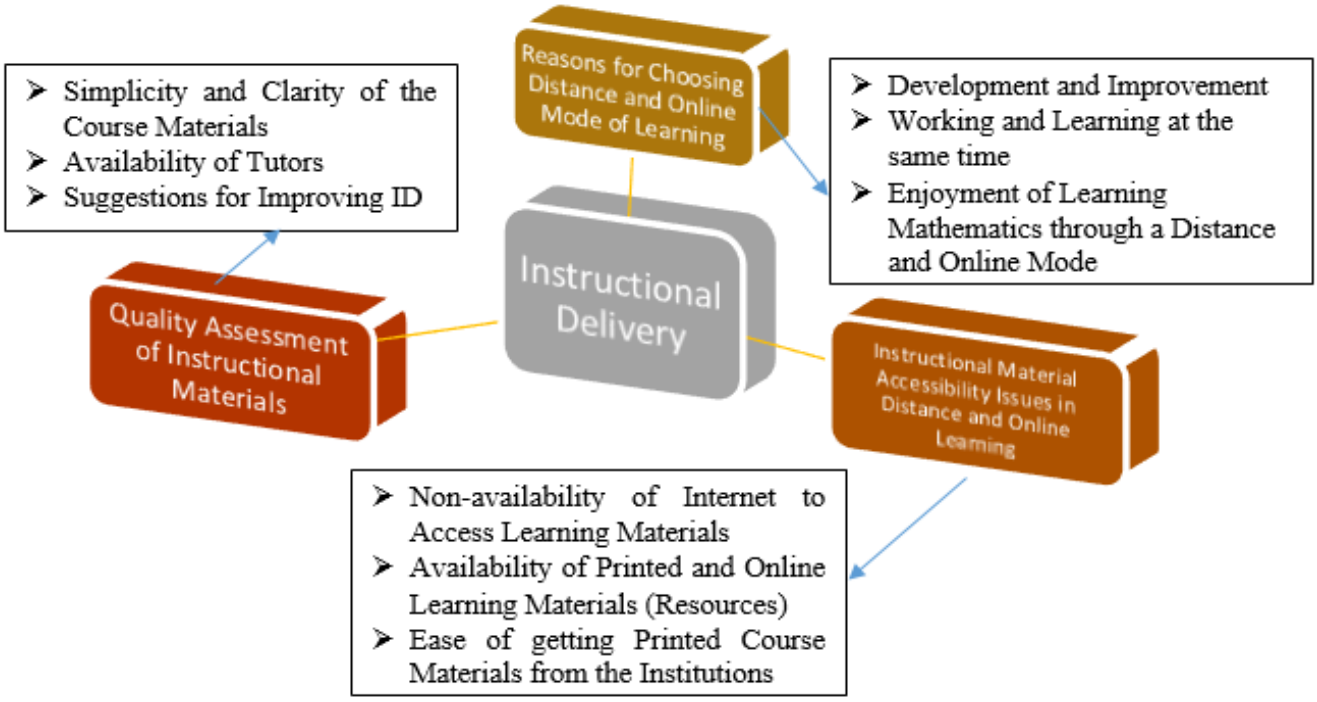

Figure 1. Outline of emerging themes, sub-themes, and categories.

The emerging categories from reasons for choosing a distance and online mode of learning revealed that the students' desire for career development and improvement necessitated their choice of studying through this mode. As one of the participants reflected, "(i)t gives room for somebody that is working to acquire knowledge, so that I will be going to school and also doing my work together." Despite the students pointing out experiences that hinder their enjoyment of the programme, which included not putting the right infrastructure in place, there seems to be some level of enjoyment among the students who were learning mathematics through this mode, as captured by a student: "I am enjoying the programme, it is just there are some difficulties here and there and this may be due to the new development going on in this school but maybe with time, they will improve."

The narratives of the students on the challenges they face in accessing learning materials through the Internet revealed that the universities provided little or no Internet facilities for the students and that many students were required to provide their own Internet access. A number of comments from the

participants from the ODL institutions used for this study indicated the need for improvement in access to the Internet. One participant commented as follows: "Yea, I have my own personal access to [the] Internet [and] it's not from school," while another student stated: "No I provide internet on my own, [the] school did not provide [it] for me. Though sometimes, you might get [it] at the school e-library but it is not effective. I use my personal Internet to source and download learning materials online." These comments demonstrate the gap between the participants' expectations and service provisions received from the universities.

The results on available resources further suggest that the students are not entirely satisfied with the learning resources in their institutions. The points raised by the students were captured in the following statements:

> There are [not] enough resources available for studying mathematics through this mode. Most [of the] time we work with other institutions, doing joint work, comparing and sourcing for materials where one can get. It is more like you the student [are] studying, sourcing and getting learning materials yourself.
>
> The simplicity is there but not in all the modules, most [of our] mathematics modules [are not] simple [enough] for one to read and understand on his or her own.
>
> No, the [course] materials are not simplified [or designed] enough to take care of the abstract nature of mathematics, except you can get [some] face-to-face ([assistance], asking question from the lecturer.

The majority of students interviewed in both institutions felt that mathematics resources were not available and also not simplified to mitigate the abstract nature of mathematics. Lack of access to mathematics resources may have led the students sourcing materials on their own, thereby encouraging the development of mathematical skills and widening intellectual ability in them.

The students also indicated that the process of obtaining the printed materials demands extra time due to long queues they experience. One of the participants had the following to say:

> Just look at the queue right there [pointing at the direction where the course materials were being distributed], [the students] are queuing for course materials; the last time I queue for course materials was in 100 level [first year].When you [visit the school to] queue for [the course materials you have already paid for], you [spend lots of] your money to come and queue for the materials whereas [at the end, you will not be able to get them], except you [visit the school website] online to download [the materials using] your personal Internet that is the only way you can [have access to] your course materials. Don't rely on the hardcopy [of the materials because] they [will not give them] to you, except you [can] go and buy because they sell outside there as well even after paying to the school for them.

Students learning in this mode seem to take responsibility for their own learning by supporting themselves. The students' narratives indicated availability of tutors in other subjects with very few or none in mathematics education courses. Interestingly, students' frustration regarding a lack of mathematics tutors for ID can be gleaned from the following comment: "Talking about the tutor, we don't have any, we can just forget about that because they are not available. But we talk among ourselves,

we normally meet face-to-face, sometimes to discuss some topics." The students made a number of suggestions including the need to provide occasional face-to-face lectures to address their challenges with content, using different forms of media for teaching, providing learning resources, and availability of mathematics tutors for effective ID.

Discussion

The study revealed that most students chose to study through this mode due to work commitments, however, the lack of essential resources for complete course delivery may be affecting them negatively in their studies. Based on the results from quantitative and qualitative analyses, it appeared that even while the students may have access to learning materials over the Internet and through print (Garrett, 2016), the abstract nature of mathematics is not addressed adequately in the materials resulting in the content not being simplified enough to address the challenges.

This paper has shown that to further improve the students' experiences in ID for mathematics, access to helpful tutors is not only necessary but perhaps critical. The ELT emphasised that every learner produces "rules and mental patterns" they can use to make meaning of their experiences (Murphrey, 2010). This was specifically demonstrated (Table 1, question 8, and students' narratives) by how the students regulated their mental mind to adapt to new experiences in not giving up when there are challenges in understanding the learning materials and organising themselves to solve mathematical problems facing them. Noteworthy from this theory is the tutors' availability to facilitate and regulate learning instead of just giving out information. This expectation was, however, not fulfilled for many of the participants in this study, as expressed by the learners' comments above.

Conclusion and Recommendations

The ELT is a function of four aspects: concrete experiencing, reflective observation, abstract conceptualisation, and active experimentation (Kolb, 1984). As reflected in the results of our study, learners prefer receiving feedback from peers, while recognising the instructors as helpers. Thus the students relating among themselves and sourcing learning materials on their own as revealed in their narratives were the reflections of their concrete experiences. In support of reflective observation, learners who prefer acting and relating with all the available learning materials may be limited with a shortage of learning resources and a lack of mathematics tutors as reflected by the participants.

Abstract conceptualisation learners prefer working with symbols, while those with active experimentation are good at solving practical problems through group discussion. Therefore, lack of effective Internet connectivity and extra time required in getting printed mathematics course materials as reported by the participants suggest that abstract conceptualisation and active experimentation of Kolb's ELT are not supported in this study. Without doubt, this may adversely affect the students' conduct of systematic close examination in learning and development of ideas for solving mathematical problems. It can be concluded that a holistic model of the learning experience to empower students to manage and gain control of their learning is not totally evident in this study.

The results of this study provides evidence that well-designed course materials and instructor support are very important to the success of distance and online learning of undergraduate mathematics courses. This calls for an urgent need to improve the design, development, and provision of

mathematics course materials and programmes for distance and online mathematics learning. The processes involved in this study were fundamental because they helped to clarify thoughts and to generate new insight into the ID of mathematics in Nigeria.

As a recommendation, further research is needed using, for example, specific mathematical topics to explore ID and student experiences of learning the topics through this mode. Students' dependence on printed materials suggest the need for mathematics course designers and developers to make the materials as simple as possible for the students to study and understand on their own. Finally, the regulatory agencies such as the National Universities Commission (NUC) in Nigeria should ensure and oversee the ID of mathematics at university-level to strengthen the understanding of the subject and its applications in sciences, engineering, and other courses that require mathematical literacy.

One limitation of this study lies in the sample of two ODL institutions in Nigeria. Even though these cohorts are fairly representative, students' experiences at other ODL institutions would enhance our understanding of the challenges and opportunities for studying mathematics through this mode.

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Quality Assurance for Online Higher Education Programmes: Design and Validation of an Integrative Assessment Model Applicable to Spanish Universities

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Abstract

The quality assurance of online Higher Education online programmes is one of the great challenges faced by Spanish universities. Regular assessment of these programmes is essential in order to take actions to improve their quality. The said assessment should be complex and include all of the components of the programme, as well as its planning and implementation stages and its effects. The purpose of this paper is to present a model designed to assess the quality of online Higher Education online programmes that includes the assessment of the quality of the programme itself, as well as its continuous assessment. In order to design the model, the author conducted a bibliographical analysis of different standards, models, and guides developed in Spain and other countries to assess online education. The model was validated by 23 international online education experts. The results of the validation were triangulated with specialized literature, thus allowing the author to make decisions regarding whether to change the model by keeping, reformulating, or removing a dimension or indicator. As a result, two variables, fourteen dimensions, and 81 indicators were obtained. In order to verify the utility of the model it was applied in the assessment of four online programmes. The model guides the persons in charge of the implementation of online programmes and allows to conduct a more comprehensive assessment of the programme in order to discover its strengths and weaknesses, and opportunities for its improvement. The model can be also applied by online programme designers as a guideline for creating other, high quality programmes.

Keywords: online education, quality of education, online programmes, assessment model

Introduction

According to figures provided by the Spanish Ministry of Education, Culture, and Sports (2016) more than 15% of Spanish students study online. Given this high percentage, guaranteeing a high quality of online education is one of the main objectives of Spanish universities that offer online education programmes. This way, these universities seek to put an end to the assumption that the quality of online education cannot be as high as that of traditional education.

Furthermore, there is a discussion among Spanish academic groups regarding the appropriate method for assessing the quality of online education programmes with the purpose of answering the question of whether this quality should be assessed based on the same criteria as those applied to traditional programmes. The dominant view is that the assessment of the quality of these two types of programmes—online and traditional—is basically the same and only differs when it comes to the meaning given to the criteria and the instruments used to make measurements (Padilla, 2005; Marúm-Espinosa, 2011). As a result of this approach, the current trend in assessing online education programmes, especially when it comes to universities that offer both traditional and online education, is to assess them in the same manner as the traditional ones. Thus, online education programmes are assessed by using the criteria and indicators designed for assessing the quality of traditional education programmes without applying quality dimensions and indicators suitable to the context of online education. Moreover, Spanish accreditation organizations also assess and certify online programmes by applying the same models as the ones applied to traditional education programmes (Chmielewski, 2013).

Assessing online programmes in this way is a major drawback, as online education differs from traditional education when it comes to its organization and functioning. Online education is not equivalent to traditional models, and thus the same quality assessment mechanisms and models should not be applied to both types of education (Jung & Latchem, 2012; Veytia & Chao González, 2013).

Some models exist that seek to provide a response to the issue of quality assessment in online Higher Education programmes in Spain, such as those developed by AENOR (2012), ANECA (2012), AQU (2007). These models, however, combine a variety of approaches and sometimes respond to contradictory paradigms. They thus use divergent dimensions (and assign different meanings to these dimensions) to assess the quality of online education. Moreover, the indicators proposed by these models rarely highlight the need to assess all pedagogical and technological elements of the programm, its planning and implementation stages, and its impact, as postulated by Martínez Mediano (2013):

> Programme evaluation is the systematic collection of information regarding a programme in order to meet specific needs, that is focused on 1) the quality of the programme itself, its basic elements, structure and coherence; 2) the planning of its launching, taking into consideration human, material and organizational resources, 3) the development of the programme and 4) the results of the programme. (p. 197)

The lack of knowledge in Spanish universities when it comes to the correct assessment of online education programmes, and the lack of models that could contribute to said assessment, inspired us to conduct our own research. The general purpose of the research was to design an applicative model for assessing online Higher Education online programmes in Spain by integrating the assessment of the quality of the programme itself and the ongoing assessment of the programme. This paper presents,

from a panoramic point of view, the process of designing and validating this model, which is expected to become a useful tool for assessing and improving all of the components of education online programmes as well as the three stages of their existence—that is, the initial stage, the development stage and the final stage. It should be noted that this global approach has not been addressed so far (or has only been partially addressed), as has been noted by authors such as Butcher & Hoosen (2014), and Chmielewski (2013).

Theoretical Framework

Assessment of the Quality of Online Education Programmes

An online education programme is a document (computerized or not) that covers actions designed to achieve the educational objectives for a determined period of time and which, in turn, is composed of a set of elements necessary for the development of a learning/teaching process regarding a determined subject taught online. It is conducted in its entirety using communication and information technology with the technological support of an online platform and the support of online teachers who assist and guide the students' academic development through different interactive telecommunication systems (Marciniak, 2016).

It seems that there is not much point in separating the assessment of the components of the programme—the traditional purpose of assessment—from the ongoing assessment of the programme. These are two sides of the same coin, if we take into account that the assessment of an online programme—considered as an organizational scheme of pedagogical and technological components—only makes sense if we assess the quality of those components together with the implementation of the programme and the results obtained from its implementation.

As a result, except for the evaluative research and other purposes, it is perfectly possible to harmoniously integrate the assessment of the quality of the components of the programme (i.e., the assessment of the quality of the programme itself) and the ongoing assessment of the programme. In this way, the assessment will be complete, will allow for an in-depth diagnosis of the current quality of the programme and will allow to reflect on what needs to be modified in order to ensure the highest quality possible. Furthermore, it will make it possible to determine whether the programme has been designed, developed, and implemented in a way that will produce the desired effects.

Assessment of the quality of the online education programme itself. The assessment of the quality of the programme itself is defined as the assessment of all of the elements that constitute an online programme (Marciniak, 2016).

Based on a bibliographical review (Barnard & Echols, 2015; Berge, Collins & Dougherty, 2000; Higher Education Compliance and Quality [HECQ], 1997; Meza, 2012; Rushby & Surry, 2016; Shattuck, 2014, among others) it has been established that there are no formulas or schemes defining the components that should be included in online learning programmes or in the assessment of such programmes. This is due to the fact that each programme is unique and, thus, its structure and elements depend on its objectives, contents, resources, and so on. Nevertheless, the Higher Education Committee on Quality (1997) proposes the following elements that should be taken into account while designing and assessing online programmes: learning objectives, teaching strategies, learning assessment strategies,

student profile, interactive teaching resources, learning resources, thematic contents, and activities schedule.

According to Barnard and Echols (2015), an online programme should include student profiles, thematic contents, learning strategies, characteristics of the educational technology, and strategies for the assessment of the learning process. Rushby and Surry (2016) propose different components of online programme: curricular data, general learning objectives, programme contents, learning activities, information sources, communication tools, media use, and strategies for the assessment of the learning process.

Based on the proposals made by the above cited authors, we can conclude that an online education programme should focus on clarifying and developing the following components:

- Online programme justification (What is the reason for the existence of the online education programme?)
- Online programme objectives (What is the online education programme for?)
- Student profile (Who is the online education programme for?)
- Thematic contents (What is going to be taught?)
- Learning activities (How is the online education programme going to be carried out?)
- Online teacher profile (Who is going to conduct the online education programme?)
- Didactic materials and resources (What is the online education programme going to be carried out with?)
- Learning assessment strategies (How is the student's learning process going to be assessed?
- Tutorial (What support is going to be offered to the students during the learning process?)
- Virtual classroom of the programme (What is the virtual environment of the programme going to be like?)

These components define the quality of online Higher Education programmes and, thus, should be assessed in order to identify the strengths and weaknesses, and the opportunities for improvement, of each programme.

Ongoing assessment of the online education programme. The ongoing assessment of the programme provides constant information regarding its progress. This information allows for the improvement the programme through feedback.

Pérez Juste (2014) and Surry and Ensminger (2009) affirm that the assessment of an education programme (whether traditional or online) should be designed to be carried out in three stages (initial, development, and final). Furthermore, each stage should have its own entity and objectives and the three stages combined should contribute to the improvement of the programme as a whole.

The initial assessment of an online programme is carried out before the programme is launched and has two main purposes: (1) to launch the programme under favourable conditions and (2) to establish the level of readiness of the programme for its launch so as to minimize the risk of failure.

The processual assessment of the programme evaluates the performance of the programme in its development stage and the possibilities for its improvement. This assessment has two main purposes: (1) To facilitate the timely making of immediate decisions regarding the improvement of the programme based on the results of the assessment and (2) to collect data for subsequent decisions (Pérez Juste, 2014).

The final assessment of the programme is focused on the achievements made by the programme. The purpose of this assessment is to verify whether the objectives of the programme have been reached, measure its effects, and assess student satisfaction with the programme.

Referents for Designing the Model

The specific nature of online education makes it necessary to draft, develop, and assess a series of educational actions for its correct development, and to determine unified guidelines in order to guarantee that these actions lead to high-quality results. To address these challenges, several authors have developed initiatives (standards, models, and guides) related to the quality assurance of online education. These initiatives can be used by universities as *allies* in their assessment of educational programmes. Some of the aforementioned initiatives are internationally recognised, while others have been designed to be applied in Spain.

International referents. It is worthwhile to consider the *five pillars of quality online education model* developed by the Online Learning Consortium (OLC, 2002) in the United States. The purpose of this model is to assist institutions in the identification of objectives related to online education and to measure their progress. This purpose can be fulfilled by assessing five pillars that constitute the quality of online education: (1) learning effectiveness; (2) faculty satisfaction; (3) student satisfaction; (4) scale; and (5) access.

In Latin America, the Latin American and Caribbean Institute for the Quality of Online Higher Education (CALED, 2010) developed the *Guía de autoevaluación para programas de pregrado a distancia* (guide for the self-assessment of distance undergraduate programmes) in order to improve the quality of the distance Higher Education offered by institutions in Latin America and the Caribbean. The guide includes a series of self-assessment guidelines within the certification process offered by CALED. The following areas of online education are assessed in this self-assessment: technology, training, instructional design, student information, and services.

While describing initiatives related to the assessment of the quality of online education, we must also mention the European Foundation for Management Development's (EFMD, 2006) technology-enhanced learning accreditation (EFMD CEL) programme. EFMD CEL is an accreditation process that assesses online education programmes with the purpose of improving the quality of online education programmes offered worldwide. The core of this process is the self-assessment of the programme by a group of internal auditors who assess the programme based on: programme profile, pedagogy, economy, technology, organization, and culture.

The aforementioned programmes are not the only programmes developed to assess the quality of online education. Table 1 contains the comparative analysis of some of the models analysed during the bibliographical research. The analysis has been arranged chronologically.

Table 1

Comparative Analysis of Some of the Models Developed to Assess the Quality of Online Education

Model/author/year of creation	**Model characteristics**	**Assessment dimensions**
The e-learning maturity model (eMM; Marshall, 2006)	This model constitutes the framework for the improvement of the quality of online education programmes. It has been developed to guide organisations in their understanding of their capacities regarding e-learning, and to help them in the assessment of its quality.	•Learning •Development •Support •Evaluation •Organisation
CAPEODL Model (comprehensive approach to program evaluation in open and distributed learning; Khan, 2007)	This model focuses on the critical revision of e-learning products and services by collecting data related to all the aspects of e-learning programmes from its initial to final stages.	•Pedagogical •Technological •Evaluation •Management •Resource Support •Ethical •Institutional
Evaluation logic model (University of Wisconsin, 2009)	This model helps to plan, implement, assess and communicate the programme to all the stakeholders. The model proposes five actions that describe online education programmes.	•Entries •Outputs •Assumptions •External Factors
A conceptual model for measuring the quality of e-learning through knowledge sharing indicators (Raeesi, Qorbani, & Akhgar, 2010)	This model offers a series of indicators to assess the knowledge sharing process carried out through online education programmes. These indicators are divided in two groups: (1) indicators of quality measurement of e-learning with respect to knowledge sharing; and (2) indicators of knowledge sharing that directly affect the e-learning process.	Each group of indicators is assessed based on three perspectives: •Individual •Organisational •Technical

PDPP model (planning evaluation, development, process evaluation, and product evaluation; Zhang & Jiang, 2012)	The PDPP Model is based on the Stufflebeam assessment model and on the characteristics of online programmes. It proposes a system for assessing the quality of these programmes based on four dimensions and 24 indicators.	• Planning evaluation • Development evaluation • Process evaluation •Product evaluation
Conceptual framework for quality of e-learning (Ossiannilsson & Landgren, 2012)	The goal of the model is to guide institutions in the development, implementation, evaluation, and internalization of e-learning in Higher Education.	•Accessibility •Flexibility •Transparency •Interactiveness •Personalization •Participation •Productivity
A model for the online education quality assessment (Giorgetti, Romero, & Vera, 2013)	This model proposes a series of dimensions and criteria to assess the educational quality in order to continuously improve it.	•Professional training •Institutional and administrative management •Support for professional training
A model and an index for e-learning quality assessment (Petkova & Radeva, 2014)	This model is focused on the measures for the generalized quantitative assessment of the quality of distance learning platforms. It offers a geometric index to calculate different factors (characteristics) and subfactors, and to complete a final, generalised assessment of the quality of e-learning.	•Interaction •Staff support •Institutional quality •Assurance mechanism •Institutional credibility •Learner support •Information and publicity and learning tasks

These analysed models—as well as other models that could have been quoted, the utility of which is undeniable—enable the assessment of online education programmes through a series of dimensions that contain the information necessary to draft assessment plans. The main problem is that the variables and indicators proposed by these models rarely highlight the need to assess the quality of the programme, as well as the quality of its planning, implementation, and results.

Another weakness of the analysed models is the lack of consensus regarding the number of dimensions. Some models propose the assessment of only three dimensions, while other models propose to assess up to eight dimensions. It is further observed that we do not encounter any dimension common to all analysed models. Another weakness of the aforementioned models lies in the differing meaning given to the dimensions, as their interpretation differs depending on the author and the methodology.

Spanish referents. In Spain, few authors have developed initiatives (standards, models, guides) related to guaranteeing the quality of online education that can be used by Spanish universities as assessment allies as they move forward the assessment of educational programmes. Among others,

we should mention the Association for Standardisation and Certification of Spain's (AENOR, 2012) UNE 66181:2012 standard, which sets out a quality model based on a set of indicators that represent three satisfaction factors of the recipients of online education. Each of these factors break down into key quality dimensions, based on which actions can be taken in order to improve the corresponding factor:

1. Recognition of the training for employability. (This factor represents extent to which online education increases the student's ability to integrate into the labour market and improve their existing position in the said market.)

2. Learning methodology. (This factor defines the most appropriate conditions applicable to the learning process based on the defined objectives.)

3. Accessibility. (This factor seeks to determine to what extent online education is accessible, usable, and practicable with efficiency and effectiveness by anyone.)

The Agency for the Quality of the University System of Catalonia (AQU, 2007), designed a guide for the internal self-assessment of online education, which is an assessment model for Higher Education online programmes. It is composed of five dimensions that do not differ much from the dimensions proposed for assessing traditional programmes:

1. Strategic position of the degree (internal and external);

2. Training programme (educational profile and its suitability);

3. Instructional design (teaching methodology, suitability of the activities, teaching organization, guidance system, and interpersonal communication systems);

4. Learning assessment (evaluative system); and

5. Results (academic, professional and personal dimension).

The quality of online programmes is also assessed by the National Agency for Quality Assessment and Accreditation of Spain (ANECA, 2012) at three different stages. The first stage consists of an initial assessment of the education programme. ANECA assesses the project of the programme through the accreditation programme VERIFICA. Once the programme is implemented, ANECA monitors its implementation and development by the university, using for this purpose a specific accreditation programme called MONITOR. The third stage consists of a periodical renewal of the accreditation of the education programme. The said renewal is carried out by ANECA by using an accreditation programme called ACREDITA. Table 2 shows the criteria used by ANECA to assess programmes at the three abovementioned stages. It should be noted that the said criteria are used by ANECA to assess both traditional and online educational programmes.

Table 2

Criteria for the Assessment of Education Programmes Used by ANECA

Accreditation programme

VERIFICA	MONITOR	ACREDITA
Programme description	Organization and development	Organization and development
Justification	Information and transparency	Information and transparency
Educational objectives	Internal quality guarantee system	Internal quality guarantee system
Accessibility by students		
Teaching methods	Academic faculty	Academic faculty
Academic faculty	Didactic materials and student services	Support staff, didactic materials and student services
Didactic materials and student services		
Expected teaching results	Efficiency indicators	Teaching results
Quality guarantee system	Implementation of recommendations, observations and suggestions	Indicators of the student satisfaction and efficiency
Programme implementation schedule		

From "Programas de Evaluación" [Assessment Programmes], by National Agency for Quality Assessment and Accreditation of Spain, 2017 (http://www.aneca.es/Programas-de-evaluacion). In the public domain.

Methodology

The starting point for designing the model was a bibliographical/documental analysis of the components of e-learning education programmes and of guidelines regarding the assessment methods proposed for these programmes, as well as a specific bibliographical study of the standards, models and guides created in Spain and other countries in order to evaluate the quality of e-learning education (AENOR, 2012; ANECA, 2012; AQU, 2007; EFMD, 2006; European Foundation for Quality in eLearning [EFQUEL], 2012; Giorgetti, Romero & Vera, 2013; Marshall, 2006; OLC, 2002; and others).

Based on the results of the said analysis, a first draft of the model was created, composed of two variables, fourteen dimensions and ninety indicators. In order to facilitate the application of the indicators and determine its utility, a descriptive sheet was created for each of them which contained all of the components indicated by the standard UNE 66175 (see an example in Table 3).

Table 3

Example of the Descriptive Sheet of an Indicator Developed According to the Spanish Norm UNE 66175:2012

Indicator	
Code	APEV-3
Name	The educational goals of the online programme are adequate to the demands of the labour market.
Objective	To verify that the educational objectives are suitable to the demand for experts in the labour market.
Description	While defining the objectives, we should take into consideration the conditioning factors related to the demand for experts in the labour market.
Calculation formula	Option: Yes/No
Proposed evidences	The document containing the educational goals of the programme. Studies on the labour market and on the demand of specialists within the field of the assessed online programme.

From "Autoevaluación de programas de educación universitaria virtual" [Self-assessment of higher virtual education programmes] (p. 311), by R. Marciniak, 2016, Barcelona, Spain: Autonomous University of Barcelona. Licensed under CC BY-NC-ND.

Taking into consideration that the model was the result of the author's own elaboration, it was necessary to validate it and determine its reliability through a methodological proceeding in order to determine the extent to which the model assessed the components it was supposed to assess.

According to Hernández, García, Padilla, García, and Leal (2012), validity refers to "the extent to which an instrument actually measures the variable that it intends to measure" (p. 201). Specialized literature proposes different types of validity and procedures to define the validity of a measurement instrument. All of these procedures apply formulas that allow to obtain reliable results and that guarantee the achievement of the set out goals (Pérez Juste, 1986). In our case, the process of validating the model was conducted through validation by experts and application of the model in the assessment of four online programmes.

Validation through expert judgement "consists, mainly, in asking several persons to cast judgement regarding an object, instrument, educational resource or to give their opinion regarding a particular element" (Cabero & Llorente Cejudo, 2013, p. 14). For this purpose, we asked 23 international experts from different countries (Spain, Portugal, Italy, Mexico, Chile, Paraguay, and Uruguay) to validate the model. The experts were selected based on their experiences in the field and on papers they authored. The experts were asked to determine the validity of each dimension and indicator of the model based on the assessment and evaluative judgment of its univocality, relevance, and importance. As for the indicators, the experts were asked to assess the suitability of the calculation formula and the relevance of the evidence.

An online form was designed in order to facilitate the validation of the model by the experts. The form was divided in three sections. In section 1 the experts were asked to provide certain personal data. Sections 2 and 3 were used to carry out the validation of the dimensions and indicators (see Figures 1, 2, and 3).

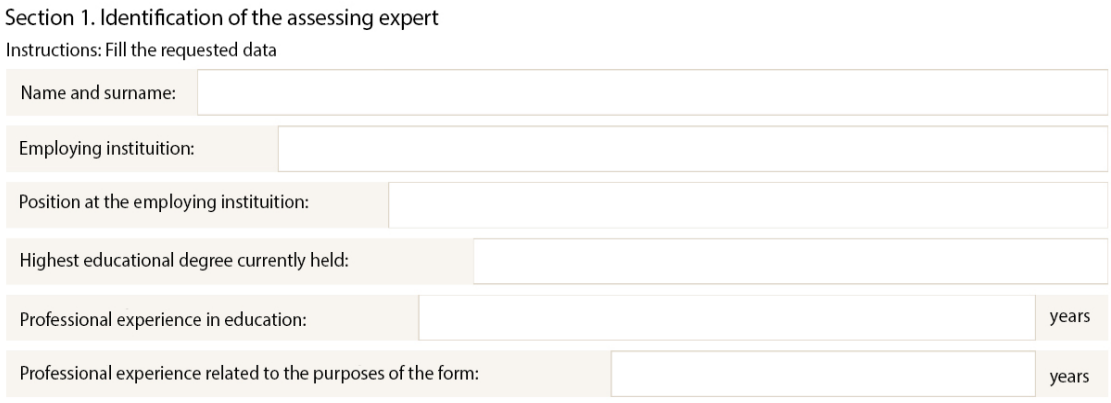

Figure 1. A screenshot of the online validation form (section 1).

Section 2. Validity of the dimensions

Section 2.1 Validity of the dimensions of the variable 1: Quality of the programme itself

Name	Univocality	Relevance	Importance	Comment
Online programme justification	Yes No	1 2 3 4	1 2 3 4	
Online programme objectives	Yes No	1 2 3 4	1 2 3 4	
Student profile	Yes No	1 2 3 4	1 2 3 4	
Thematic contents	Yes No	1 2 3 4	1 2 3 4	
Learning activities	Yes No	1 2 3 4	1 2 3 4	
Online teacher profile	Yes No	1 2 3 4	1 2 3 4	
Educational Strategies	Yes No	1 2 3 4	1 2 3 4	
Tutoring	Yes No	1 2 3 4	1 2 3 4	
Assessment of student's learning	Yes No	1 2 3 4	1 2 3 4	
Educational material	Yes No	1 2 3 4	1 2 3 4	
Virtual platform	Yes No	1 2 3 4	1 2 3 4	

Figure 2. A screenshot of the online validation form (section 2).

Section 3. Validity of the indicators of the dimensions

Online programme justification

Code	Univocality	Relevance	Importance	Suitability of the calculation formula	Relevance of the evidence	Comment
APEV-1	Yes No	1 2 3 4	1 2 3 4	Yes No	Yes No	
		3 4	1 2 3 4	Yes No	Yes No	
		3 4	1 2 3 4	Yes No	Yes No	

Response of the programme to the educational needs of the society

Formative goals of the programme

Student profile

Thematic contents

Learning activities

Figure 3. A screenshot of the online validation form (section 3).

Each dimension and indicator contained a comment field that could be used by the experts to suggest modifications. This field could also be used to suggest improvements of the proposed model. After validating all the dimensions and indicators, the expert saved and sent the form using the buttons appearing at the bottom of the form.

We contacted the experts via email in order to ask for their cooperation in the validation process of the provisional model. We attached two documents to the email message: (1) a brief description of the

proposed model, its objective, and the operationalization of its variables; and (2) a document with instructions on how to fill in the online validation form. We asked the experts to respond via e-mail within one month.

The results of the validation provided by the experts through the online form were received in webpage format based on HTML5 technology, making its analysis more difficult. For this reason, the results were incorporated to a table generated by the Microsoft Excel program. Once the results were incorporated, the quantitative and qualitative validity of the model was verified.

The quantitative validity was verified using the Statistics programme in version 12 and included calculating the facial validity index, the contents validity index, and the interjudge reliability index for all the indicators composing the model. The qualitative validation of the model was verified by collecting all the comments made by the experts to justify their validation, as well as their suggestions for the improvement of the model.

Once the qualitative validation was completed, the results were triangulated with the results of the quantitative validation and specialized literature, which allowed us to make decisions regarding the maintenance, modification or removal of an indicator. For this reason, we created Tables with the specific findings related to the dimensions of the model and all the proposed indicators (see Table 4).

Table 4

Example of Triangulation of the Data for One of the Indicators of the Model

Indicator: Accessibility and disclosure of the educational objectives		
Findings based on the source		
Quantitative validation	*Qualitative validation*	*Theory*
Indicator has a very high validation compared with all quantitative indexes: Index = 1 (maximum punctuation). Average CVR Index =1 (maximum punctuation). Average Fleiss' Kappa Index = 0.78.	*Experts*: Highly assessed indicator. Nevertheless, not all experts understand the accessibility of educational objectives.	According to Ardila (2011), the educational objectives of the programme should be duly described. According to ANECA (2015), the students enrolled in the online programme should be granted access to the relevant information regarding the programme and its educational objectives.
Researchers' decision: 1. The name of the indicator has been adjusted in order to facilitate its univocality. The new name is: The educational goals of the programme are available and accessible to all persons interested in the online programme.		

The definitive model for the assessment of Higher Education online programmes was designed based on the results of the triangulation process. In order to verify the utility of the model, it was applied in the assessment of four online programmes.

The main purpose of this part of the study was to validate the model in an actual context and to verify its suitability for the self-assessment of online Higher Education programmes. To achieve this goal, four self-assessment protocols were designed (one for each of the assessed programmes) to be used by researchers as observation and assessment guidelines. The data was collected from the evidence described in the descriptive sheets for each indicator. By way of example, Table 5 shows a fragment of the protocol for one of the aforementioned self-assessments.

Table 5

A Fragment of a Self-assessment Protocol

DIMENSION : Learning activities				
Indicator	*Assessment*		*Comments*	*Analysed evidences*
	Yes	No		
The learning activities proposed within the programme are of different types.	X		The programme offers a wide range of learning activities, which include, among others: participation in forums; drafting of essays; drafting of comparative tables; design of research projects; case studies; and watching and commenting on videos, etc.	The document "Planning of activities" posted in the virtual classroom of the programme. The document "Activities" posted for each unit of the programme.
All the activities are coherent with the educational goals.		x	The educational objectives of the assessed programmes have not been defined and, thus, it is not possible to verify whether the learning activities are coherent with the objectives.	The document "Programme syllabus." Interview with the coordinator for the degree in logistics and transport.
Instructions for each learning activity have been drafted.	x		Each activity includes guidelines that describe it, as well as its purpose, the Web tools to be used and the assessment of the activity.	The documents entitled "Learning activities for Unit 1," "Learning Activities for Unit 2," and "Learning Activities for Unit 3."

This application allowed us to verify the potential of the model while assessing the quality of the programmes through the detection of their strengths and weaknesses in order to design an action plan for their improvement.

Results

An Integrative Model for the Assessment of the Quality of Online Higher Education Programmes

The main result of this research is the development of a model composed of two variables, fourteen dimensions, and eighty-one indicators.

Variables of the model. A *variable* is a characteristic or quality, magnitude or quantity, that can undergo changes and that is subject to analysis, measurement, assessment, or control during a research project (Arias, 2012). In the field of the assessment of the quality of education programmes,

a variable is a characteristic that expresses the feature of the quality to be assessed. There are two variables considered in the integrative model for the assessment of the quality of online Higher Education programmes developed here. The first variable is the quality of the online programme itself. We consider this variable to be crucial, as it enables the assessment of the quality of all of the components of an online education programme. The second variable refers to the ongoing assessment of the online programme, which provides continuous information regarding its progress. This information enables the improvement the programme through feedback and self-adjustment.

Dimensions of the model. "The dimensions indicate the direction of the actions and cover the hallmarks of the whole, as an integrated piece" (Careaga Butter, Meyer Aguilera, Graciela Badilla Quintana, Jiménez Pérez, & Sepúlveda Valenzuela, 2017, p. 276). A single dimension catches only one aspects of quality. The quality assessment model proposed in this study contains fourteen dimensions. The first eleven dimensions make it possible to assess the quality of all of the components of an education online programme, and the last three dimensions verify the quality of all stages of the programme. The working definition of each dimension is:

- Dimension 1—*Online programme justification*: the determination of the reasons for the existence of the online programme.
- Dimension 2—*Online programme objectives*: the proposals and objectives to be achieved by the programme.
- Dimension 3—*Student profile*: a set of the defined knowledge and competences that must be met by new students and those who have completed the programme.
- Dimension 4—*Thematic contents of the e-learning programme*: themes and topics that constitute the online programme.
- Dimension 5—*Learning activities*: different tasks carried out by students.
- Dimension 6—*Online teacher profile*: particular features that characterize the person who gives the online programme.
- Dimension 7—*Educational material*: any material used by the online teacher or by the student to facilitate the teaching-learning process.
- Dimension 8—*Educational strategies*: strategies used by the online teacher to support the teaching/learning processes.
- Dimension 9—*Tutoring*: a coaching process during the learning process that is carried out by the online teacher via individual attention.
- Dimension 10—*Assessment of student's learning*: the evaluation and monitoring of students.
- Dimension 11—*Virtual platform*: a software that allows educational contents to be distributed and to carry out the online educational programme.

- Dimension 12—*Initial assessment of the programme*: an assessment carried out one week before the planned start of the programme in order to establish the degree to which the programme is prepared to begin, and to know whether it can be launched.

- Dimension 13—*Processual assessment of the programme*: an assessment of the programme at the midpoint of its course, done in order to maximize its development, identify its weaknesses, to make decisions about how to eliminate them.

- Dimension 14—*Final assessment of the programme*: an assessment carried out immediately after the completion of the online programme to determine the degree to which the programme achieved its educational goals, and to measure the effects of the programme and student satisfaction.

Quality indicators for online programmes. *Indicators* are a set of characteristics or features that constitute or allow for the description and assessment of certain dimensions of a variable. They can be presented as guiding questions or a checklist that make apparent the achieved degree of quality.

The system of 81 indicators developed to describe and assess the dimensions of our model can be used as a tool by Spanish universities to verify the extent of the application of the standards, parameters, and recommendations aimed at guaranteeing and assessing the quality of online education programmes.

Table 6 describes the distribution of the indicators based on the dimensions. The appendix to this paper describes the indicators selected to assess each dimension.

Table 6

Distribution of the Indicators Based on the Proposed Dimensions

Variable 1: The assessment of the quality of the e-learning education programme itself	
Dimension	*Number of associated indicators*
1. Justification of the online programme	3
2. Educational goals of the online programme	5
3. Student profile	7
4. Thematic contents of the online programme	5
5. Learning activities	8
6. Online teacher's profile	3
7. Learning materials	9
8. Teaching strategies	3
9. Tutoring	7
10. Assessment of the students' learning	4
11. Quality of the virtual classroom	9
Variable 2: The ongoing assessment of the online programmes	
Dimension	*Number of associated indicators*
12. Assessment of the initial stage of the online programme	4

13. Assessment of the development stage of the online programme	7
14. Assessment of the final stage of the online programme	7
Total	81

The purpose of the indicators of dimension 1 is to assess whether the online programme successfully explains and justifies itself so that students can see that the programme is useful, and can understand it in terms of their learning process and professional development.

The indicators of dimension 2 are proposed as ways of assessing whether the programme defines clear and measurable objectives and whether these objectives are coherent with the syllabus of the programme and are responsive to the demands of the labour market.

The purpose of the indicators of dimension 3 is to assess whether the programme clearly defines its access and graduation profiles, and whether these are made available to the students.

The indicators of dimension 4 assess the quality of the thematic content of the programme. They assess, among other things, whether the content is appropriate, taking into consideration the study load and whether the content is coherent with the educational objectives and the graduation profile of the programme, as well as whether the different topics and subjects are up to date, easily understandable, and arranged in a logical manner.

The indicators of dimension 5 allow for the assessment of whether the learning activities meet the following quality criteria: different typology; contribution to the achievement of the educational objectives of the programme; encouragement of teamwork; definition of guidelines, schedules, deadlines, and delivery methods for each activity.

The indicators of dimension 6 refer to the qualifications necessary to teach the programme. These qualifications include the pedagogical and technological competences required for the online teaching/learning process.

The indicators of dimension 7 serve to assess the quality of the teaching materials. Among other aspects. These indicators assess whether the teaching materials are appropriate, sufficient, up-to-date, motivating, and accessible by students.

The indicators of dimension 8 assess the quality of the teaching strategies applied by the online teacher, focusing on their typology and coherence with the educational objectives of the programme.

The purpose of the indicators of dimension 9 is to assess the quality of the individual and group tutoring sessions carried out by the online teacher. Moreover, they assess whether the teacher provides the students with appropriate feedback for each activity.

The indicators of dimension 10 assess the strategies applied for the continuous assessment of the learning process undertaken by the students. These indicators assess, among other things, whether the programme introduces clear assessment criteria and rules, and whether it applies them while taking into consideration the nature of each learning activity.

The indicators of dimension 11 assess the quality of the virtual classroom and whether it allows to manage all stages of the programme, such as the preparation of the programme content, the implementation of the programme, the assessment of the abilities acquired by the students, and the assessment of the learning process.

The indicators of dimensions 12, 13, and 14 serve to assess the three stages of the programme, that is, its initial, development, and final stages.

By generating a complete model for quality assessment that includes indicators for online education programmes, and allows for the assessment of the pedagogical and technological components of the programme and of its planning, development, and results, we intend to promote an improvement process for the continuous adequacy of the programmes based on their quality objectives.

Results of the Validation of the Model

Being aware of the limitations of this type of paper, below we present a summary of the results of the qualitative validation of the dimensions (Table 7) carried out by the experts who validated them in relation to their univocality (U), suitability (S), and importance (I). We also present some comments and suggestions regarding the indicators of the model.

In order to affirm that a dimension was sufficiently valued by the experts, the following criteria were established:

- 0% to 69% positive responses: dimension insufficiently valued
- 70% to 79% positive responses: dimension sufficiently valued
- 80% to 89% positive responses: dimension highly valued
- 90% to 100% positive responses: dimension obtained maximum value

The type of validity sought was “positive” or “negative.” Two scales of validation were used: the dichotomous validation (yes, no) and Likert validation (values from 1 to 4). In this former, a “yes” was considered positive; a “no” was considered negative. In the latter, a 3 or 4 was considered positive; a 1 or 2 was considered negative. Moreover, a high score was considered as a criterion to affirm that a dimension was sufficiently valued by the experts. To that end, a minimum score of 70% of positive responses was established. Qualitative feedback received from the experts, which was not mandatory, was also used for the reformulation of the dimensions.

Table 7

Results of the Qualitative Validation of the Dimensions of the Model

Nº	**Dimensions**	**Assessment obtained by the dimension (%)**		
		U	***S***	***I***
1.	Justification of the online programme	92	83	83
2.	Educational goals of the online programme	100	94	94
3.	Student profile	92	94	86
4.	Thematic contents of the online programme	92	100	100

5.	Learning activities	100	92	100
6.	Online teacher's profile	92	97	97
7.	Learning materials	100	94	94
8.	Teaching strategies	83	86	92
9.	Tutoring	92	94	86
10.	Assessment of the students' learning	100	94	92
11.	Quality of the virtual classroom	92	97	100
12.	Assessment of the initial stage of the online programme	100	89	92
13.	Assessment of the development stage of the online programme	92	92	94
14.	Assessment of the final stage of the online programme	100	96	96

As can be seen in Table 5, all 14 dimensions are considered clear, which means that they are precisely presented and understandable by the experts. Moreover, all dimensions are considered as highly suitable, that is, they allow, to a high extent, for the assessment of the quality of the online programme. Furthermore, the experts consider that all dimensions are very relevant, which means that they are considered as crucial for the assessment of the quality of online programmes.

Regarding this point, we would like to note that the differences in the percentages are due to the validation by the experts of the three validation criteria. The experts did not always give the same score for each validation criterion. For example, when it comes to dimension 1, 92% of the experts considered that the dimension was clearly defined (univocality), while only 83% of them considered it suitable and important for the assessment of the quality of the online programme. The percentages show the percentage of positive responses provided for each criterion.

Table 8 shows the qualitative feedback provided by the experts regarding the dimensions of our model.

Table 8

Comments Made by the Experts Regarding the Dimensions of the Model

Nº	**Dimension**	**Comments**
1.	Justification of the online programme	• Contributes to personal development. • I do not consider it important. • An appropriate dimension. We can see that programmes and courses are created and offered solely because it is possible to do so and not because they respond to the students' needs. • It is neither relevant nor suitable.
2.	Educational goals of the online programme	• Very relevant for the assessment of the quality of the programme. • It does not mention the competencies and maybe it should mention them.
3.	Student profile	• The access profile does not appear in many programmes. • I recommend that the name of the dimension be modified to "student profile" [previously called "access profile"].

4.	Thematic contents of the online programme	• The updating and structuring of the contents are important. • It is necessary to point out the criteria for the selection of the thematic content in order to assess whether they are appropriate or not.
5.	Learning activities	• I do not consider it relevant. • It should be kept in mind that, in some cases, students must carry out learning activities outside of the virtual classroom.
6.	Online teacher's profile	• I think it is necessary to divorce the development of the thematic contents from the teaching activity, as often teachers are assigned programmes with already prepared teaching materials.
7.	Learning materials	• This dimension is very useful. • If the materials are outdated they cannot be used in the learning process. • The materials must be coherent with the educational objectives. • It is mandatory. • I think that this is the aspect with the most influence on the quality of the online programme.
8.	Teaching strategies	• In online education it is difficult to assess the teaching strategies applied by the online teacher. Moreover, teachers often teach programmes designed by someone else. • It is necessary to describe in a clear manner what the object of the assessment is. • Even though it is clear from the indicators, it would be useful to clarify in the definition of the dimension that it refers to pedagogical and not technological strategies.
9.	Tutoring	• It is unnecessary. • It is a very important dimension. • It should even be taken into account that a tutoring plan is advisable
10.	Assessment of the students' learning	• It is not very relevant. • It could be more detailed in order to verify whether the activities include assessment rubrics.
11.	Quality of the virtual classroom	• A great tool. • Apart from the virtual classroom as software, other elements, such as hardware, should be taken into account, even though they are not part of this research.
12.	Assessment of the initial stage of the online	• It is useful for motivation. • The assessment of this stage allows to improve the weak elements of

	programme	the programme before launching it.
13.	Assessment of the development stage of the online programme	• It is important to correctly define the purpose of this assessment stage. • This stage is very valuable. Almost all programmes are assessed once they are finished, and, thus, they cannot be improved prior to their end.
14.	Assessment of the final stage of the online programme	• It should not be limited to quantitative indicators.

As for the indicators of each dimension, all of them were assessed by the experts as unambiguous in their semantic definitions and relevant with respect to the dimensions in which they were included. Moreover, almost all of them were considered important for the assessment of Higher Education online programmes. Only nine indicators were assessed as unimportant; these were removed from the model:

1. Selection criteria for the thematic contents of the programme (The experts consider that the contents should be selected based on the knowledge and experience of the programme designers.)

2. The suitability of the learning activities with respect to online education (According to the experts, students should not be deprived of the possibility of carrying out practical activities in on-site mode.)

3. Requirements regarding the knowledge and use of the Information and Communication Technologies (ICTs) by the candidates to the online programme (According to the experts, students complete a propaedeutic course during which they acquire knowledge of ICTs and the ICT skills sufficient to enroll in the online programme.)

4. Qualifications of the online teacher regarding online education (According to the experts, this indicator should not be a requirement, but is a desirable feature of the online teacher.)

5. Qualifications of the persons in charge of the development of the programme in relation to online education (According to the experts, this indicator should not be a requirement, but is a desirable feature of the online teacher.)

6. Suitability of the materials and didactic resources for disabled students (The experts considered that this is not a universal element of the quality of online programme given that there are different degrees of disability).

7. Variety of didactic materials (The experts consider that a wider variety is not a sign of quality.)

8. Variety of didactic resources (The experts consider that a wider variety is not a sign of quality.)

9. Interactive components of the contents of the didactic unit (The experts consider that this indicator should not be a requirement, as the interaction is not always mandatory.)

The validation carried out by the experts allowed us to adjust and improve the model according to the comments made by them, which were incorporated in the definitive model.

Limits of the Research

The main constraints of this research are:

- The bibliographical research is limited to analysing the standards, models and guides developed to assess online education that can be used as reference in the design and performance of the assessment of education online programmes.

- The dimensions and indicators proposed for the model are a selection within multiple models designed to assess the quality of online education in general. We can encounter multiple dimensions and indicators in specialized literature and, thus, it is impossible to analyse all of them, making it necessary to select some of them.

- The analysis of the standards and models was based on analysing objectives, structures, dimensions, and indicators. Nevertheless, it was necessary to conduct an analysis of all of their documents, ideologies, proceedings, and other characteristics.

Implications and Conclusion

The issue of quality is a current concern for everyone involved in training and education, both traditional and online (Vlachopoulos, 2016). Some researchers (Grifoll, 2010, Ehlers, 2013; Butcher & Hoosen, 2014) point out that the assessment of online education programmes should be a permanent practice in order to provide a critical view of these programmes, as well as of the aspects relevant to ensuring a high quality of online education programmes.

Nevertheless, the assessment should be complete so that a detailed diagnostic of the current quality of the online programme, and a reflection on what should be modified and what should not be modified to guarantee its high quality, can be accomplished (Eby, 2015). The assessment of online programmes is complete if it is performed from a wide point of view, with the support of periodically collected data, and a strict analysis of this data that is focused on:

1. The assessment of the quality of the programme itself, the quality of all of the pedagogical components of the programme and the quality of the virtual environment used to carry out the programme; and

2. The continuous assessment of the programme—that is, the assessment of the program in three different stages: the initial, development, and final stages.

The model presented in this paper integrates two kinds of assessment and includes dimensions that serve to carry out the assessment of all of the components of the programme (programme justification,

programme objectives, student profile, thematic contents, learning activities, online teacher profile, didactic material, learning strategies, learning assessment, tutorial, online classroom) and the assessment of its planning, application, and final stages. Various indicators were proposed for each dimension as an example of what should be assessed. The application of these indicators depends on the data collected and managed by the university, as well as on the university's available means.

The model presented here is addressed to the persons in charge of implementing online programmes, and to programme directors/coordinators. It can also be applied by online programme designers as a guideline for creating high quality programmes. It can also be useful to those who supervise the quality of Higher Education, as it is a technical document that allows for its revision and the drafting of a final report.

The model also provides a framework for future research, which will need to identify the elements of the model are stable, and those that can be adjusted to the specific context of each university in different countries. And given the variability of the conditions of the quality of online education, there is always a need for research that aims at these kinds of dimension and indicator adjustments.

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Appendix

The System of Indicators for the Quality Assessment Model for Online Higher Education Programmes

Variable 1: The assessment of the quality of the education online programme itself		
N°	***Dimension***	***Indicator***
1	Online programme justification	The online programme has been created in relation to the educational needs existing within the society.
		The online programme responds to the labour market.
		The reasons that justify the necessity of enrolling into the programme by the student are duly explained.
2	Educational goals of the online programme	The educational goals of the programme are adequate to the demands of the labour market.
		The educational goals are drafted based on the skills to be acquired by the students after completing the programme.
		The educational goals are coherent with the contents of the programme.
		The educational goals of the programme are measurable.
		The educational goals of the programme are available and accessible to all persons interested in the programme.
3	Access and graduation profile	*Access profile*
		The access profile has been designed.
		The access profile describes the previous education required in order to enrol in the online programme.
		The access profile is accessible to all persons interested in the online programme.
		Graduation profile
		The programme contains the graduation profile.
		The graduation profile has been defined in terms of the competences to be acquired by the students after completing the programme.
		The graduation profile has been updated according to the needs.
		Verification of whether the graduation profile of the programme is accessible to all persons interested in the programme.
4	Thematic contents of the online programme	The thematic contents of the programme are appropriate taking into account the subject of the programme.
		The thematic contents of the programme are proportional to the study load indicated in the syllabus.
		There is coherence between the thematic contents of the programme and its educational goals.
		The themes and subthemes of the thematic contents of the programme are arranged in a logical manner.
		The thematic contents of the programme are reviewed on an annual basis.
5	Learning activities	The learning activities proposed within the programme are of different types.
		All the activities are coherent with the educational goals.
		Instructions for each learning activity have been drafted.
		A schedule of the activities has been provided.
		A deadline for the delivery of each activity has been set out.
		The method and format of delivery has been described for each learning activity.
		The proposed activities promote collaborative learning.
		The volume of the learning activities is suitable to the teaching load of the programme.
6	Online teacher profile	The online teacher has the appropriate professional profile according to the requirements of the programme subject.

		The online teacher has the appropriate pedagogical competences in order to carry out the online teaching/learning process.
		The online teacher has the technological competences necessary to carry out the teaching/learning process.
7	Educational material	The resources made available to the students are of different types.
		The programme offers the basic learning resources.
		The programme offers complementary learning resources.
		The programme contains a set of Web-based learning resources.
		All the learning resources are coherent with the educational goals of the programme.
		The learning resources of the programme have been selected based on clear selection criteria.
		The basic bibliography of the programme is described.
		The complementary bibliography of the programme is described.
		The basic and complementary bibliography is updated (30% of the bibliographical suggestions is dated no longer than five years prior).
8	Educational strategies	The online teacher uses different types of teaching strategies.
		The teaching strategies used by the online teacher are coherent with the educational goals.
		The online teacher promotes different learning strategies among the students.
9	Tutoring	The functions of the online teacher and of the persons involved in the development of the programme are defined and accessible by students.
		The online programme includes instructions regarding the communication methods with the online teacher.
		The timetable of the tutoring sessions has been defined.
		The online teacher carries out individual tutoring sessions.
		The online teacher carries out group tutoring sessions.
		The tutoring sessions carried out by the online teacher are monitored.
		The students receive feedback regarding each task.
10	Assessment of students' learning	Different strategies for the assessment of the students' learning process have been defined.
		The assessment criteria of the learning process are accessible by the students.
		The criteria to be used to grade the students' progress are detailed and accessible by the students.
		The students participate in the process of determining and assessing the achieved progress.
11	Quality of the virtual platform	The virtual platform includes a tool to submit activities or files.
		The virtual platform offers tools that allow to manage the learning activities.
		The virtual platform includes tools that allow to create group tasks.
		The virtual platform contains tools that allow the students to create their own personal learning environments.
		The virtual platform offers tools for the asynchronous communication.
		The virtual platform contains tools for the synchronous communication.
		The students can view the results of the completed exercises and/or exams in the virtual platform.
		The virtual platform contains a tool that allows the online teacher to monitor and manage the students.
		The virtual platform contains a section describing the functionalities of all the tools available in itself.
	Variable 2: The ongoing assessment of the education online programme	
N°	*Dimension*	*Indicator*
12	Initial assessment of the online programme	The programme is ready to be launched at least one week prior to its start.
		All the resources (human, financial and technical) are sufficient to guarantee the quality of the development of the programme.
		All the persons involved in the programme are ready for it to start.
		The virtual classroom is ready to be used one week prior to the programme being launched.

3	Processual assessment of the online programme	The teaching strategies used by the online teacher are appropriate in order to achieve the educational goals of the programme.
		The learning activities are appropriate for the students to acquire the competences described in the graduation profile.
		The planning of the programme regarding the activities, the deadlines and the resources is met.
		The online teacher is involved in the execution of the programme.
		The teaching materials and resources are suitable to the students' expectations.
		Student's motivation is stimulated.
		Some of the programme goals have been achieved.
4	Final assessment of the online programme	Level of achievement of the educational goals set out for the online programme.
		Level of fulfilment of the planned learning activities.
		Level of students' satisfaction with the online programme.
		Level of online teachers' satisfaction.
		Impact rate of the online programme
		Performance rate of the online programme.
		Success rate of the online programme.

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A Review to Weigh the Pros and Cons of Online, Remote, and Distance Science Laboratory Experiences


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Abstract

The effectiveness of traditional face to face labs versus non-traditional online, remote, or distance labs is difficult to assess due to the lack of continuity in the literature between terminology, standard evaluation metrics, and the use of a wide variety non-traditional laboratory experience for online courses. This narrative review presents a representative view of the existing literature in order to identify the strengths and weaknesses of non-traditional laboratories and to highlight the areas of opportunity for research.

Non-traditional labs are increasingly utilized in higher education. The research indicates that these non-traditional approaches to a science laboratory experience are as effective at achieving the learning outcomes as traditional labs. While this is an important parameter, this review outlines further important considerations such as operating and maintenance cost, growth potential, and safety. This comparison identifies several weaknesses in the existing literature. While it is clear that traditional labs aid in the development of practical and procedural skills, there is a lack of research exploring if non-traditional laboratory experiments hinder student success in subsequent traditional labs. Additionally, remote lab kits blur the lines between modality by bringing experiences that are more tactile to students outside of the traditional laboratory environment. Though novel work on non-traditional labs continues to be published, investigations are still needed regarding cost differences, acquisition of procedural skills, preparation for advanced work, and instructor contact time between traditional and non-traditional laboratories.

Keywords: laboratory, non-traditional laboratory, online, virtual, distance learning, lab format

Introduction

Despite a wealth of research on the topic of online versus traditional higher education courses, less focus has been aimed at comparing laboratory experiences. A longstanding question within the science education community is: "What is the effectiveness of lab experiences (traditional vs. non-traditional) relative to each other?" Some studies compared a traditional laboratory course to a non-traditional laboratory course as a whole while others compared the outcomes of an individual lab experiment or activity by modality (Table 1). Some modality comparison studies of science courses that traditionally have a lab neglected to describe if the course analyzed included a laboratory component (Colorado Department of Higher Education, 2012; Rosenzweig, 2012).

Table 1

Non-Comprehensive List of Literature Exploring Non-Traditional Science Laboratory Experiences

Type of comparison	Subject Area	Reference
Whole course	Chemistry	(Casanova & Civelli, 2006)
	Biology	(Biel & Brame, 2016) (Garman, 2012) (Hauser, 2013) (Johnson, 2002) (Riggins, 2014)
	Anatomy & Physiology	(Barbeau, Johnson, Gibson, & Rogers, 2013) (Kuyatt & Baker, 2014)
	Soil Science	(Reuter, 2009)
	Histology	(Schoenfeld-Tacher, McConnell, & Graham, 2001)
Single lab or subset of course	Chemistry	(Hawkins & Phelps, 2013) (Selmer & Kraft, 2007)
	Biology	(Meir, Perry, Stal, Maruca, & Klopfer, 2005)
	Physics	(Zacharia & Olympiou, 2011) (Esquembre, 2015) (Ko et al., 2000) (Winer, Chomienne, & Vazquez-Abad, 2000)
	Biochemical Engineering	(Domingues, Rocha, Dourado, Alves, & Ferreira, 2010)

An important consideration before initiating a comparison of lab modalities is to establish the value of the laboratory component in the science course. In introductory science courses designed for non-majors, the laboratory environment may be a tool to reinforce the lecture content (Feig, 2010). However, in many cases, the main goals of the laboratory experience include developing learner skills in making and recording observations as well as deductive reasoning and hypothesis construction (Adlong et al., 2003). Furthermore, the purpose of the lab course often includes the development of practical instrumentation skills and safety awareness or transferable skills such as teamwork, time management, communication, and conflict resolution (Boyer, 2003; Woods, Felder, Rugarcia, & Stice, 2000). The science lecture courses are not necessarily expected to cultivate these skills and instead tend to deliver general concepts and information. Thus, the laboratory section, both traditional and non-traditional, are often expected to put the ideas into practice and provide students with a practical skills experience (Waldrop, 2013).

The goal of this review was to organize and synthesize the existing literature in order to outline the benefits and drawbacks of the traditional face-to-face approach for laboratory experiences compared to non-traditional laboratory experiences, which can take many forms. This novel work systematically compared various types of non-traditional lab experiences to evaluate the strengths and weaknesses of the experiences, which no other work currently does in the literature. Furthermore, this investigation identified multiple gaps in the literature and future research in targeted areas was recommended.

Research Method

An initial survey indicated that the literature was neither robust enough nor was it homogeneous enough to justify a systematic review or meta-analysis. For this reason, a narrative review was executed.

This review focused on literature published between 1997 and 2017. Very little research was performed on distance science laboratory experiences prior to this time frame. Studies included in this review were identified through keyword searches of the ScienceDirect database. Keyword searches included the terms 'remote,' 'virtual,' 'online,' or 'simulation' AND 'laboratory' or 'experiment.' Manual searches of several relevant journals (Journal of College Science Teaching, Journal of Chemical Education, Journal of Research in Science Teaching, American Journal of Distance Education, etc.) were performed. Furthermore, the references lists of key articles in this review were mined. Articles were excluded that did not directly relate to the research question, including articles on laboratory infrastructure and non-teaching laboratories. Studies focused explicitly on engineering or computer laboratory experiments were largely excluded, except when discussing terminology. Conference papers and unpublished materials were not explored. This review is representative, not exhaustive, and some relevant educational studies may have been excluded.

The collected literature was then analyzed based on the following: terminology used, learning outcomes, multiple benefits, practical skill development, cost, growth potential, accessibility, student-instructor communication, safety, and instructional design. These specific topics were investigated because they had the most inconsistencies between articles and/or there was a dearth of information regarding these themes.

Analysis

Non-Standard Terminology

Even with a clear research question in mind, the first stumbling block was encountered immediately. Non-traditional labs can include simulated labs, remote labs, lab kits, or some combination. Furthermore, some traditional face-to-face laboratory courses have adopted non-traditional experiences to varying degrees. Confounding this even further is the fact that the literature does not present standard terminology for non-traditional experiences. In order to code the terms used in the literature for various non-traditional laboratory experiences, the following definitions were used. An *online laboratory* was defined as a laboratory experience where the learner accessed simulated experiments, instruments, or equipment through a computer. A *remote laboratory* was defined as a laboratory experience where the learner accessed real experiments, instruments, or equipment virtually through a computer. A *distance laboratory*

was defined as a laboratory experience where the learner performed hands-on labs outside of a traditional laboratory space through portable laboratory kits, often delivered through the mail.

The inconsistency of the terminology was highlighted by Ma and Nickerson (2006) and no resolution has emerged in the literature since. This lack of standard terminology means that the same online laboratory experience can be labeled "simulated labs," "virtual labs," or "distributed learning labs." Engineering tends to account for a large percentage of the literature on non-traditional labs and these studies often use confusing labeling like referring to remote labs as "online labs" and "remote labs" in the same discussion (Ma & Nickerson, 2006; Tuttas & Wagner, 2001). Table 2 provides a sample of variable terms present in the literature.

Table 2

Examples of Terminology for Non-traditional Labs in Literature

Coding	Term	Reference
Online	Simulated (labs or experiments)	(Corter, Esche, Chassapis, Ma, & Nickerson, 2011; Meir et al., 2005)
	Virtual (labs or experiments)	(Dalgarno, Bishop, Adlong, & Bedgood, 2009; Domingues et al., 2010; Esquembre, 2015; Ko et al., 2000; Yaron, Karabinos, Lange, Greeno, & Leinhardt, 2010)
	Virtual learning environment	(Annetta, Klesath, & Meyer, 2009)
	Internet-based (labs or experiments)	(He, Shen, & Zhu, 2014)
	Virtual manipulative experiments	(Zacharia & Olympiou, 2008; Zacharia & Olympiou, 2011)
	Online (labs or experiments)	(Frt'ala & Zakova, 2014)
	Distributed learning labs	(Winer et al., 2000)
Remote	Remote (labs or experiments)	(Corter et al., 2011; Esquembre, 2015; Herrera, Marquez, Mejias, Tirado, & Andujar, 2015; Kennepohl, Baran, & Currie, 2004; Meir et al., 2005)
	Web labs	(Selmer & Kraft, 2007)
Distance	Take-home (labs or experiments)	(Jackson, 1998; Mickle & Aune, 2008; Patterson, 2000; Turner & Parisi, 2008)
	At-home experiments	(Casanova & Civelli, 2006)
	Hands-on labs	(Mickle & Aune, 2008)
	Distance (learning/education) lab	(Abdel-Salam, Kauffmann, & Crossman, 2007; Reeves & Kimbrough, 2004)

Comparing Learner Outcomes

Beyond the lack of standard language to discuss lab modalities, there is no standard evaluation criteria to compare their effectiveness. The literature disagrees on the appropriate measures to use to answer the question of modality equivalence. For example, studies supporting non-traditional labs lean towards outcomes in content knowledge (using quizzes and exams as assessment tools) while studies supporting traditional labs rely on qualitative measures (surveys) (Brinson, 2015). A recent large-scale review of this question concluded that laboratory learning outcomes can be achieved at equal or even greater frequency

in non-traditional labs than traditional labs, regardless of the outcome category being measured (Brinson, 2015). In a biology-specific review, these findings are supported (Biel & Brame, 2016).

Comparing Other Variables

While the effectiveness of a lab experience at achieving the learning outcomes is critical to both educators and administrators, it is not the only variable to consider. There are pedagogical, economic, and safety benefits and drawbacks for all permutations of a laboratory experience. Some variables are straightforward (Table 3) while others fall into a gray zone.

Table 3

Benefits of Traditional and Non-Traditional Laboratory Modalities

Benefits	Traditional lab	Online or remote	Distance (lab kit)
Tangible results with sensory feedback	✓		✓
Low operating & maintenance costs		✓	✓
Student costs	(variable)	✓	
Growth potential & class sizes		✓	✓
Replication	✓	✓	
24/7 availability		✓	✓
Multiple access opportunities		✓	✓
Extended access time		✓	✓
Disability access	✓	✓	✓
Student-instructor contact	✓	(variable)	(variable)
Safety		✓	

Practical skill development. A common argument in support of traditional laboratory experiences is their role in developing practical skills needed to conduct more advanced research. However, there is no evidence in the literature to suggest that students who took an introductory lab through non-traditional methods perform worse in more advanced labs than those who participated in a traditional introductory lab. With that said, it is fair to say that there are procedural skills that involve sensory feedback where a simulation would simply not be equivalent (Brinson, 2015). A study on the necessity of touch sensory feedback in the K-16 science classrooms (study includes kindergarten through undergraduate level), applying both embodied cognition and additional (touch) sensory channel theories, found that the touch sensory feedback is not necessarily a critical component for learning through science experimentation (Zacharia, 2015). Due to inconsistencies in the literature, Zacharia (2015) was unable to arrive at a framework to describe when touch sensory feedback is ideal for learning through experimentation. Compounding this issue, some laboratories are blurring the lines between modalities. In some cases, robotics bring in a more tactile experience by allowing students to remotely control an experiment and monitor the progress in real-time using video (Rivera, 2014). In other scenarios, laboratory settings involve both physical and virtual manipulatives (Zacharia & Olympiou, 2008).

Cost. The cost to students in various modalities varies by institution. In some cases, students must pay lab fees and purchase a lab manual for traditional labs while other institutions do not assess lab fees.

The cost of lab kits vary significantly based on the extent of utilization in the course. Online simulations often have a lower cost than lab kits.

Growth potential. One clear benefit of non-traditional labs is the growth potential. With traditional labs, space is limited by facilities and bottlenecks can occur. Cal-Tech addresses this very issue (Rivera, 2014) by using non-traditional labs. With laboratory kits or online simulations, the limitation of facilities is removed. By offering introductory labs through non-traditional methods, space at the traditional facilities is available for advanced courses. One option for a non-traditional lab is eScience labs, where kits are shipped directly to students globally and the experiments are performed at home, with the assistance of video tutorials, animations, and a lab manual (eScience Labs, 2014). Alternatively, Late Nite Labs (owned by MacMillan) is a company that offers virtual lab environments with over 100 experiment options (Late Nite Labs, 2014).

Accessibility. A clear benefit of non-traditional labs is the expanded accessibility. With online simulations, remote access, and lab kits, learners have the opportunity to engage with the material on their own schedules. This is particularly ideal for non-traditional students who have career and family responsibilities or military deployments. These non-traditional laboratory formats also offer multiple access opportunities that are typically not available in a traditional hands-on laboratory. In many settings using non-traditional labs, the learners have extended time to work with the material, compared to a typical 3 hour weekly lab session. Surveys have indicated that students recognize this as a benefit (Turner & Parisi, 2008). This format also allows increased access to those with physical or psychological disabilities that prevent them from attending traditional laboratories.

One drawback of the lab kits compared to online or traditional labs is the inability to replicate experiments, particularly if an error was made. The lab kits typically do not provide excess reagents for the microscale experiments. A spill or an oversight in the procedure could prevent the student from being able to complete the experiment. Furthermore, students would not have the opportunity to replicate experiments either for error calculations or to confirm unexpected results. Even in a face-to-face laboratory setting with instructor oversight and guidance, experiments sometimes do not go as planned and students have to start from scratch. This is simply not an option for lab kits.

Another aspect of accessibility is the technological hurdles in getting computer simulations or remote control software to work on the various computers used by students. This poses a unique challenge for students, instructors, and the institutions' IT support staff.

Student-instructor contact time. Another consideration is that non-traditional labs are often asynchronous in nature. This means that the instructor or teaching assistant is not directly in front of the student. This can also limit peer collaboration, depending upon pedagogical choices in the course design. Additionally, the unsupervised nature of asynchronous laboratory experiences can provide a barrier to asking timely questions. For non-traditional labs using lab kits, this can diminish safety awareness and increase risks associated with the laboratory work.

Safety considerations. Another factor to consider is the experiences that each modality can support. Hands-on labs (traditional and lab kits) not only reinforce subject area content but also procedural

skills. Safety should be an integral component of the course in order to control risks. Due to the unsupervised nature of working with lab kits, the types of experiments are inherently limited. Lab kits need to be able to operate without generating hazardous waste, without advanced instrumentation, and without easily mitigated chemical and physical risks (Boschmann, 2003). The challenge is to not only develop activities that are safe for transportation/delivery and unsupervised experimentation but activities that are also engaging and do not have obvious results that would detract from motivation to complete an experiment. For these reasons, lab kits are microscale and use low-risk chemicals (Gould, 2014).

On the other hand, labs taught through online simulations are strong in reinforcing content but often gloss over safety and often do not approximate actual procedural skills. Remote labs are likely better at approximating procedural skills but safety may not inherently be addressed.

In online labs, there are often safety oversights and over-simplifications. For example, Late Nite Labs does not address hazardous waste. Students dispose of chemical waste in a bin labeled "chemical recycling" with a biohazard symbol. This does not meet waste management standards established by the Resource Conservation and Recovery Act (RCRA; Environmental Protection Agency, 2011). The oversimplification and recognition that it is "not really happening" can affect student motivation (Rivera, 2014). A benefit of online labs, however, is the ability to explore reactions and procedures that are too expensive or simply too dangerous to perform in a hands-on setting. Safety in remote lab experiences is likely to be variable based on the procedure being remotely operated and the presence of personnel at the physical location of the equipment or experiment being remotely operated.

Non-Traditional Lab Course Design Suggestions

The literature has an abundance of advice regarding creating an effective learning environment in online and non-traditional lecture courses. A common theme, which is easily applicable to the non-traditional laboratory, is active, visible, intentional engagement with students. Deep engagement has been shown to correlate with increases in student performance (Jaggars, Edgecombe, & Stacey, 2013). Instructional design focused on developing students' skills in self-regulated learning is critical for their success in online courses. Student strengths in time, study environment, and effort regulation have been shown to have a significant positive influence on student performance in online courses while rehearsal, metacognitive self-regulation, time, and study environment correlated with student satisfaction with the course (Puzziferro, 2008). Literature providing course design and execution guidance for online courses is abundant, with less focus placed on providing this guidance specifically for non-traditional labs. Much of the literature on non-traditional labs focuses on infrastructure, student outcomes, or student satisfaction, with little attention to pedagogical design. However, data-supported guidance is present. Inquiry is often considered a best practice for laboratory courses and non-traditional lab courses are no exception. An inquiry cycle presented for online laboratory courses proceeds with Orientation, Conceptualization, Investigation, Conclusion, and Discussion (Zacharia et al., 2015). An analytical taxonomy of guidance for inquiry in online courses presents the following categories: performance dashboard, prompts, process constraints, heuristics, scaffolds, and direct presentation of information (de Jong & Lazonder, 2014). Zacharia (2015) presents this taxonomy as ideal for consideration in design and execution of non-traditional lab courses, identifying one of the strengths of this taxonomy being that the guidance is classified in a way that is context independent (e.g., inquiry phase or discipline). While at this time the literature does not clearly indicate which types of

guidance (prompts, process constraints, etc.) are ideal for each inquiry phase, Zacharia (2015) organized existing literature on computer supported inquiry learning according to the taxonomy presented by de Jong and Lazonder (2014).

The literature also reveals additional course features that promote success in an online laboratory environment. As with any online course, student success has been shown to be improved by the use of an online laboratory course orientation (Garman, 2012). The development of an online learning community that allows for peer collaboration has also been demonstrated as a best practice (Garman, 2012; Lowe, Berry, Murray, & Euan, 2009; Palloff & Pratt, 2013). Student surveys from online laboratory courses have highlighted the importance of a well-organized calendar for the course that includes hyperlinks to the laboratory activities, assessments, and deliverables (Reeves & Kimbrough, 2004). For remote laboratory exercises, following industry standards regarding technology platforms ensures students develop skills that are easily transferable and not outdated (Esquembre, 2015).

Conclusion

In conclusion, a well-designed, non-traditional lab can be as effective as a traditional face-to-face laboratory experience when measuring either content knowledge or student opinions as the metric for equivalence. While there is a limited generalizability of the findings, this mirrors results for meta-analyses comparing traditional and non-traditional modalities for lecture courses and non-science courses (Allen et al., 2004; Means, Toyama, Murphy, Bakia, & Jones, 2009; Shachar & Neumann, 2003). However, there are other considerations that institutions must weigh when deciding to take a traditional or non-traditional approach to a laboratory course. The ideal choice of format (traditional, online, remote, or distance) will vary based on the needs and goals of both the institution and the learner.

There are still some rather important questions that have yet to be properly addressed. First, there should be a large-scale cost comparison for various modalities of laboratory courses, for both institutional costs as well as student costs. Second, a long-term study should explore whether non-traditional introductory laboratory experiences properly prepare students for more advanced laboratory experiences, particularly in comparison to those who participated in traditional introductory lab courses. And third, it would be interesting to learn if the instructor-student and peer-to-peer contact time significantly vary in traditional laboratories compared to non-traditional laboratories. With more attention to resolving these questions, the literature may finally arrive on standard terminology and metrics for evaluating equivalency.

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Mental Health in Higher Education: A Comparative Stress Risk Assessment at an Open Distance Learning University in South Africa

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Abstract

Universities depend on committed efforts of all staff members to function effectively. However, where occupational demands outweigh occupational resources, challenging work becomes stressful, followed by an exhausted, disengaged workforce. It is unlikely that disengaged university staff will provide adequate care and service to geographically distant and psychologically isolated learners. As students rely heavily on the support of both administrative staff, as well as academic staff, to manage their learning experience, the work stress experienced by both groups deserves research attention. This study employed a comparative mixed method design, including administrative and academic staff from an Open Distance Learning university in South Africa using the Job Demands-Resources measurement instrument. Findings established from 294 university staff members elucidated staff members' experience of work stress within a mega-distance learning university in the developing world. Mindfulness about the stressors that influence university personnel can inform strategic interventions required to alleviate distress for each employment category.

Keywords: academics, administrative staff, distance learning university, job demands-resources (JDR) model, occupational stress

Introduction

It is generally reported that stress and depression are contemporary occupational diseases which adversely impact the well-being of employees to the detriment of organisational performance. Brough, Dollard, and Tuckey (2014) indicate that high levels of occupational stress experienced by academics from universities have been reported for over 20 years. The incidence of stress, anxiety, and depression furthermore seem to be increasing in most organisations, despite intensified scientific attention to this phenomenon from various disciplines. In the United Kingdom, at any one time, one worker in every six will be experiencing mental health problems related to stress (Marten, 2009). Although an academic career was traditionally seen as one offering low-stress, security, safe employment and high social standing with opportunities to do satisfying, autonomous work, universities have increasingly been exposed to the consequences of a changing environment, the changing world of work, and the concomitant, increased levels of occupational stress. Evidence in the United Kingdom (Tytherleigh, Webb, Cooper, & Ricketts, 2007), China, and Australia (Sun, Wu, & Wang, 2011) indicate that academics are specifically vulnerable to a lack of job security. Research in the higher education sector reported that academics could actually be more exposed to stress than other occupations (Catano et al., 2010). In addition, Ntshoe, Higgs, Higgs, and Wolhuter (2008) highlight the complexities of academic work, academics abandoning core teaching functions in order to give attention to miscellaneous tasks, and the distortion of roles, all of which may give rise to low staff morale.

The presence of stress at work is almost inevitable and it should also be borne in mind that it is not possible, nor desirable, to eliminate all stress. A distinction is drawn between between constructive or good stress (eustress) to which a person can easily adapt, and deconstructive or bad stress (distress), which could have discouraging consequences. However, it is maintained that a certain amount of stress is beneficial as it can be perceived as motivational (Selye, 1983; Grant, Ali, Thorsen, Dei, & Kathryn, 1995; 1995; Moorhead & Griffin, 2001). Conversely, stress only becomes problematic once the person experiencing the stress becomes convinced that the demands of the situation outweigh the ability to cope with the situation. In addition, a belief that insufficient resources (personal and otherwise) are available to deal with the demands of the situation contributes to distress.

Theoretical Perspectives

Occupational stress among university employees is a global phenomenon that does not differentiate between the socio-economic status of countries (Rocca & Kostanski, 2001; Chaudhry, 2012a; 2012b; Ablanedo-Rosas, Blevins, Gao, Teng, & White, 2011; Giorgi, 2012). O'Connor and O'Hagan (2015) elucidates a concern with the drive towards excellence in university academic staff performance as it contributes to pressure for greater accountability, bringing about higher levels of stress to succeed. The effect of such a task- and output-driven culture was observed in a study among universities from The Netherlands, Sweden, and United Kingdom, reporting an increased emphasis on performance measurement, inclusive of assessment of research, teaching, and quality (Teelken, 2011). The study refers to a verbatim comment made by an academic staff member, stating that, "university employees no longer enjoy any part of the job, apart from the vacations…" mainly due to the performance and administrative task focus that seem to distract from primary academic responsibilities (Teelken, 2011, p. 272). In addition, Pon and Lichy (2015) note that there is very little research carried out on the perceptions of academic staff in business and management fields on their working conditions,

globally. They stress the importance of the latter, especially in a time when internationalisation is rapidly increasing.

Even though occupational stress seems to be globally present in universities, not all employees react similarly. An employee's natural disposition in dealing with adversity may largely determine the extent to which occupational stress is managed (Zhang, 2012). Symptoms of ill mental health, associated with uncontrollable stress levels include anxiety, panic attacks, absenteeism, irritability, loss of a sense of humour, constant tiredness, a disconnect with other people, mood swings, heart disease, and suppression of the immune system (Jackson & Rothmann 2006). The negative work outcomes associated with stress may thus be linked to impaired productivity, deteriorating interpersonal relationships, negative organisational culture, and a poor overall level of service delivery expected from staff in an ODL university.

According to Barkhuizen and Rothmann (2005) research findings have alluded to the fact that occupational stress has a negative impact on the physical and psychological health and wellbeing of both academic and administrative staff within universities. In addition, adding to the stress levels of both groups, numerous studies have reported the conflicting relationship between academic and administrative university employees (Pitman, 2000; Gill, 2009; Polster, 2012; Szekeres, 2011; Wallace & Merchant, 2011; Ylijoki & Ursin, 2013; Courtney, 2012; Kyvik, 2013; Lentell, 2012; Meng, Liu, & Xu, 2014). A typical us-and-them relationship is often depicted. However, this well-documented cause of conflict and organisational stress needs to be understood and managed, as universities worldwide rely on the skill and expertise of both the academic and supportive administrative role players to ultimately succeed in delivering high quality service to ODL learners.

Due to education demands and service delivery expectations, ODL academics often rely heavily on technology to remain contactable and attend to correspondence any time of day, as opposed to staff from contact universities (Schuldt & Totten, 2008). The continuous effort to keep up with information technology developments is one of the most cited causes of stress in higher education. A distinction can be made between "technophobia," where staff struggle to keep up with new technological developments and "over-identification" with technology, where technology consumes more time than what is desirable. Tagurum, Okonoda, Miner, Bello, and Tagurum (2017) use the term "technostress" to refer to the feeling of anxiety or mental pressure form overexposure and involvement with computer technology. Similarly, Jahanzeb (2010) describes the following general stressors in an online university environment, for which an ODL university is known for, in Pakistan: technological changes, job uncertainty, information overload, increased demand for productivity, fierce competition, and an ever changing and uncertain future. According to Siltaloppi, Kinnunen, & Feldt (2009), an online environment involves a universal occurrence of being available 24 hours a day by means of the Internet and mobile phone accessibility. In support of this finding, Schuldt and Totten (2008, p. 13) report higher stress levels in online educators than in contact educators, and attribute this mainly to the "24/7 phenomenon."

ODL universities face a significant problem in that an exhausted workforce may not have the personal resources to provide adequate care and superior service to distant learners, who are already experiencing isolation and need support to experience successful learning. As uncontrolled levels of stress are linked to increased absenteeism, presenteeism, and increased worker compensation claims, there are numerous negative consequences for the university and students. Nicklin, McNall, Cerasoli, Varga, and McGivney (2016) found that the ODL learners' physical isolation and lack of interpersonal

interaction, not only increases the demands and expectations that learners may direct towards the lecturer, but also for other professionals and officials providing technical support. As the students' need for support from both administrative and academic staff to manage their learning experience increases, the work stress experienced by both groups is a relevant and important problem in ODL universities and demands research attention.

The World Health Organization (WHO, 2018) acknowledges occupational stress as a serious problem and defined work-related stress as "the reaction people may have when presented with work demands and pressures that are not matched to their knowledge and abilities and which challenge their ability to cope" (para. 3). The WHO (2018) also advises that stress occurs in a wide range of work circumstances but is often made worse when employees feel they have little support from supervisors and colleagues and where they have little control over work or how they can cope with its demands and pressures (para. 3).

Conservation of Resources Theory

This research is grounded in the Conservation of Resources (COR) theory (Höbfoll, 1989), which is relevant for understanding the effect of job resources (or lack thereof) on employees. Although job demands are not necessarily negative, they may turn into job stressors when meeting those demands requires high effort from which the employee has not adequately recovered. Job resources refer to those physical, psychological, social, or organisational aspects of the job that are either/or:

- Functional in achieving work goals.
- Reduce job demands and the associated physiological and psychological costs.
- Stimulate personal growth, learning, and development.

Hence, resources are not only necessary to deal with job demands, but they also are important in their own right. This agrees on a more general level with Conservation of Resources (COR) theory (Höbfoll, 2001) that states that the prime human motivation is directed towards the maintenance and accumulation of resources important in their own right. Höbfoll (2002) has additionally argued that resource gain, in turn, and in itself, has only a modest effect, but instead acquires its saliency in the context of resource loss. This implies that job resources gain their motivational potential, particularly when employees are confronted with high job demands.

Stressful organisations are characterised by high demands yet low resources, whereas organisations characterised by high demands and resources present a challenging work environment. Four kinds of stressors may be experienced, including acute, time limited stressors (e.g., dentist visit, disciplinary hearing), stressor sequence (e.g., job loss), chronic, intermittent stressors (e.g., regular performance reviews), and chronic stressors (e.g., unhealthy organisational culture). In addition, Hobföll (1989) identified four specific kinds of resources that play an important role in the stress experience of individuals, namely object resources (e.g., office space), conditions (e.g., tenure), personal orientation toward the world, and energies aiding the acquisition of other kinds of resources such as time, money, and knowledge.

Job Demands-Resources Research Instrument

The job demands-resources (JD-R) instrument was developed based on the COR theory of Höbfoll (1989), which integrates a number of occupational stress scales, and, at the same time extends these

scales to reflect occupational stress more holistically (Pasca & Wagner 2011; van den Broeck, van Ruysseve ldt, Vanbelle, & De Witte, 2013). Moreover, this scale was validated for a South African context (Rothmann, Mostert, & Strydom, 2006). In a study of 201 telecom managers, Schaufeli, Bakker, and Van Rhenen (2009) found support for the JD-R model. The results of their study revealed that increases in job demands (i.e., overload, emotional demands, and work-home interference) and decreases in job resources (i.e., social support, autonomy, opportunities to learn, and feedback) predict burnout and burnout (positively) predict registered sickness duration and frequency (involuntary absence), respectively. Consequently, this scale was appropriate to use for purposes of this study.

The term job demands (JD) may include physical, social, or organisational demands of a job, requiring physical, cognitive, and emotional effort (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001). When these demands are high and employees do not get enough time to recover between meeting these high demands, the job demands turn into job stressors (Sonnentag & Zijlstra, 2006, as cited in Demerouti, Bakker, Geurts, & Taris, 2009). Furthermore, it is important to note that job demands may be quantitative in nature (e.g., workload, time pressures, due dates), demands may also be unique to the specific context and qualitative in nature (e.g., very complex, highly cognitive, ambiguous).

Job resources (JR) refer to physical, social, and organisational resources that support the individual in performing their jobs. These resources may reduce the strain caused by the job demands as they may reduce the costs associated with the job, help the employee to achieve their work goals, and facilitate personal growth and development (Demerouti, Bakker, Nachreiner et al., 2001). It is evident from the above that an absence of sufficient job resources to perform the job effectively will cause an increase in the amount of stress the job incumbent experience in trying to perform the job in the best possible way. Figure 1 depicts the JD-R model of burnout.

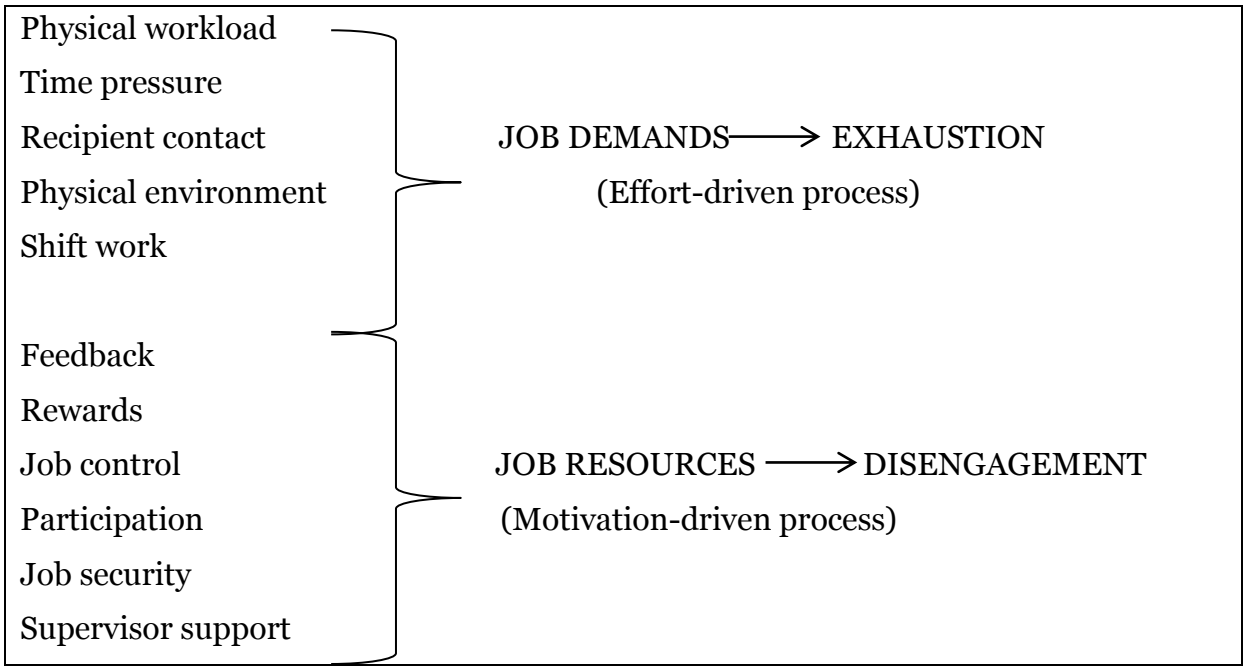

Figure 1. JD-R Model of burnout (adapted from Demerouti, Bakker, Nachreiner & Shaufeli, 2001). This model illustrates the relationship between Job Demands and Job Resources on the one hand, and employees' experience of either exhaustion or disengagement on the other hand.

Thus, prolonged, ever increasing demands may exhaust the person's coping ability to such an extent that they begin to feel exhausted, cynical, and experience reduced self-efficacy, constituting the three dimensions of burnout (Maslach, Shaufeli, & Leiter, 2001).

As various groups of employees in ODL learning universities are reporting increased strain and high stress levels, this study targeted both the academic and the administrative sections of the staff complement in the largest college within a mega ODL university in South Africa. The overall purpose of this article is to explore both academic and administrative staff members' experience of work stress within a mega ODL university in the developing world.

Research Design

A post-positivistic paradigm perspective guided the primary descriptive research methodology comprising a non-experimental, cross sectional survey design. The staff database of the university's Human Resources Department was used for obtaining e-mail addresses of all staff employed within one of the five colleges within the university, namely the College of Economic and Management Sciences. This college is the largest college within the participating university, comprising of 548 permanent and temporary employed academic and administrative staff with e-mail accessibility. All staff members are involved in ODL learning exclusively, as the university does not offer any face-to-face teaching and learning. These sample elements all have Internet accessibility, which made computer-aided web surveying the most appropriate data collection method. According to this method, staff were invited via e-mail to access a survey website by clicking on a hyperlink designed for the survey. A first-round personal e-mail invitation was sent to all staff members, followed by three further weekly reminders to encourage participation among those respondents who had not responded previously to supplement the response rate. As such, the population comprised all employment categories, namely permanent and temporary fixed term employees ranging from peromnes job levels 5 (e.g., full professor) to 12 (e.g., ground level, operational). At the university the peromnes (P-level) job design system is used across all functions to refer to different hierarchical post levels of employees in permanent, full-time employment. Others are referred to as temporary staff. The total sample frame of 548 staff members were invited to participate in the survey, yielding a realised sample of 294, as such, a response rate of 54%. Table 1 presents the sample structure by P-level and employment category. The P-level titles applicable to both academic and administrative employees differ, and are also reflected.

Table 1

Sample Structure by Peromnes Job Level and Employment Category

P-level	Academic title	Administrative title	Employee category	
			Academic	Admin
			N	
5	Full Professor	Executive Director	25	2
6	Associate Professor	Director	16	2
7	Senior Lecturer	Manager	39	11
8	Lecturer	Admin/Research Coordinator	78	14

9	Junior Lecturer	Admin Officer/ Secretary/ Research Assistant	3	42
10-12	Support Staff – Admin/Research Assistant	Support Staff – Typist/Admin Assistant	0	6
Temp	Supportive academic functions	Supportive administrative functions	25	31
		Sample *(n)*	**186**	**108**

An online survey employing the Qualtrics survey software platform (Qualtrics, 2017), comprising quantitative and qualitative questions was used. The research instrument consisted of standardised questions from the JD-R instrument, customised to ensure a more personable delivery to university employees. Responses were captured on a 4-point Likert-scale, where a rating of 1 implies "never" and 4 implies "always."

Table 2

JD-R Items by Factor

Factor	Item
Organisational Support	Do you receive sufficient information on the purpose of your work?
	Do you receive sufficient information on the results of your work?
	Do you know exactly what your direct line manager/supervisor thinks of your performance?
	Are you kept adequately up-to-date about important issues within the university?
	In your work, do you feel appreciated by your line manager/supervisor?
	Do you get on well with your line manager/supervisor?
	Do you know exactly what other people expect of you in your work?
	Can you discuss work problems with your direct line manager/supervisor?
	Can you count on your line manager/supervisor when you come across difficulties in your work?
	Do you know exactly for what you are responsible?
	Can you participate in decisions about the nature of your work?
	Does your direct line manager/supervisor inform you about important issues within your department?
Growth Opportunities	Does your job offer you the possibility of independent thought and action?
	Do you have freedom in carrying out your work activities?
	Does your work give you the feeling that you can achieve something?
	Do you have influence in the planning of your work activities?
	Does your job offer you opportunities for personal growth and development?

Factor	Item
	Do you have enough variety in your work?
	Does the university give you opportunities to follow training courses?
Overload	Do you work under time pressure?
	Do you have to be attentive to many things at the same time?
	Do you have too much work to do?
	Do you have to remember many things in your work?
	Are you confronted in your work with things that affect you personally?
	Does your work put you in emotionally upsetting situations?
	Do you have contact with difficult people in your work?
	Do you have to give continuous attention to your work?
Job Insecurity	Do you need to be more secure that you will keep your current job in the next year?
	Do you need to be more secure that you will still be working in one year's time?
	Do you need to be more secure that next year you will keep the same function level as currently?
Relationship with colleagues	If necessary, can you ask your colleagues for help?
	Can you count on your colleagues when you come across difficulties in your work?
	Do you get on well with your colleagues?
Control	Does your job give you the opportunity to be promoted?
	Is it clear to you whom you should address specific problems?
	Do you have a direct influence on your department's decisions?
	Is the decision-making process of your department clear to you?
	Can you participate in the decision about when a piece of work must be completed?
Rewards	Do you think you are paid enough for the work that you do?
	Can you live comfortably on your pay?
	Does your job offer you the possibility to progress financially?
	Do you think that the university pays good salaries?

To facilitate interpretation, one satisfaction question to be rated on a 7-point Likert scale was posed, namely: "Thinking about your job at [university name], taking all things into consideration, how would you say you feel about your current situation?"

Lastly, one open, qualitative question was included to allow a deeper level of information sharing and analysis, namely: "Thinking about your job, taking all things into consideration, how do you feel about your current situation?" Table 2 depicts the JD-R items loaded onto all of the seven factors.

Research and Ethical Procedure

The study adhered to a strict research ethics Code of Conduct and did not report or avail any personal identifying information. Respondents were obliged to complete an informed consent letter, accompanying the anonymous, online survey (UNISA, 2007). A number of experts were consulted, comprising a task team of five university professors and researchers in the fields of human resources,

occupational stress, industrial psychology, and research psychology, who analysed the instrument and made recommendations for improvement to ensure face validity. A pilot study with 10 respondents also provided inputs for improvement. Data obtained from the pilot study was not included in the main data set as these respondents were purposefully selected based on the fact that they would be in a position to provide constructive feedback to the questionnaire.

Statistical Analysis and Results

In terms of the quantitative analysis of the standardised JD-R survey, mean scores obtained from the 42 JD-R items rated on a 4-point Likert scale were converted to index scores to reflect a score out of 100. The methodology followed involved rank ordering the index scores and establishing quartile cut-off points based on the overall average. In presenting the findings, index scores are ranked by item. The rank ordering aids in pinpointing the most important job related stressors for both the academic and the administrative staff members. In addition an independent samples t-test analysis, also known as the two sample t-test, was performed to determine whether there is a statistically significant difference between the means in two unrelated groups (Tustin, Ligthelm, Martins, & Van Wyk, 2005), namely the manifestation of stress levels between the academic and administrative staff. Comparison of column means was performed to test for the direction of significance using the Bonferroni correction for pairwise comparisons. Statistical analyses were performed using the IBM Statistical Package for Social Sciences (SPSS) version 24. Given that the research instrument comprises 42 items, the independent samples t-test and comparison of colum means to determine the direction of significance is displayed in additional tabular format by factor only, not item, in Tables 4.1 to 4.3. Statistical significance according to the t-test by item is, however, reflected in Table 3 by asterisk (*).

Conversely, in terms of the qualitative interpretation of the participants' responses to the open-ended question, responses were analysed and categorised accordingly. Qualitative content analysis was employed, as it allows for a comprehensive and methodical analysis of the written word, in the persuit finding patterns, themes, or prejudices (Krippendorf, 2013). The qualitative analysis is useful in allowing a deeper level of understanding and interpretation of the quantitative results. An inductive coding approach was used to analyze the data (Hsieh & Shannon, 2005). Initially, the researchers read through all the text to get an understanding of the "big picture" (White & Marsh, 2006, p.37). The procedure followed was aligned to the guidelines provided by Krippendorf (2013), as well as White and Marsh (2006). This entailed developing a coding scheme through a process of close, iterative reading to identify concepts and patterns. Similar codes were combined into categories, in order to reduce the data further. Thus, a process of reading and re-reading, trying to identify important, key phrases, and unexpected ideas were followed. The researchers continued to identify codes and categories through the iterative reading process. Care was taken to ensure the codes and categories were independent, mutually exclusive, and exhaustive.

In order to improve the rigour of the research, multiple coding was employed, as both researchers analysed the same data set (Barbour, 2001). As recommended by Weber (1990), the researchers discussed and defined the meaning of codes and categories in detail, to avoid ambiguity and ensure they share the same understanding of the different codes and categories. This process helped to improve the inter-rater reliability (reproducibility) and intra-rater reliability (stability) referring to the ability of the same rater to get the same results, during another round of coding (Weber, 1990). Both intra- and inter-rater reliability is necessary to ensure the trustworthiness.

Finally the analysed data was related back to the phenomenon under study, and inferences were drawn (Krippendorf, 2013). The inferences were aimed at the overall purpose of this article, namely to explore both academic and administrative staff members' experience of work stress within a mega ODL learning university in the developing world.

Quantitative analysis is presented by employment category and either item and/or factor. The JD-R occupational stress and risk ranking index scores of the work-related items are reflected in more detail in Table 3. The bold entry items reflect the averages for the seven underlying factors.

Table 3

Occupational Stress and Risk Ranking by Item

JD-R item	Employment category		
	Academic	**Admin**	**Gap**
Does your job give you the opportunity to be promoted?	49.1	*23.8	25.3
Does your job offer you opportunities for personal growth and development?	65.3	*48.3	17.0
Does the university give you opportunities to follow training courses?	78.2	*61.4	16.8
Do you need to be more secure that you will keep your current job in the next year?	*47.6	63.2	15.6
Are you confronted in your work with things that affect you personally?	50.9	*65.8	14.9
Can you participate in the decision about when a piece of work must be completed?	*41.6	56.4	14.8
Job Insecurity	***46.3**	**60.5**	**14.2**
Do you need to be more secure that you will still be working in one year's time?	*50.0	64.1	14.1
Do you think that the university pay good salaries?	*48.7	62.3	13.6
Does your work give you the feeling that you can achieve something?	64.7	*51.5	13.2
Do you work under time pressure?	*32.9	46.0	13.1
Do you need to be more secure that next year you will keep the same function level as currently?	*45.4	57.5	12.1
Do you have to be attentive to many things at the same time?	26.3	*36.4	10.1
Do you have enough variety in your work?	65.0	*55.9	9.1
Is it clear to you whom you should address for specific problems?	*59.7	68.6	8.9
Does your work put you in emotionally upsetting situations?	61.4	*69.9	8.5
Growth Opportunities	**62.1**	***54.4**	**7.7**

JD-R item	Employment category		
	Academic	Admin	Gap
Do you know exactly for what you are responsible?	*78.0	85.7	7.7
Do you know exactly what your direct line manager/supervisor thinks of your performance?	55.5	63.0	7.5
In your work, do you feel appreciated by your line manager/supervisor?	60.0	67.3	7.3
Do you know exactly what other people expect of you in your work?	*65.7	72.7	7.0
Workload	***36.7**	**43.0**	**6.3**
Do you get on well with your line manager/supervisor?	74.1	80.3	6.2
Can you participate in decisions about the nature of your work?	54.6	60.7	6.1
Do you have a direct influence on your Department's decisions?	29.6	35.1	5.5
Are you kept adequately up-to-date about important issues within the university?	62.0	56.8	5.2
Do you get on well with your colleagues?	76.8	81.8	5.0
Organisational Support	**64.6**	**69.6**	**5.0**
Does your job offer you the possibility of independent thought and action?	63.3	58.6	4.7
Relationships	**60.5**	**65.1**	**4.6**
Do you have contact with difficult people in your work?	52.0	48.0	4.0
Do you have too much work to do?	32.2	36.1	3.9
Do you receive sufficient information on the purpose of your work?	60.0	63.9	3.9
Rewards	**42.7**	**46.1**	**3.4**
Can you count on your line manager/supervisor when you come across difficulties in your work?	67.8	71.0	3.2
Control	**53.8**	**56.9**	**3.1**
Does your job offer you the possibility to progress financially?	41.1	38.2	2.9
Do you have to give continuous attention to your work?	16.3	19.1	2.8
Do you receive sufficient information on the results of your work?	55.1	57.7	2.6
If necessary, can you ask your colleagues for help?	64.4	62.0	2.4
Do you think you are paid enough for the work that you do?	39.8	42.2	2.4
Can you live comfortably on your pay?	43.0	40.8	2.2
Do you have to remember many things in your work?	20.4	22.2	1.8
Do you have freedom in carrying out your work activities?	61.5	60.2	1.3

JD-R item	Employment category		
	Academic	Admin	Gap
Can you discuss work problems with your direct line manager/supervisor?	66.5	67.3	0.8
Do you have influence in the planning of your work activities?	53.0	52.3	0.7
Can you count on your colleagues when you come across difficulties in your work?	59.5	60.1	0.6
Does your direct line manager/supervisor inform you about important issues within your department?	65.1	64.5	0.6
Is the decision-making process of your Department clear to you?	53.4	54.0	0.6

* $p \leq 0.05$

Whilst not highly significant, administrative and academic staff at the ODL university are in agreement about certain occupational stressors, namely time pressures, the need to be attentive to many things simultaneously, workload, being excluded from departmental decisions, rewards and remuneration, and having to give continuous attention to work. The findings show that certain causes of stress within the university college are generic and effects the entire staff complement. However, it is evident from Table 3 that administrative and academic staff show statistical significant differences to occupational stressors on 17 of the 42 JD-R items, and the direction of significance revealed that administrative staff experience stress due to mainly limited promotional and personal growth and development opportunities, such as not having enough or any opportunities to follow training courses. These individuals often feel personally affected by things that happen at work and are less convinced that they can attain success. Administrative staff furthermore experience significantly higher levels of stress from having to be attentive to many things at the same time, yet also report significantly high stress due to not having sufficient variety in their work. Therefore, it seems that although there is a high expectation from them to complete many tasks, these staff are of the opinion that their tasks are often mundane in nature, not providing sufficient intellectual stimulation.

Contrary, academic staff experience significantly higher stress due to mainly feelings of job insecurity, poor renumeration, high workload, time pressure, not having role clarity on what is exected from them, and not knowing whom can be asked for help if needed. These individuals feel excluded from decisions about work that affect them. Tests for statistical significant differences are displayed in Tables 4.1 to 4.3.

Table 4.1

Occupational Stress and Risk Indices by Factor

Factor	Admin	Academic
	Index	
Overload	42.97	*36.67
Growth opportunities	*54.44	62.07
Relationships	65.05	60.46
Organisational support	69.61	64.58
Control	56.93	53.80
Job insecurity	60.50	*46.33
Rewards	46.09	42.68
Average	**59.38**	**58.39**

* p≤ 0.05

Results in Table 4.1 show that academic and administrative staff members differ significantly with regard to overload, growth opportunities, and job insecurity. Whilst staff from both employee categories experience concerning high levels of overload, the academic staff members reportedly carry a heavier burden and experience higher levels of job insecurity. In contrast, administrative staff members reported higher stress levels as a consequence of insufficient growth opportunities. The statistical significance was performed using an independent samples t-test, of which the results of the two-tailed t-test is evident in Table 4.2.

Table 4.2

Independent Samples T-Test by Factor

Factor	t	Sig. (2-tailed)
Overload	*2.99	0.003
Growth opportunities	*-2.76	0.006
Relationships	1.78	0.076
Organisational support	1.92	0.056
Control	1.10	0.270
Job insecurity	*3.45	0.001
Rewards	1.01	0.316
Average	**0.61**	**0.544**

* p≤ 0.05

Table 4.2 displays the results of the two-tailed t-test to determine statistical significance by factor. The statistical tests in Tables 4.2 and 4.3 confirm that academic staff experience significantly higher levels of occupation stress related to work overload and job insecurity, whereas administrative staff experience significantly higher levels of occupational stress related to growth opportunities. The statistical significance was analysed at a 95% confidence interval of the difference.

In order to clarify the direction of the significance, the Bonferroni correction for pairwise comparisons in Table 4.3 is used to indicate whether administrative or academic staff experience higher levels of occupational stress on the identified factors.

Table 4.3

Bonferroni Correction for Pairwise Comparisons

Factor	Admin (A)	Academic (B)
Overload	B(.003)	
Growth opportunities		A(.006)
Relationships		
Organisational support		
Control		
Job insecurity	B(.001)	
Rewards		
Average		

* p≤ 0.05

The direction of the significance confirmed by Table 4.3 indicates that Academic staff reported significantly higher occupational stress levels due to perceived aspects related to work overload and job insecurity. Conversely, Administrative staff reported statistically higher occupational stress levels due to perceived aspects related to growth opportunities.

Findings and Discussion From Qualitative Analysis

A few comments reiterating the "us-and-them" sentiment between administrative and academic staff can be seen in some of the following verbatim excerpts, mostly related to support, or the lack thereof. In addition, some comments illustrate generic occupational stressors for administrative and academic staff respectively. The JD-R factor best aligned to the sentiment is given in brackets.

Stressors for academic staff. A sense of being overwhelmed, helpless, and not having personal control emerged from the ODL educators. It seemed that increasing governance demands and the impact on workload has been significant. For example, academics, used to the academic freedom to decide the standard of an exam paper, find it stifling to adjust to governance demands. The possibility of litigation gave birth to numerous "quality assurance templates" to be completed. Various rounds of quality assurance by secondary lecturers, quality assurers, chairs of departments, and even

faculty management. Similarly the ODL educators are required to check and re-check fellow academics' material, assignments and papers. This fuels the impression of an extremely high administrative burden.

Evidence of the frustration caused, include comments such as "admin tasks are gradually being transferred to the academics." Due to the fear of security breaches, academics within this college are expected to capture exam marks on a specific ICT system. Previously this task was allocated to administrative staff. Although it may be a minor addition, it entails additional ICT training, typing skills, and competencies that academics may not have. Class sizes of thousands of students and checking marks for correctness add a significant time investment to an overburdened staff compliment. Academics typically feel robbed of research time and this may lead to more stress and resistance. "My work now is administrative because I never get time to immerse myself in my academic passions" (lack of organisational support / loss of personal control / work overload). Academics expressed a lack of personal control such as to "(r)esist the extreme intrusion and prescriptiveness of administration and educational philosophers." Many of the ODL educators' reflections allude to feelings of being overworked and over extended, for example expressing a need for "assistance with workload," "communicate due dates of all activities and submissions at the beginning of the year to all members of staff," "less relentless mind numbing never ending deadlines," "get rid of the ever escalating administrative burden imposed on academics," "extended time frame for completion of tasks," "work-life balance – require flexible working hours to manage workload," direct requests to "hire more staff," and a need for "user friendly operational systems." When interpreted in terms of the JD-R theoretical framework a pattern emerges from the verbatim evidence showing a lack of organisational support, loss of personal control, and work overload.

Stressors for administrative staff. Tipping the scale towards the other side, administrative staff expressed a need for "clear job descriptions," "task clarity," and require more "goal directedness" (organisational support). Furthermore, from some of the administrative staff's statements it seems as if they often feel misused, as illustrated by quotes such as "draft and construct clear job descriptions for administrative staff based on the departmental expectations" (operations, objectives, support) and "not to put admin only when there are already existing problems" (organisational support). In addition administrative staff members expressed a need for "improved teamwork" and "bridging the gap between admin staff and academics" (relationships). The verbatim evidence shows that although the main administrative stressors may be different from academic stressors, these staff members too suffer from continuous feelings of uncontrolled stress and anxiety.

Finding solutions. Both employment categories were given the opportunity to express core changes necessary to alleviate occupational stress levels. Sentiments relating directly to academic versus administrative staff were expressed mostly by academic staff members. Aligned to the JD-R model, experiencing a sense of a lack of support is indicative of a perceived lack of resources. As such, these academics mostly feel that they are not sufficiently equipped and supported by administrative staff in order to meet their job expectations. Evidence for this sentiment is presented in statements such as: "use people according to their strength," "with the way we are going now - fire all the academics and appoint admin people in their place," and "a supportive administration - currently, the tail wags the dog" (Organisational support).

Given the opportunity to reflect on occupational matters requiring improvement, these staff members expressed the pervasive need for reduced levels of workload, a fair and manageable distribution of

workload, a need for improved institutional and administrative support, and efficient systems. Administrative staff expressed the need to be more involved and engaged in teamwork, improved task clarity, and goal directedness. The feeling of being overburdened was reiterated by academics' comments related to the need to not be overworked, academics needing administrative tasks to be assigned to administrative colleagues, and expressing a need for realistic timeframes to attend to job demands. Overall, academics seemed of the opinion that they are unable to dedicate the required time and attention to academic responsibilities due to increased administrative, regulatory, and compliance responsibilities. Table 5 presents a summary of the major qualitative findings.

Table 5

A Summary of the Major Qualitative Findings

Major sources of stress		
Generic to both academic and administrative staff	**Specific to academic staff**	**Specific to administrative staff**
Time pressures	Feelings of job insecurity	Limited promotional and personal growth and development opportunities
Being attentive to many things simultaneously	Poor remuneration	Feelings of being personally affected by things that happen at work
Workload/ overload	High workload and time pressure	Doubt whether they can attain success
Being excluded from departmental decision-making	Feel excluded from decisions about work that affect them	Not having sufficient variety in allocated work
Rewards and remuneration	Role clarity	
Having to give continuous attention to work		

Discussion and Recommendations

The empirical evidence reported on in this article helps to foster a deep psychological understanding of the job-demands that face staff members within this university. Thus, the findings create mindfulness about the stressors, in order to inform the strategic decisions and interventions required from policy makers, to alleviate some of the distress experienced by all the people affected in the university.

Due to the pervasiveness of occupational stress and stressors, no one is immune to the effect on their mental health and well-being, regardless of job title, daily tasks, or work setting. A heavy workload accompanied by unfeasible additional administrative duties and limited organisational support have been identified as predominant contributors that place these university staff members at risk of experiencing negative occupational stress. Although organisational support personnel and systems are

in place, these staff members and systems are perceived as either lacking sufficient capacity or being incompetent in dealing with requirements.

Academic staff members experience exceptional levels of occupational stress due to a wide array of time consuming job requirements against which performance is measured, resulting in limited time for research when having to weigh immediate requirements. In addition, bureaucracy and "red tape" prevents staff members from taking innovative and independent action.

The study results' main contribution lies in the support of the findings of Bakker, Demerouti, De Boer, and Schaufeli (2003) within the higher education context. The empirical evidence provided, showed that poor and lacking resources within the university context preclude actual goal accomplishment, which is likely to cause failure and frustration and therefore may lead to withdrawal from work, and reduced motivation and commitment. The results furthermore explicate the additional stressful challenges that ODL university staff experience with regard to resources and demands. A number of differences were revealed between the stressors experienced by academic and administrative staff.

With regard to job overload, it seems that staff, especially in academic positions, experience increased time pressure, work overload, and concomitant increased levels of stress, which may lead to ill health and reduced commitment over the long term, if not addressed. This finding is in line with the drive towards excellence in university academic staff performance, performance measurement, assessment, and accountability, giving rise to high stress levels, observed by O'Connor and O'Hagan (2015) among universities from The Netherlands, Sweden, and United Kingdom.

On the contrary, the results indicated that administrative staff members in this ODL university often experience stress as a result of a lack of opportunities to grow and develop. The lack of these job resources may hinder administrative employees in achieving their work goals and facilitating personal growth, learning, and development, as predicted by Demerouti, Bakker, Nachreiner et al. (2001). It is strongly advised that the university invest in planned talent management strategies for administrative staff, to enable them to grow and develop in their positions.

This study found that the academic staff members experienced high levels of job insecurity. This is in line with what previous studies found in the United Kingdom (Tytherleigh et al., 2007), China, and Australia (Sun et al., 2011). It is thus recommended that the ODL university involved would pay attention to academics' experience of a lack of job security, in an effort to reduce their stress levels.

With regard to job control, it seems that staff feel that they have little control over many aspects of their job (autonomy) and have little or no influence over their performance targets. Individuals who experience little control are inclined to experience higher levels of stress and be less committed to work. This finding is supported by Coetzee and Rothmann (2005), who found that employees perceived control as a big source of stress and as a result perceive the organisation as less committed to them, and therefore also become less committed to the organisation.

Conclusions

Occupational stress among university staff members deserve dedicated research attention, especially given the fact that it is a global phenomenon. Continuous research to monitor university staff's

wellbeing is necessary and we recommend that this research be expanded to include a larger and more diverse proportion of administrative and academic staff's stressors. The conceptual framework raises several questions that could be explored further through alternative or longitudinal research approaches. Other limitations include the use of a cross-sectional survey design, limiting the investigation of causal relationships. It is furthermore difficult to establish the time sequence of events. Secondly, the self-report measure involves subjective perceptions. However, despite these limitations, this study utilised a standardised measurement instrument, customised for the South African environment, previously used in higher education scenarios. Furthermore, cross-validation is evident in the quantitative and qualitative findings that complement one another with pertinent occupational stress and risk factors identified, to be addressed among administrative and academic staff respectively.

A clear need is articulated indicative of the importance to restructure positions within which realistic expectations with clear and transparent job descriptions are defined. Sufficient and effective support functions to support staff members when needed are imperative, especially with regard to the increasing administrative task demands. Eliminate unnecessary administration and duplication where possible. Identify individuals with a need and potential to cope well with task diversification that could contribute to job enrichment and utilise graduate students under supervision as part of personal research teams. Staff members, who have proven themselves competent, need to be empowered with greater decision-making authority. Research interests need to be salvaged and academics on all levels need more time for their scholarly pursuits while serving departments. Dissatisfaction occurs when time for research is put aside, resulting in additional distress and at times also burnout. Lastly, timeous identification of stressors present need to be addressed. Whilst the intensity in which these pressures are experienced may be relative to the respective staff member, however, the manner in which stressors are dealt with can be crucial to prevent escalation of problems.

As the higher education sector continues to battle turbulent times of change and upheaval, it is imagined that these findings may provide a new vantage point on some of the difficulties faced by people working within the industry. As people battle to maintain mental health issues within their various professions, the higher education sector is no exception. It is hoped that the new knowledge presented in this article will facilitate a deeper psychological understanding of how people experience the stressors within the university system. An improved understanding is essential for managers and policy makers to address these issues to the benefit of the whole higher education community, including academics, administrative staff, learners, and all other stakeholders involved.

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Goal Orientation and Academic Performance in Adult Distance Education

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Abstract

Research has shown the importance of goal orientation in predicting academic performance for children, adolescents, and college students in traditional educational settings. Studies on this relationship within adult distance education, however, are lacking. To fill this gap, the present study was conducted to investigate the relationship between goal orientation and academic performance in adult distance learners. A sample of $N = 1128$ distance university students (age 18-75 years) filled out an online questionnaire. Their exam grades were collected from the files of the Open University of the Netherlands (OUNL). A mixed model regression showed performance approach goal orientation to be a positive predictor of academic performance, whereas performance avoidance and work avoidance were negative predictors of academic performance. Non-significant results were found for mastery approach as well as for mastery avoidance. Implications of these results are discussed.

Keywords: ALOUD study, adult distance students, achievement goal questionnaire, AGQ, work avoidance, mixed model analysis

Introduction

Being academically successful is highly dependent on what motivates a person to study, something which can also be expressed as someone's goal orientation (Dweck, 1986). Although the relationship between goal orientation and academic achievement has been studied extensively in traditional educational settings for children (e.g., Anderman & Midgley, 1997; Butler, 2008), adolescents (e.g., Brdar, Rijavec, & Loncaric, 2006; Greene, Miller, Crowson, Duke, & Akey, 2004; Steinmayr, Bipp, & Spinath, 2011; Steinmayr & Spinath, 2009), and college students (e.g., Elliot, Murayama, & Pekrun, 2011; Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008; Pekrun, Elliot, & Maier, 2009), not much is known about this relationship for adult learners in distance education. As society and technologies are rapidly changing and the amount of information continues to increase at exponential rates (Nagy, Farmer, Bui, & Trancik, 2013) it has become increasingly important for people to keep up with these developments throughout their lives. Therefore, the group of adult learners is rapidly gaining both in size and importance. In a time-limited environment, distance education is a suitable educational alternative. Hence, the present study was conducted to investigate the relationship between goal orientation and academic performance in adults participating in distance education.

Distance Education

In our continuously changing society, employers often demand that employees continue to develop their professional knowledge and skills throughout their careers. As a result, formal adult education is growing in importance. In 2015, 10.7% adults in Europe between 25 and 64 years of age participated in formal education or training (Eurostat, 2016). Time to study is often limited, however, as many people have a full time job, a family, and/or a busy social life. Distance education can be a suitable solution because, generally speaking, this type of education allows people to study from their own home and according to their own time schedule.

Over the years, many definitions of distance education have been presented. A widely-accepted definition is the one of Schlosser and Simonson (2010), who defined distance education as "institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors" (p. 1). This definition consists of four elements. The first element is that distance education is institution-based, which separates it from self-study. Second, the definition states that the learning group is separated. Teachers and students could either be separated by time (i.e., asynchronous distance education), place (i.e., separate locations), or intellect. The third part of the definition concerns the use of interactive telecommunication systems. Interaction between teacher and students, as well as between students and their fellow students, can either be at the same time (i.e., synchronous) or at different times (i.e., asynchronous). Telecommunication includes communication by electronic (e.g., the Internet) as well as non-electronic media (e.g., the postal system). The last element, connecting learners, resources, and instructors, refers to the interaction between teachers and students, with available resources that promote learning (e.g., assignments, (virtual) classes, or course material). All four elements can be found in the educational system of the Open University of the Netherlands (OUNL): students study in their own time and pace (i.e., asynchronous) and, most of the time, from their own homes (i.e., separation by place), they communicate for the most part by the Internet, and interaction between teachers and students, as well as between students and their fellow students, takes place synchronous (e.g., virtual classes, exams) as well as asynchronous (e.g., assignments, e-mail contact) in time. Therefore, in the present study, the definition of Schlosser and Simonson (2010) was utilized.

A common problem in all higher education, but especially in distance education, is the high dropout and low retention rate (Berge & Huang, 2004; Yukselturk, Ozekes, & Türel, 2014). Knowing what motivates students to follow courses in distance education in the first place, and knowing the relationship between their goal to study and academic performance might be valuable information to heighten the retention rate for adult distance learners.

Achievement Goal Theory

People can have different motives to reach a certain goal, also known as one's *goal orientation* (Dweck, 1986). To understand the concept of goal orientation, it is important to refer to the achievement goal theory by Dweck (1986) and Nicholls (1984). They stated that goal orientation can be classified in mastery and performance goal orientation. In educational context, this means that students who are mastery oriented focus on developing knowledge and skills, whereas students who are performance oriented focus on doing better than others (Dweck, 1986; Nicholls, 1984). In 1996, Elliot and Harackiewicz made a distinction within the performance orientation. They argued that people could either focus on doing better than others (i.e., performance approach) or on avoiding doing worse than others (i.e., performance avoidance). Similarly, Elliot and McGregor (2001) argued that an approach-avoidance distinction could be made for mastery goals, with mastery approach defined as people focusing on developing knowledge and skills, and mastery avoidance defined as people focusing on avoiding stagnating in development or losing skills. More recently, a fifth concept was added to the goal orientation construct (Harackiewicz et al., 2008), a stance in which people are striving for success using as little effort as possible and are, thus, classified as having a work avoidance orientation.

Goal Orientation and Academic Performance

The relationship between goal orientation and academic performance has been studied extensively (for examples of review studies and meta-analyses, see Cellar et al., 2011; DeShon & Gillespie, 2005; Huang, 2012; Payne, Youngcourt, & Beaubien, 2007). Traditionally, researchers found a strong positive relationship between mastery goal orientation and academic outcomes, while performance goal orientation was often found to be weakly negatively to non-significantly related to academic outcomes (for meta-analysis, see Huang, 2012). The distinction between approach and avoidance within the performance goal orientation clarified these findings, namely, that the performance avoidance goal orientation was negatively related to learning outcomes, whereas the performance approach goal orientation was positively related to learning outcomes (Cellar et al., 2011; Chen, 2015; Diseth, 2011; Elliot & Church, 1997; Elliot & McGregor, 2001; Huang, 2012). Since Elliot and McGregor (2001) introduced their 2 x 2 framework with mastery also subdivided into approach and avoidance, the positive relationship between mastery goal orientation and academic achievement seemed to disappear. Most researchers failed to find a significant relationship between mastery approach and academic achievement (Abd-El-Fattah & Patrick, 2011; Cury, Elliot, Da Fonseca, & Moller, 2006; Elliot & McGregor, 2001; Elliot & Murayama, 2008; Eum & Rice, 2011) and between mastery avoidance and academic achievement (Cury et al., 2006; Elliot & McGregor, 2001; Elliot & Murayama, 2008; King & McInerney, 2014). The relation between work avoidance and academic performance is more straightforward; researchers consistently found negative relations (Brdar et al., 2006; Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997; Harackiewicz et al., 2008; King & McInerney, 2014). All of these results, however, are based on research among children, adolescents, and college students within traditional education.

Goal Orientation and Academic Performance in Distance Education

Within distance education, research on goal orientation associated with academic performance is limited. To our knowledge, the research of Remedios and Richardson (2013) is the only study in which the relationship between goal orientation and academic achievement for adult students in a distance education setting was examined. Remedios and Richardson found a positive relationship between performance approach and examination grades and a negative relationship between mastery avoidance and performance avoidance with examination grades. They did not investigate work avoidance goal orientation.

In the Remedios and Richardson (2013) study, students were enrolled in three specific courses within an educational program at the Open University of the United Kingdom (UKOU). These courses were part of an educational system that was organised into semesters similar to traditional education. However, in this type of distance education, students do not have the opportunity to study fully at their own pace. In contrast, in the present study, students have the opportunity to study at their own pace since the educational system is a modular system in which students have 14 months from the moment they enrol to finish a course. They determine their pace themselves. Therefore, the present study was designed to investigate the relationship between goal orientation (including work avoidance) and academic performance in adult distance education within a self-paced modular system.

Present Study

The present study was designed to increase knowledge about the relationship between goal orientation and academic performance for adult distance learners. The research question that was investigated was: "What is the predictive value of goal orientation on academic performance for adult distance learners?" To study this, a 2 x 2 framework, as first described by Elliot and McGregor (2001), was used and was supplemented with the work avoidance goal orientation (Harackiewicz et al., 2008). Participants in the present study are expected to be highly mastery oriented compared to children and adolescents, as adult distance learners actively choose to enrol in a study while children and adolescents are required by law. Furthermore, since students are mostly working from their own homes, competitiveness against other students is expected not to play a big roll (Sachs, 2001). Even though these differences between populations in goal orientation were expected, it was hypothesised that: (1) mastery approach as well as mastery avoidance are not significantly related to academic performance, (2) performance approach is positively related to academic performance, and (3) performance avoidance and work avoidance are negatively related to academic performance.

Methods

Design

This study is part of the ALOUD study, a large observational longitudinal study in which a broad range of biological and psychological determinants of learning performance within adult distance education was investigated (for more detailed information regarding the ALOUD study, see Neroni, Gijselaers, Kirschner, & de Groot, 2015). In this study, baseline measurements of goal orientation and work avoidance were used. These data were linked to academic performance data after 14 months.

The ALOUD study was approved by the Ethics Committee of the Open University of the Netherlands (OUNL).

Setting

All data were collected from students participating in adult distance education at the OUNL. The OUNL has an open admission policy (i.e., no prior education is required) and the only requirement is a minimum age of 18 years. The OUNL has seven educational bachelor and master programs: Law, Management Science, Computer Science, Environmental Science, Cultural Science, Learning Sciences, and Psychology. Up until September 2014, students could enrol in one or more individual courses at once, or in a full-length degree program, and could choose from nearly 300 courses. A course consisted of one or more study modules, each corresponding to 4.3 European Credits (ECs; i.e., 120 hours of studying). Students could enrol in a course at any moment and were able to choose their own study pace during a period of 14 months.

Participants

Between August 6th, 2012 and August 5th, 2013, all newly registered students at the OUNL were approached to participate in the ALOUD study. In total, 4,945 students were approached, of which 2,842 (57.5%) agreed to participate in the study. Eventually, 2,040 (41.3%) fully completed the questionnaire.

Exclusion criteria were: (a) not attempting an exam within 14 months (n = 894), as academic performance could not be determined without exam information; (b) no data available on academic performance (n = 13); and (c) courses exclusively with a pass/fail exam (n = 5). Only courses that were finished with a traditional exam where a grade was given were included in the current dataset in order to calculate performance scores. Analyses were conducted on the remaining 1,128 participants (708 females, 420 males, M_{age} = 35.4 years, age range: 18–75 years).

Procedure

Students received an automatic email invitation to participate in the ALOUD study 14–21 days after their registration at the OUNL. After reading the introduction and ticking a box to indicate informed consent, participants filled out an online questionnaire (see Neroni, Gijselaers, Kirschner, & de Groot, 2015). Total time investment of the baseline measurement was approximately 45–60 minutes. Participants had the possibility to pause and/or leave the questionnaire and return to it at any time.

Non-respondents and non-completers received an email reminder after two weeks and were followed up with a final email reminder one week later. Finally, individuals who had not completed the questionnaire or did not respond to the mail were approached by phone one week after the last e-mail. In total, recruited students had 9 weeks to complete the questionnaire. To increase participation in the ALOUD study gift coupons of 20 euro with a winning chance of 5% were allotted as an incentive.

The exam database of the OUNL was used for data extraction on examination grades of the participants.

Measurements

Questionnaires which were originally in English were translated from English into Dutch by a native Dutch speaker. To ensure the content validity, the items were translated back into English by a bilingual English/Dutch speaking person and adjustments were made where necessary. In addition,

those aspects of the tests which did not apply with the current setting (i.e., adult distance education) were replaced by the most relevant analogous alternative. For example, in the current questionnaires, *this class* was replaced by *a course*.

Goal orientation. Goal orientation was measured with the Achievement Goal Questionnaire (AGQ; Elliot & McGregor, 2001), which has four subscales. The subscales, consisting of three items each, are: (1) mastery approach (e.g., I want to learn as much as possible from a course), (2) mastery avoidance (e.g., I worry that I may not learn all that I possibly could in a course), (3) performance approach (e.g., It is important for me to do better than other students), and (4) performance avoidance (e.g., I just want to avoid doing poorly in a course). Work avoidance was measured using the 3-item work avoidance subscale of a questionnaire developed by Harackiewicz et al. (2008; e.g., I don't want to work hard in a course). All items had to be answered on a 7-point scale, ranging from *totally disagree* (1) to *totally agree* (7). Elliot and McGregor (2001) reported Cronbach's alphas ranging from .87 to .89 for mastery approach, from .84 to .89 for mastery avoidance, from .92 to .96 for performance approach, and from .82 to .83 for performance avoidance. Harackiewicz and colleagues (2008) reported a Cronbach's alpha of .90 for work avoidance.

Academic performance. Academic performance was conceptualised using all the examination grades the students obtained for the courses followed within 14 months after their registration at the OUNL. This data was extracted from the exam database of the OUNL. Students were free to choose the number of courses they wanted to follow within this 14 month period. Therefore, academic performance was calculated per course nested within students.

Covariates. In literature, age (Lee & Choi, 2011), gender (Duckworth & Seligman, 2006), and intended study hours (Bernt & Bugbee, 1993) were found to be related to academic performance. For this reason, these variables were investigated as possible confounders. These variables were measured by the online questionnaire participants completed. Additionally, as it is known that academic performance differs for students at different faculties, faculty was investigated as possible confounder. Furthermore, the number of study modules within a course was investigated as possible confounder, as the workload per course differed (i.e., some courses only consisted of one module corresponding to 4.3 European Credits, while other courses consisted of two or more modules). Faculty and number of modules per course were gathered from the exam database of the OUNL.

Statistical Analyses

All analyses were conducted using SPSS 22.0.0 (Chicago, IL, USA). First, descriptive statistics were reported for all measured variables. Second, although this was outside the scope of present study, t-tests and a chi-square test were conducted to investigate group differences between participants included and excluded from the main analyses, to check for potential sampling bias. Third, several non-parametric tests (i.e., Spearman rank order correlation, Mann-Whitney U tests, and Kruskal-Wallis tests) were performed to investigate which variables were possible confounders (i.e., variables that threaten the internal validity of the study). Variables which were significantly related to both academic performance and goal orientation with an effect size of ≥ .10 were included in the main analysis (i.e., the mixed model regression analysis) as covariates (as effect sizes of <.10 are indicated as trivial; Cohen, 1992). If a variable was not related to either goal orientation or academic performance, it could not distort the identified effect size, and therefore, the variable was not included as a covariate. Fourth, to investigate the relationship between goal orientation and academic performance, a mixed model regression analysis was conducted. Students could follow a variable

number of courses during the study period of 14 months. Therefore, the analysis was not run with a composite score of all examination grades but mixed model regression was run for individual course grades while accounting for the correlation of exam grades for different courses (N = 2544) nested within students (N = 1128). The following models built to the final model: (1) Model 0: Only a fixed intercept without hierarchical structure; (2) Model 1: Covariates as fixed variables were entered; (3) Model 2: Predictors as fixed variables were entered; (4) Model 3: Random intercepts were added; and (5) Model 4: Random slopes were added. Building to a next model was only performed if the model was significantly better than the previous model. If the model did not improve significantly, the final model was reached. For each model, this was tested with a chi-square model comparison.

Results

Descriptive Statistics

Overall, students seemed to report highest on mastery approach goal orientation (M = 5.55, SD = .92) and lowest on work avoidance (M = 2.70, SD = 1.17). An overview of the descriptive statistics of all variables, as well as internal consistency of the goal orientation scales, is given in Table 1. As Cronbach's alpha for performance avoidance goal orientation was rather low (i.e., α = .55), inter-item correlations, as well as item-total correlations, were taken into account to assess the reliability of the subscale. Inter-item correlations ranged from .22 to .35, and item-total correlations ranged from .32 to .42. As the optimal inter-item correlation is between .20 and .40 (Briggs & Cheek, 1986), and the item-total correlations should best be above .30 (Field, 2009), it was justified to include the subscale of performance avoidance in the main analyses.

Table 1

Participant Characteristics

Variables	*M*	*SD*	Min - max	α
Mastery approach	5.55	.92	1.67 – 7.00	.75
Mastery avoidance	3.44	1.36	1.00 – 7.00	.78
Performance approach	2.90	1.48	1.00 – 7.00	.88
Performance avoidance	3.76	1.18	1.00 – 7.00	.55
Work avoidance	2.70	1.17	1.00 – 6.33	.81
Age (years)	35.36	11.20	18 – 75	
Intended study hours (per week)	13.38	7.62	1 – 60	
Academic performance [a]	6.31	1.71	1 – 10	
	Count	% of total		
Sex				
Male	420	37.2		
Female	708	62.8		
Number of modules per course				
One	1548	60.8		

More than one	996	39.2
Faculty		
Learning sciences	131	5.1
Environmental sciences	58	2.3
Law	651	25.6
Management sciences	201	7.9
Psychology	963	37.9
Computer sciences	285	11.2
Cultural sciences	255	10.0

Note. [a] A mean score for academic performance per student was calculated before an overall mean score was calculated, [b] At course level, $N = 2544$.

Included vs. Excluded Participants

Included ($n = 1128$) and excluded ($n = 912$) participants were compared to investigate group differences on gender, age, intended study hours per week, and goal orientation scores. A chi-square test showed that there was no group difference for gender, $\chi^2(1, N = 2040) = 1.07$, $p = .30$. An independent samples t-test showed a significant difference between included ($M_{age} = 35.36$, $SD = 11.20$) and excluded ($M_{age} = 38.34$, $SD = 10.87$) participants for age, $t(2038) = 6.06$, $p < .001$. Also, included ($M = 13.38$ hours, $SD = 7.62$) participants intended to study more hours per week than excluded ($M = 10.80$ hours, $SD = 6.80$) participants, $t(2018.07) = -8.09$, $p < .001$. Furthermore, included participants scored significantly higher on performance approach goal orientation, $t(2038) = -1.99$, $p = .05$ ($M_{included} = 2.90$, $SD = 1.48$; $M_{excluded} = 2.77$, $SD = 1.45$), and on performance avoidance goal orientation $t(2038) = -3.24$, $p = .001$ ($M_{included} = 3.76$, $SD = 1.18$; $M_{excluded} = 3.59$, $SD = 1.20$), than excluded participants. There were no group differences for mastery approach, $t(2038) = 1.24$, $p = .22$, mastery avoidance, $t(2038) = -1.14$, $p = .26$, and work avoidance, $t(2038) = 0.70$, $p = .48$.

Possible Confounders

Possible confounders and academic performance. A Kolmogorov-Smirnov test was performed to test for normality. Academic performance significantly deviated from normality, $D(2544) = .15$, $p < .001$. Therefore, non-parametric tests were performed to test whether possible confounders were related to academic performance. Spearman rank order correlation showed a positive correlation between age and academic performance, $r_s = .13$, $p < .001$. Intended study hours per week and academic performance were negatively correlated, $r_s = -.05$, $p = .008$, but the effect size was negligible. Furthermore, females ($Mdn = 7.00$) scored significantly higher than males ($Mdn = 7.00$) on academic performance, $U = 722{,}642.50$, $p = .001$, $r = -.06$, but the effect size was negligible. Also, academic performance was greater for courses consisting of more than one module ($Mdn = 7.00$) than for courses consisting of only one module ($Mdn = 7.00$), $U = 707{,}091.00$, $p < .001$, $r = -.07$, with a negligible effect size. A Kruskal-Wallis test indicated a statistically significant difference between academic performance by different faculties, $H(6) = 57.88$, $p < .001$. Six Mann-Whitney U tests were performed as post hoc comparisons using the Bonferroni adjusted alpha levels of .008 (i.e., 0.05/6). Psychology courses ($Mdn = 7.00$) scored significantly lower on academic performance than Management Sciences courses ($Mdn = 7.00$), $U = 80{,}191.00$, $p < .001$, $r = -.11$ and Learning Sciences courses ($Mdn = 7.00$), $U = 45{,}892.00$, $p < .001$, $r = -.16$.

Possible confounders and goal orientation. A Kolmogorov-Smirnov test showed that all goal orientation scales significantly deviated from normality, $D(1128)$ ranging from .08 to .17, with ps < .001. Therefore, non-parametric tests were performed to test whether possible confounders were related to goal orientation. The previous section showed no or trivial effect sizes for the relationships between academic performance and intended study hours per week, gender, and number of modules within a course. For this reason, only age and faculty were analysed in relation to goal orientation as possible confounders. Spearman rank order correlation showed a significant negative correlation between age and mastery avoidance, $r_s = -.19$, $p < .001$, performance approach, $r_s = -.24$, $p < .001$, performance avoidance, $r_s = -.25$, $p < .001$, and work avoidance, $r_s = -.19$, $p < .001$. Five Kruskal-Wallis tests showed differences between faculties for all goal orientation scales, with $H(6)$ ranging from 17.80 to 62.86, with ps < .01. The main analysis, therefore, included age and faculty as covariates.

Goal Orientation Predicting Academic Performance

A linear mixed model regression analysis was performed to investigate the predictive value of goal orientation on academic performance. A model including all predictors with intercepts as well as slopes varying across participants (i.e., Model 4) was the best fitting model and a significant improvement compared to Model 0 to 3 (see Table 2). Work avoidance showed to be the strongest and a negative predictor of academic performance, $F(1, 728.85) = 16.64$, $p < .001$, indicating that the more students wanted to gain high grades with as little effort as possible, the lower their exam grades were. Also, performance avoidance was found to be a significant negative predictor of academic performance, $F(1, 860.37) = 4.52$, $p = .03$, indicating that those students who wanted to prevent obtaining a lower score than other students (i.e., avoiding looking bad), in fact had lower exam grades. Performance approach was a significant positive predictor of academic performance, $F(1, 746.48) = 5.13$, $p = .02$. In other words, increment in performance approach was associated with higher exam grades. Mastery approach ($F(1, 294.00) = 0.09$, $p = .76$) as well as mastery avoidance ($F(1, 896.73) = 0.72$, $p = .40$) were no significant predictors of academic performance.

Table 2

Fixed Effects for Models of the Predictors of Students' Grades

	Estimate	SE	95% CI
Model 0 (χ^2 = 10,028.25; *df* = 2)			
Intercept	6.58***	0.03	[6.52, 6.65]
Model 1 (χ^2 = 9,936.87; *df* = 9)			
Intercept	5.91***	0.13	[5.66, 6.16]
Age	0.02***	0.00	[0.01, 0.03]
Faculty (Psychology as reference)			
Educational sciences	0.69***	0.16	[0.38, 1.01]
Environmental sciences	-0.47*	0.23	[-0.93, -0.02]
Law	-0.24**	0.09	[-0.41, -0.07]
Management sciences	0.42**	0.13	[0.16, 0.68]

Computer sciences	0.26*	0.12	[0.03, 0.49]
Cultural sciences	0.04	0.12	[-0.20, 0.28]
Model 2 (χ^2 = 9,896.68; *df* = 14)			
Intercept	6.71***	0.31	[6.10, 7.32]
Age	0.01***	0.00	[0.01, 0.02]
Faculty			
Educational sciences	0.71***	0.16	[0.40, 1.02]
Environmental sciences	-0.51*	0.23	[-0.96, -0.06]
Law	-0.22*	0.09	[-0.39, -0.05]
Management sciences	0.47***	0.13	[0.21, 0.72]
Computer sciences	0.26*	0.12	[0.03, 0.48]
Cultural sciences	0.02	0.12	[-0.22, 0.26]
Goal orientation			
Mastery approach	0.02	0.04	[-0.06, 0.10]
Mastery avoidance	-0.06*	0.03	[-0.12, -0.01]
Performance approach	0.06*	0.02	[0.01, 0.11]
Performance avoidance	-0.11**	0.03	[-0.18, -0.04]
Work avoidance	-0.11**	0.03	[-0.17, -0.05]
Model 3 (χ^2 = 9,378.88; *df* = 15)			
Intercept	6.86***	0.44	[6.01, 7.72]
Age	0.01*	0.00	[0.00, 0.02]
Faculty			
Educational sciences	0.72***	0.18	[0.37, 1.06]
Environmental sciences	-0.45	0.28	[-1.00, 0.09]
Law	-0.26*	0.12	[-0.49, -0.03]
Management sciences	0.69***	0.16	[0.38, 1.00]
Computer sciences	0.40*	0.17	[0.07, 0.72]
Cultural sciences	0.28	0.16	[-0.04, 0.60]
Goal orientation			
Mastery approach	-0.03	0.06	[-0.14, 0.08]
Mastery avoidance	-0.04	0.04	[-0.12, 0.04]
Performance approach	0.08*	0.04	[0.01, 0.15]
Performance avoidance	-0.10*	0.05	[-0.20, -0.01]
Work avoidance	-0.19***	0.05	[-0.28, -0.10]
Model 4 (χ^2 =9,364.23; *df* = 20)			
Intercept	6.80***	0.42	[5.98, 7.62]
Age	0.01*	0.00	[0.00, 0.02]

Faculty			
Educational sciences	0.69***	0.18	[0.34, 1.03]
Environmental sciences	-0.49	0.27	[-1.02, 0.05]
Law	-0.25*	0.12	[-0.47, -0.02]
Management sciences	0.71***	0.16	[0.40, 1.02]
Computer sciences	0.41*	0.16	[0.09, 0.73]
Cultural sciences	0.29	0.16	[-0.01, 0.60]
Goal orientation			
Mastery approach	-0.02	0.05	[-0.12, 0.09]
Mastery avoidance	-0.03	0.04	[-0.11, 0.04]
Performance approach	0.08*	0.04	[0.01, 0.15]
Performance avoidance	-0.10*	0.05	[-0.20, -0.01]
Work avoidance	-0.19***	0.05	[-0.28, -0.10]

Note. SE = Standard Error; CI = Confidence Interval, * $p < .05$; ** $p < .01$; *** $p < .001$.

Discussion

The aim of the current study was to investigate the predictive value of goal orientation on academic performance in adult distance learners. Results of 1,128 students participating in adult distance education at the OUNL revealed that mastery approach, as well as mastery avoidance, were not significantly related to academic performance. Performance approach was a positive predictor of academic performance, whereas performance avoidance and work avoidance were negative predictors. These results confirmed the hypotheses of the present study.

For college students in traditional education, past research also failed to find a relationship between mastery approach and academic outcomes as well as mastery avoidance and academic outcomes (Elliot & McGregor, 2001; Cury et al., 2006). One explanation for not finding these relationships is that students who are highly mastery oriented study primarily to gain knowledge. This may be an indication that obtaining high grades might be less important to them. They might not push themselves that hard to finish their courses with high grades as much as performance approach oriented students do. In other words: highly mastery oriented students might obtain their personal goal (i.e., gaining knowledge) while this is not expressed in their academic performance (i.e., their grades). To find out if this is the case, future research should also investigate students' subjective learning performance next to academic performance in terms of grades.

Although adult distance learners seem to score much lower on performance approach and performance avoidance than the college students studied by Elliot and McGregor (2001), the directions of the relationship between these orientations and academic performance remain the same. Hence, even though performance approach and performance avoidance may not be as important to adult learners as it is to young learners (Sachs, 2001), focusing on doing better than others is still beneficial for earning high grades, while focusing on avoiding doing worse than others remains a maladaptive educational strategy.

This study shows that goal orientation is a significant predictor of academic performance during a period of 14 months of studying. The relationship between goal orientation and academic performance in adult distance education has hardly been studied before, with the exception of the research of Remedios and Richardson (2013). The present study partly replicates their findings, as they also found performance approach to be a positive predictor and performance avoidance to be a negative predictor of exam grades. Their negative prediction of mastery avoidance, however, was not found in the present study. The strength of the present study compared to theirs is that in the present study all followed courses within a timeframe of 14 months were taken into account instead of only one course. Also, the research here deals with a modular model of distance education, which is more the "norm" than the more regulated setting studied by them. Furthermore, Remedios and Richardson (2013) did not investigate work avoidance in their research.

This is the first study that investigated work avoidance in relation to academic performance in adult distance education. A big difference between younger and adult students is that adult students generally voluntarily choose to study, while for younger students school is compulsory and, thus, is experienced as such. This might explain why students in the present study scored relatively low on work avoidance compared to students in traditional education research (Harackiewicz et al., 1997; Harackiewicz et al., 2008). Adult students might also be work avoidant for different reasons than younger students. For example, adult distance students often have busy lives (e.g., they have a fulltime job, a family, and/or a more social life during the week). As a result, finding time to study might be difficult for them. Participants in the present study and in the study of Harackiewicz and colleagues (2008) may have interpreted the same items in a different way because of the different mind-set they have. Despite these differences in work avoidance scores, the negative relationship with academic performance remained the same.

Included and excluded participants were compared to see whether the sample of present study was biased. These groups were compared for gender, age, intended study hours per week, and goal orientation scores. Included students were significantly older and intended to study more hours per week then excluded students. Furthermore, included participants scored higher on performance approach as well as performance avoidance goal orientation. Excluded students did not attempt an exam within the 14 months period. As the reasons for not attempting an exam are not known, it remains speculation how the difference in performance approach and performance avoidance for these groups could be explained. For instance, some students might not have aimed for finishing the course and taking the exam in the first place, but only started the course to gain knowledge. It is plausible that these students would have a different goal orientation than students who did aim for finishing the course, but along the way, found out it was not feasible. Future research should indicate whether the differences in goal orientation scores could be clarified by looking into the reasons for students not attempting an exam.

To summarise, in the present study, a significant association was found between performance approach, performance avoidance, and work avoidance on the one hand and academic performance on the other hand. This study was a first step to examine the relationship between goal orientation and academic performance within adult distance education. It contributes to goal orientation as well as distance education literature in several important ways. First, to our knowledge, this was the first study in which goal orientation, including work avoidance, was examined within adult distance education. Second, it was a large scale study, which decreases the high risk of a type-I error. Third, the

modular system in this research, in which students can study in their own time and at their own pace, makes this research unique compared to the research of Remedios and Richardson (2013).

Nevertheless, this study had some limitations, and these considerations should be taken into account. First, the significant estimates that were found were rather small, suggesting that practical relevance is lacking. However, looking at work avoidance, for instance, a one point increase in work avoidance score resulted in a 0.19 decrease in academic performance. This could make a difference in a grades score of 1.15 (on a range of 1 to 10) between people with a low and a high work avoidance orientation. Therefore, these results should not be neglected. Second, it must be mentioned that results are exclusively based on observational research, so no conclusions of causality can be drawn from these results. Furthermore, academic performance in the present study was measured within a time frame of 14 months. For future research, it would be valuable to extend this time frame and to follow students throughout their study career at the OUNL. Finally, goal orientation was measured as a trait, i.e., generally for all enrolled courses. It is possible that students adopt different goal orientations for different courses. Future research could reveal whether the relationship with academic performance would remain the same if goal orientation was measured at course level.

Several important implications could be drawn from this study. Knowing that performance approach is beneficial and that performance avoidance as well as work avoidance are detrimental for academic performance gives educators the opportunity to anticipate on this in their courses. It also gives educators the opportunity to monitor and give extra attention to students who are at risk for low performance. Furthermore, to increase study success or to lower study dropout, these results offer opportunities for future research to develop interventions that stimulate the development of a performance approach orientation, and to demotivate development of a performance avoidance or a work avoidance orientation.

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Applying Learning Analytics to Explore the Effects of Motivation on Online Students' Reading Behavioral Patterns



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Abstract

This study aims to apply a sequential analysis to explore the effect of learning motivation on online reading behavioral patterns. The study's participants consisted of 160 graduate students who were classified into three group types: low reading duration with low motivation, low reading duration with high motivation, and high reading duration based on a second-order cluster analysis. After performing a sequential analysis, this study reveals that highly motivated students exhibited a relatively serious reading pattern in a multi-tasking learning environment, and that online reading duration was a significant indicator of motivation in taking an online course. Finally, recommendations were provided to instructors and researchers based on the results of the study.

Keywords: learning analytics, motivation, sequential analysis, online learning, behavioral pattern

Introduction and Background

In recent years, learning analytics has been a hot topic in information technology. It is a technology that allows for the analysis of highly complex information and deals with the professional storage, management, analysis, and imaging of such complex information (Chen, Chiang, & Storey, 2012). Furthermore, the technology of learning analytics involves administration, research, teaching, learning, and support resources (Long & Siemens, 2011). Led by the trend in the recent innovation of information technology, learning analytics in education is an application which gathers large amounts of data to process, collect, measure, and analyze the content or behavior of students generated in the online learning process. The information obtained from learning analytics can allow us to gain a more in-depth understanding and determine the best methods in learning and teaching. Learning analytics was listed on the NMC Horizon Report from 2011 to 2014 as an innovative and potential agenda item in higher education in recent years, underscoring its importance in education research (Johnson, Adams, & Cummins, 2012; Johnson Adams, Cummins, Estrada, Freeman, & Ludgate, 2013; Johnson, Becker, Estrada, & Freeman, 2014).

Learning analytics was formed through two coinciding trends: the increase in the application of virtual learning environments in education, and the expansion of data mining techniques used in business organizations (Agudo-Peregrina, Iglesias-Pradas, Conde-González, & Hernández-García, 2014). Based on this viewpoint, Agudo-Peregrina et al. (2014) believed that learning analytics is often regarded as educational data mining (EDM). The International Educational Data Mining Society defines EDM as follows: Educational Data Mining is an emerging discipline, concerned with developing methods for exploring the unique and increasingly large-scale data that come from educational settings, and using those methods to better understand students and the settings in which they learn in. The methods utilized by EDM include statistics, graphics technology, social network analysis (SNA), online analytical processes (OLAP), regression, cluster analysis, correlation analysis, and text mining (Black, Dawson, & Priem, 2008). Macfadyen and Dawson (2010) considered that learning behavior tracking logs, such as on-line hours, the number of interaction in discussion forums, and the duration and time required to complete the online test, were meaningful data for analysis. This study investigated learners' reading behavior in an online context through a behavioral sequence analysis, which is a technique of learning analytics.

E-learning is a teaching format that combines the application of education and information technology, and which allows students and instructors to engage in learning activities at different temporal and spatial distances (Raab, Ellis, & Abdon, 2001). However, after reviewing students' online activities such as login frequency, frequency of accessing course materials, number of bulletin board messages posted, and number of synchronous discussions attended, Hung and Zhang (2008) found that the majority of the students tended to demonstrate passive learning behavioral patterns. In other words, most online learning activities involved reading of materials rather than posting messages or participating in synchronous discussions. As a result, Chen and Jang (2010) proposed to incorporate learning motivation into learning analytics to further explore the relationship between student's motivation, online learning behavior, and learning achievement. Learning motivation is a psychological variable that significantly impacts learning behavior, engagement, effort, and learning achievement (Bandura, 1977; Schunk, Meece, & Pintrich, 2013; Sun & Rueda, 2012). Learning motivation affects the students' choice of learning tasks, effort, and degree of perseverance that is invested in certain tasks, as well as the mental state of the student (Schunk et al., 2013). Deci and Ryan (1985) defined motivation both in terms of intrinsic motivation and extrinsic motivation

according to the self-determination theory. Empirical studies have pointed out that both intrinsic motivation and extrinsic motivation influence learning attitude, self-learning efficacy, learning achievement, and overall acceptance of e-learning (Saadé, He, & Kira, 2007; Tseng & Tsai, 2010; Yoo, Han, & Huang, 2012).

Engagement is a cognitive process in learning tasks and an indicator of active participation, emotion, and other aspects in learning (Pellas, 2014). In online learning, online time spent and other behavior records represent the behavior engagement of the student, such as the frequency in which they log in and out of their online platforms, and the frequency in which they open and close reading materials, download and upload exercises, and post in internal discussion forums. "Online time" appears to have a positive impact on online learning achievement (Hu, Lo, & Shih, 2014; Ma, Han, Yang, & Cheng, 2015; Macfadyen & Dawson, 2010). Skinner, Furrer, Marchand, and Kindermann (2008) categorized learning engagement into behavioral engagement and emotional engagement. Behavioral engagement is defined as a continuous behavior that includes the effort spent on learning, attention, and continuity of behavior from the beginning to the execution of a learning task. Emotional engagement includes feelings such as interest, enjoyment, and frustration from defeat. Related studies have pointed out that learning motivation and user engagement levels have an impact on the actual learning behavior (Kong, Kwok, & Fang, 2012; Wang & Lin, 2007). As seen from the previous study results, both learning motivation and user engagement have a significant impact on the behavior process in online learning. However, existing research related to online learning motivation has primarily focused on behavioral aspects, such as outcomes and performance determined by one's motivation "after learning," and on the psychological aspect, such as emotions and one's level of satisfaction. Hou (2012b) suggested that gamers' behavioral patterns in educational games include collaborative learning and problem-solving. Existing studies have applied behavioral sequence analysis to investigate users' behavioral patterns during social interactions in an online learning context (Hou, 2012a; Hou & Wu, 2011; Sun, Kuo, Hou, & Lin, 2017), and behavioral patterns of knowledge construction from a cognitive perspective (Hou & Wu, 2011; Yang, Li, Guo, & Li, 2015). Furthermore, behavioral sequence analysis had been utilized in an online two-tier test strategy to diagnose students' misconceptions and to examine the pattern of students' test-learning behaviors (Yang, Chen, & Hwang, 2015). Lai and Hwang (2015) discovered that, compared to low-achieving students, high-achieving students tended to exhibit patterns of behaviors in which they repeatedly searched for additional learning materials, often attempted an input value, and observed the corresponding outcome. Chen and Jang (2010) discovered that there were no significant correlations between learning motivation and weekly login frequency, and the number of clicks on the online platform. However, changes in behavior during the learning process, as well as the relationship between learning motivation and behavioral patterns in an online environment still await further exploration, with extra attention needed to assess the differences among high and low motivated students. Therefore, the present study refers to the recommendation of Chen and Jang (2010) to combine learning motivation and user engagement to investigate the behavior pattern in online learning. This study aims to understand and compare the reading behavior patterns that students with different levels of motivation exhibit in order to provide recommendations to instructors and researchers for future use or design of online learning courses.

The sequential analysis in Bakeman (1997) is often used in peer discussions of the learning process, which includes factors such as behavior, the knowledge construction process, and problem solving skills

(Eryilmaz, Chiu, Thoms, Mary, & Kim, 2014; Hou, 2012a, 2012b; Hou & Wu, 2011; Liu, Cheng, & Huang, 2011). However, aside from teacher-student and peer interactions, online learning also includes interactions between students and e-materials (Moore, 1989). Gil-Flores, Torres-Gordillo, and Perera-Rodríguez (2012) argue that the digital culture resulting from ubiquitous information communication technology has a significant impact on the learning environment, and digital reading has become a crucial skill that a student must possess in the contemporary learning environment. Liu (2005) revealed that the digital reading environment is a topic deserving of an in-depth study as the digital environment continues to evolve. In recent years, researchers have started applying sequential analysis to investigate the interactive process happening on the discussion platform among students (Hou, 2012a; Hou & Wu, 2011). However, in terms of online reading behavioral patterns (i.e., the way students read online course materials), further studies are still needed. Therefore, this study used a sequential analysis to investigate and compare the differences in behavior patterns of students in reading online learning materials and in assessing their learning motivation. The research questions posed to the participants were as follows:

1. What are the frequencies of different types of online reading behavior?

2. What are the differences in the reading behavioral pattern of online students with different type?

Methods

Research Procedures and Participants

This study adopted the cross-sectional survey research method. Cross-sectional survey research refers to the investigation of data collected at a specific point in time or a short period of time (Ann, 2006). This study adopted a convenient sampling method. The participants were graduate students from three national universities in Taiwan who were invited to participate in this research study via campus bulletins, email, and community website marketing. The study design is shown in Figure 1. Participants read the digital learning materials from each of the four units and then took a test. If their test scores were lower than 80, the participants could re-read the learning materials and try to pass the same test again. After passing the test, the participants were prompted to complete a post-test questionnaire that measured their levels of learning motivation. The research ethics course designed for the study aimed to ensure a mastery of basic knowledge. Therefore, we defined the passing threshold to be 80% for all unit tests and permitted learners to take the tests repeatedly. The participants were required to finish the entire course online. The system recorded participants' online learning behaviors during the learning and testing processes. The open period for the online course information collection was 2 months. After the researcher informed the participants that the online course would be open for 2 months, the participants were free to control their own study pace without interference from the researcher. Out of the 249 students enrolled, 170 completed the course. After the invalid data was eliminated in the questionnaire review session, a total of 160 students had valid information; among them, 64 were female and 96 were male. The average age was 23.46 and the standard deviation for age was 2.46 years. The distribution of participants' schools and grade levels is presented in Figure 2. There were more participants from the schools of engineering and computer science (48%) than from other departments, and the majority of the participants were first-year master's students (57%).

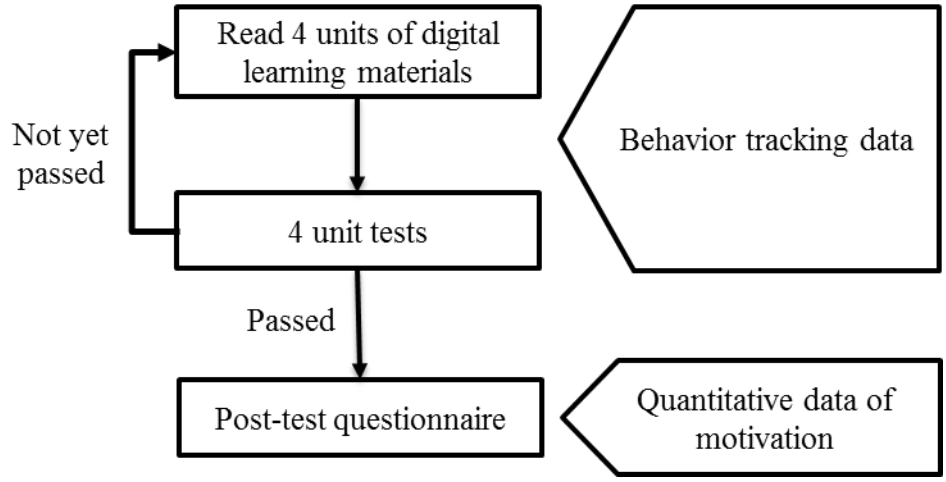

Figure 1. Experimental design.

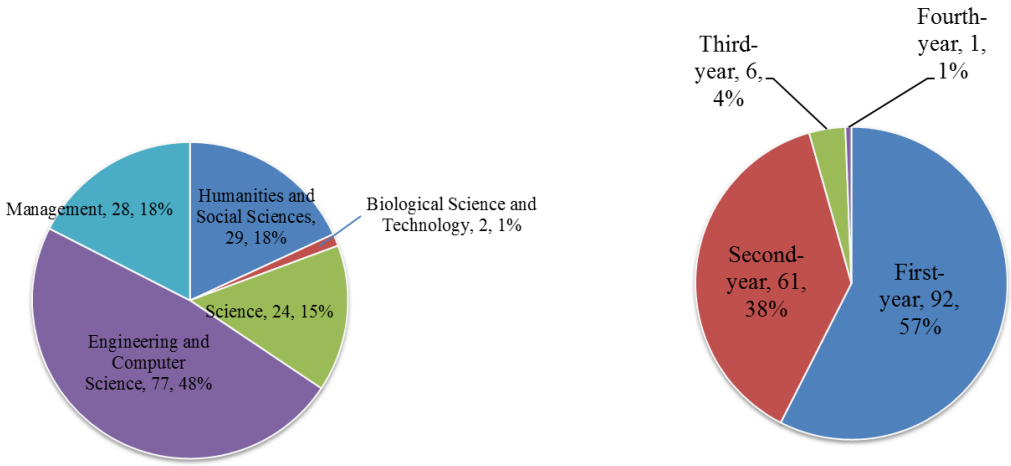

Figure 2. Distribution chart of participants' school and grade level.

Instruments

This study used the digital learning motivation scale proposed by Yoo et al. (2012) that measured employees' acceptance levels in digital learning and further categorized them into six sub-factors. There were 20 items in the original scale after translation into Chinese. Among the six sub-factors, "social influence" (three items) did not fit the online learning environment, as its online course did not include any interactive function among the teacher and students or among peers, and that items such as "(i)n general, the organization has supported the use of e-learning" did not fit the context of this study, in which our participants were asked to carry out the study autonomously, and was therefore eliminated. The scale used in this study was a 5-point Likert scale with 1 representing *strongly disagree - no confidence* and 5 representing *strongly agree - full confidence*. A confirmatory factor analysis revealed that the factor

loadings of three items were less than .40. Therefore, these three items were removed from the scale. A further test after excluding the unqualified items yielded good fit indices (χ 2 = 127.05, *df* = 67, *p* <.001, CFI = 0.96, RMSEA = 0.08, SRMR = 0.05), indicating good construct validity. The final scale contained 14 items. The five sub-factors were effort expectancy, attitude towards e-learning, anxiety, performance expectancy, and facilitating conditions; and their corresponding Cronbach's α values were .81, .84, .89, .67, and .80, respectively. The total Cronbach's α value for the 20 items was .88, which was consistent with the validity standard of .70 suggested by (Nunnally & Bernstein, 1994). The factor loadings of *effort expectancy* (three items) ranged from .59 to .81 (e.g., "So far, I think the e-learning platform is easy to use"). The factor loadings of *attitude towards e-learning* (four items) ranged from .55 to .80 (e.g., "using e-learning is fun"). *Anxiety* contained three items with reversed wording and factor loadings ranged from .77 to .83 (e.g., "I hesitate to use e-learning because of making a mistake"). The factor loadings of the two items of *performance expectancy* were .41 and .93 (e.g., "I think the e-learning tool is useful"). *Facilitating conditions* contained two items, with factor loadings of .71 and .77 (e.g., "I have sufficient knowledge to use the e-learning tool").

Online Learning Platform and Materials

Austin, Gorsuch, Lawson, and Newberry (2011) believed that in higher education, ethics courses are regarded as being of high value, and in the majority of disciplines, research ethics is considered as a compulsory basic science. Therefore, this study utilized a research ethics course in our online learning program. The course materials used in this study were the ethics education materials taken from the Taiwan Research Ethics Education Program by Taiwanese Ministry of Education. This program aims to raise the awareness of research ethics and to develop digital learning resources for Taiwanese higher education institutions. The aforementioned online course materials were used in this study to develop a proprietary platform for the learning management system. The platform was built on the Microsoft Internet Information Service server using Microsoft Visual Studio 2013 as the development tool, ASP.NET 4.5 C# as the programing language framework, and Microsoft SQL Server 2008 R2 as the database. Microsoft Windows Server 2008 R2 was used as the operation system. A screenshot of the online course is shown in Figure 3.

Figure 3. Screenshot of the online course.

The Flash multimedia audio and video animation learning materials in this course were divided into four chapters, each with 30-90 seconds of audio and video on the front page. The four units of the course are Ethics and Responsibility of Academic Research, What is Research Misconduct, Basic Concepts of Plagiarism, and How to Avoid Plagiarism. Each unit contained video, audio, and text materials. Each chapter took the user approximately 30–40 minutes to learn. The number of questions included in the four unit tests were 25, 13, 17, and 16 respectively (a total of 71 questions). All questions are multiple choices with four options. There were buttons labeled "next page" and "previous page" in the system that allowed students to sequentially or repeatedly run the pages. The system interface also provided a unit navigation menu, allowing students to switch freely between the pages.

Data Analysis Method

Black et al. (2008) pointed out that combining questionnaires and actual log data can reveal the relationship between the mental states of learners and their actual behavior. Therefore, this study adopted *learning motivation* and *reading duration* as the base of the cluster analysis. Data collected in the study included the rating of the digital learning motivation scale, the total online reading time, and the behavioral coding logs. A cluster analysis and a behavioral sequence analysis were applied to the data analysis. Predictive Analytics Software (PASW) 22 was used to perform the cluster analysis. This study used learning motivation and e-textbook reading duration as the two variables for cluster analysis. In the first stage, Ward's method was used to determine the number of clusters as the preliminary optimal. In the second stage, K-mean was used to establish the grouping results. No significant correlation was found between learning motivation and e-textbook reading duration in the pre-test performed in this study (r = .04, p = .62), and no collinearity of variables was observed, indicating that the data was fit for grouping. Ward's method was adopted to divide students into two to five groups sequentially. The variance analysis of the clustering validity is listed in Table 1. There was a substantial increase of the coefficients of determination (R^2) in the transition from three to four groups, while the increase was not apparent in the transition from four to five groups. Although four and five groups had higher coefficients of determination, the number of participants in each group was

small (<30), yet there was a large discrepancy in the number of participants in each group. Therefore, we decided to use three groups for the K-means cluster analysis. After K-means clustering, the groups were named as follows: low reading duration with low motivation (LRLM group), low reading duration with high motivation (LRHM group), and high reading duration (HR group), representing three different types of student learners. ANOVA revealed that the scores of all three groups showed significant variances in terms of pretest learning motivation ($F = 78.40$, $p < .01$) and online e-textbook reading duration ($F = 234.23$, $p < .01$). A *post hoc* comparison showed that the learning motivation of the LRHM group was significantly greater than that of the LRLM group ($p < .01$) and the HR group ($p < .01$). Furthermore, the post hoc comparison showed that the learning motivation of the HR group was substantially greater than that of the LRLM group ($p < .01$). In addition, the reading duration of the HR group was significantly greater than that of the LRLM group ($p < .01$) and the LRHM group ($p < .01$), and no apparent difference was found in reading duration between the LRLM group and the LRHM group ($p = .54$). This confirms that the characteristics of the three groups were indeed different, and therefore proves validity of this grouping.

Table 1

Cluster Analysis Results Using the Ward's Method

Number of groups	**Variables**	**Source**	***SS***	***df***	***MS***	***F***	***p***	***R²***	**Number of participants**
2	Learning motivation	Between-groups	78.49	1	78.49	152.76	<.01	.49	Group 1: 91
									Group 2: 69
		Within-groups	81.18	158	.51				
		Total	159.67	159					
	E-textbook reading duration	Between-groups	24.86	1	24.86	38.07	<.01	.19	
		Within-groups	103.18	158	.65				
		Total	128.03	159					
3	Learning motivation	Between-groups	79.78	2	39.89	78.40	<.01	.50	Group 1: 55
									Group 2: 48
		Within-groups	79.89	157	.51				Group 3: 57
		Total	159.67	159					
	E-textbook reading duration	Between-groups	95.90	2	47.95	234.23	<.01	.75	
		Within-groups	32.14	157	.21				

		Total	128.03	159					
4	Learning motivation	Between-groups	122.16	3	40.72	169.35	<.01	.77	Group 1: 23
		Within-groups	37.51	156	.24				Group 2: 63
		Total	159.67	159					Group 3: 20
	E-textbook reading duration	Between-groups	86.37	3	28.79	107.80	<.01	.67	Group 4: 54
		Within-groups	41.66	156	.27				
		Total	128.03	159					
5	Learning motivation	Between-groups	124.34	4	31.09	136.40	<.01	.78	Group 1: 66
		Within-groups	35.32	155	.23				Group 2: 20
		Total	159.67	159					Group 3: 12
	E-textbook reading duration	Between-groups	95.72	4	23.93	114.77	<.01	.75	Group 4: 48
		Within-groups	32.32	155	.21				Group 5: 14
		Total	128.03	159					

After the students were classified into different groups, a sequential analysis was then used to examine the sequential behavioral pattern in each type of student. In this study, the online learning behavior was encoded based on the guidelines proposed by Bakeman (1997). A pilot test along with the observation and interview of two graduate students was conducted. The results indicated that the time the participants took to finish the course was shorter than expected. During the interview, the participants also indicated that the learning pace was not fast and the material covered was not difficult. Therefore, this study established 120 seconds as the average amount of time needed to flip through a page of intensive reading. If a page was turned before the learning material was finished playing, it would be classified as incomplete reading of the learning materials. To sum up the results from this pilot test, a definition of behavior codes used in this study is listed in Table 2. A self-developed program system was used in this study to automatically transform the behavior records into codes to avoid human error and unnecessary omissions. There were a total of 13,035 converted codes. We then used the Multiple Episode Protocol Analysis (MEPA) software to conduct a sequential analysis.

Table 2

Online Reading Behavioral Coding Scheme

Code	Name	Description	Definition
A	Intensive reading	Finished flipping through learning materials and pressed "next page" button.	Students with time spent jumping to a page is more than 15 seconds but less than 2 minutes.
B	Multi-tasking reading	Finished flipping through learning materials and pressed "next page" button.	Students with time spent jumping to a page is more than 2 minutes but less than 20 minutes.
C	Skim reading	Pressed "next page" button but did not finish flipping through learning materials.	Students with time spent jumping to a page is less than 15 seconds.
D	Passing the unit test	Took unit test and passed.	Students "submitted the test" and scored higher than 80.
E	Not completing the unit test	Took, but did not complete the unit test.	Students "entered test" record but did not have record of "submitted the test."
F	Offline	Temporarily logged out from the learning platform.	Students with 20 minutes of gap time between two records and showed no record of other activity in between.

Results

To address research question (1), the sequential codes of each group were statistically organized based on the results of the cluster analysis conducted in this study. Related data are as shown in Table 3 and Figure 4.

Table 3

Descriptive Statistics of the Sequential Behavioral Codes of the Observed Values in Each Cluster

	LRLM group		**LRHM group**		**HR group**	
	Frequency	%	Frequency	%	Frequency	%
A. Intensive reading	715	34	944	39.9	5846	68.3
B. Multi-tasking reading	86	4.1	87	3.7	616	7.2
C. Skim reading	768	36.5	805	34	1588	18.5
D. Passing the unit test	215	10.2	185	7.8	226	2.6
E. Not completing the unit test	305	14.5	327	13.8	202	2.4
F. Offline	14	0.7	19	0.8	87	1
Total codes	2013		2367		8565	
Number of people in clusters	55		48		57	

**Note*. LRLM group means "low reading duration with low motivation group"; LRHM group means "low reading duration with high motivation group"; HR group means "high reading duration group."

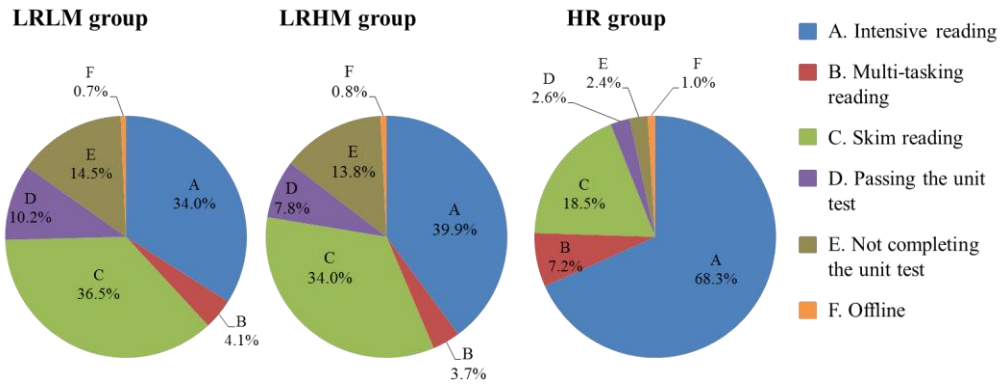

Figure 4. Pie chart of behavior percentage in each cluster.
**Note*. LRLM group means "low reading duration with low motivation group"; LRHM group means "low reading duration with high motivation group"; HR group means "high reading duration group."

To address research question (2), the data was converted into an adjusted residuals table of sequential codes, as shown in Table 4, with the horizontal axis representing "start of behavior" and the vertical axis representing "end of behavior." For the z value shown in the adjusted residuals table, if the value was greater than 1.96, the change in sequential behavior of that group reached the significance level of $p < .05$

(Bakeman, 1997; Hou, 2012b); that is, there is a significant relationship between the order of sequence. The sequential behavioral pattern among the three groups in online reading is shown in Figure 5.

Table 4

The Adjusted Residuals Table of the Three Student Groups

		Intensive reading	**Multi-tasking reading**	**Skim reading**	**Passing the unit test**	**Not completing the unit test**	**Offline**
		A	B	C	D	E	F
LRLM group	A	**14.86***	-.35	-4.17	-6.49	-10.37	-.53
	B	1.50	**3.60***	-1.55	-.31	-1.62	.59
	C	-4.59	-1.24	**15.28***	-6.41	-11.10	-.08
	D	-5.35	.45	-3.82	**9.89***	**5.55***	.53
	E	-8.24	-.82	-9.11	**6.99***	**21.59***	-.02
	F	-.35	.57	1.29	-1.21	-.73	-.31
LRHM group	A	**17.66***	**2.34***	-7.03	-7.41	-14.77	.26
	B	**2.18***	.47	-.68	-1.14	-2.1	.37
	C	-8.10	-.16	**17.01***	-5.43	-8.94	.32
	D	-3.88	-.33	-3.81	**11.46***	**3.96***	.46
	E	-9.58	-2.35	-9.04	**6.89***	**26.73***	-1.16
	F	.89	-.84	1.01	-1.24	-1.63	-.39
HR group	A	**23.84***	-6.06	-28.68	-4.03	-26.79	-9.56
	B	-.71	**5.62***	-.51	-2.22	-1.85	-.54
	C	-13.09	1.35	**22.05***	**3.01***	.11	**4.55***
	D	1.05	-.83	-2.04	-1.67	1.19	**3.19***
	E	-9.58	-.14	-2.41	**6.48***	**49.38***	**3.54***
	F	-2.15	-1.32	**6.01***	-1.53	-1.45	.12

**Note*. LRLM group means "low reading duration with low motivation group"; LRHM group means "low reading duration with high motivation group"; HR group means "high reading duration group."

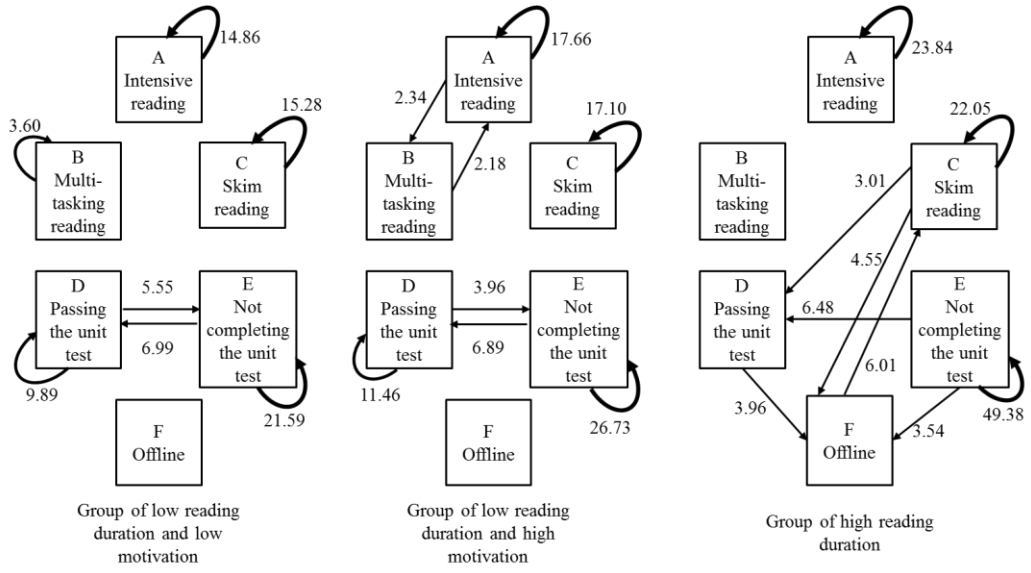

Figure 5. Diagram of sequential behavioral patterns in online reading of all three groups.

Discussion

Online Students Exhibit Different Reading Behavior Frequencies

According to the behavior frequency pie chart (Figure 4), the allocation of behavior outcomes in the two groups of low reading duration is quite similar, but is considerably different from the high reading duration group. In the high reading duration group, 68.3% of students fell into the "intensive reading" category of the overall learning behavior, whereas the intensive reading behavior in the low reading duration with low motivation and low reading duration with high motivation groups was only 34% and 39.9%, respectively. "Skim reading" behavior was only exhibited by 18.5% of the students in the high reading duration group, while the percentages of the other two groups were quite high - 36.5% and 34%, respectively. Among the students in the group of high reading duration group, only for 2.4% exhibited behavior of "not completing the unit test," but the percentages of students in the other two groups who exhibited this same behavior was 14.5% and 13.8%. In comparing the differences in behavioral proportions due to different learning motivation factors, the results showed that reading duration could significantly affect learning behavior. Students with high reading duration tended to be more seriously engaged in learning activities, and these students not only tended to exhibit page retention time spent on the e-textbook learning materials in accordance with expectations, but also tended to exhibit a relatively lower rate of occurrence in the behavior of "not completing the unit test."

In addition, for both the group of low reading duration with low motivation and the group of low reading duration with high motivation, the next behavior after "passing the unit test" was "not completing the unit test" (D→E). However, such a sequence was not observed in the high reading duration group. Thus, we could see that after passing a unit test, the two low reading duration groups had the tendency to quickly transition into the test challenge in the following unit, rather than spending time reading the learning

materials in the following unit. Such results indicate that these two low reading duration groups seem to have a speculative mentality: they hoped to finish the course quickly and therefore skipped reading the learning materials and took the test right away. This result is consistent with the study of Hu et al. (2014) who pointed out that online learning time can significantly predict the learning performance.

The Online Students of Different Types Have Different Reading Behavior Patterns

Although the behavior of digital media multitasking is believed to lower task performance (Gardner, 2008), we found that the group of low reading duration with high motivation exhibited a different behavior sequence than the other two groups. The group of low reading duration with high motivation showed that the behavior of "intensive reading" tended to follow the behavior of "intensive reading" and "multi-tasking reading" (A→A、B→A), and "multi-tasking reading" behavior also tended to follow "intensive reading" behavior (A→B). The findings suggest that when multi-tasking under the "intensive reading" environment, students may have been delayed in flipping through the learning materials and were therefore encoded as performing "multi-tasking reading." However, when encoded as performing "multi-tasking reading," this meant that a student's attention had not completely detracted from the learning materials, and that he or she had returned to the page with "intensive reading" behavior. Other data in this study showed that the group of low reading duration with high motivation exhibited 944 instances of "intensive reading," whereas the low reading duration with low motivation group only showed 715 instances of "intensive reading." Therefore, for students who prefer the multi-tasking online learning environment, highly motivated students can easily switch back from multi-tasking to the learning materials and refocus their learning. Many studies in the past have widely viewed learning motivation as an important factor in the actual learning behavior that is exhibited (Kong et al., 2012; Schunk et al., 2013). However, we found that highly motivated students may prefer to exhibit a motivated online multi-tasking reading behavior pattern; that is, in which students' learning behavior is characterized in terms of focused multi-tasking.

Conclusion, Limitations, and Future Research

This study aims to explore the effects of learning motivation on online reading behavioral patterns. In response to the research question (1), the study found that the high reading behavior duration group presented a higher ratio of intensive reading and a lower ratio of non-completion of the unit test. However, the other two groups (low reading duration with low motivation and low reading duration with high motivation groups) manifested a lower proportion of intensive reading behavior, higher proportion of skim reading behavior, and a higher proportion of non-completion of the unit. In response to research question (2), we discovered that, after taking a unit test, the low reading duration with low motivation and low reading duration with high motivation groups had a behavioral tendency to bypass the reading materials and instead participate directly in the next unit test. In addition, the behavioral patterns of the low reading duration with high motivation group showed the characteristic of interchange between intensive reading and multi-tasked reading. In summary, this study indicates that "online reading duration" in the online learning system is a strong indicator for reading motivation in students. In addition, this study proposes that multi-tasking learning should be considered in the future design of online learning courses to provide appropriate teaching strategies or platform functions. Learning motivation is an important factor in enhancing "intensive reading" in students. With the aid of online course materials, instructors can further

enhance students' learning motivation. We propose that a record function should be added for "online reading duration" in the online course platform in future online courses. Coupled with an interface with graphical presentation, instructors or system managers can better understand the learning situation so that flexible adjustments to the online learning materials can be made accordingly, and so that the effectiveness of the learning platform and student performance can be evaluated more accurately.

In terms of research limitations, we used the time spent on reading the online materials to define the student's behavior as "intensive reading," "multi-tasking reading," or "skim reading." However, these standards are not definitively certain in terms of effectiveness. As the length of each animation page in the learning materials varies, applying the same amount of time as the encoding standard may not fully explain the actual usage behavior in the students. Therefore, the analysis in this study may be limited. In addition, this study adopted a convenient sampling method to recruit graduate students from three national universities in Taiwan; therefore, readers should be cautious when applying our findings to the entire population. This study adopted reading duration as an indicator of behavioral engagement. Future research is suggested to further explore other influential factors of behavioral patterns in online learning, such as emotional and cognitive engagement, perceptual habits in reading, learning attitudes, gender, and academic background. Given that the research ethics course adopted in this study aimed to establish learners' basic knowledge, criterion-referenced tests that allowed repeated participation were utilized; therefore, the results of the test were not included in the discussion. Future studies are advised to adopt a topic with a more comprehensive question pool so as to explore the impact of online learning behavior patterns on learning performance. Finally, with the large amount of data saturation that exists today, using the back-end quantitative data on the server to undertake a massive analysis is a worthwhile direction to take in the developmental stages. We suggest that in subsequent research the correlation between the back-end data in the server and the actual usage behavior in the front end should be explored through observation and interviews. Furthermore, we suggest that data triangulation should be applied to such an investigation to examine the actual reading situations and page retention time to serve as the foundation for massive data analysis and to further understand reading behavior patterns in online courses.

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Blended Training on Scientific Software: A Study on How Scientific Data are Generated


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Abstract

This paper presents the results of a research study on scientific software training in blended learning environments. The investigation focused on training approaches followed by scientific software users whose goal is the reliable application of such software. A key issue in current literature is the requirement for a theory-substantiated training framework that will support knowledge sharing among scientific software users. This study followed a *grounded theory* research design in a qualitative methodology. Snowball sampling as well as purposive sampling methods were employed. Input from respondents with diverse education and experience was collected and analyzed with constant comparative analysis. The *scientific software training cycle* that results from this research encapsulates specific aptitudes and strategies that affect the users' in-depth understanding and professional growth regarding scientific software applications. The findings of this study indicate the importance of three key themes in designing training methods for successful application of scientific software: (a) *responsibility in comprehension*; (b) *discipline;* and (c) *ability to adapt*.

Keywords: blended learning, grounded theory, scientific software, training, distance learning, snowball sampling, purposive sampling

Introduction

Scientific Software Training

Scientific software is becoming increasingly important to the realms of science and engineering. It is a tool that is used to process data and solve models expressed mathematically in an augmented, timelier manner. Scientific software is employed in research areas that can directly affect public safety, such as nuclear power generation computer systems, groundwater quality monitoring and engineering designs. Academic researchers and industry professionals depend on such software in order to answer their scientific inquiries. Scientific software also provides infinite opportunities to share and collaborate. Howison and Herbsleb (2011) argue that the creation of new scientific knowledge requires the combination of evolving scientific methods, validated instruments, and theory. However, the value of training scientists and engineers on this type of software is underestimated. Literature has already acknowledged a general lack of formal scientific software training among users, especially for large research projects with societal importance. An overwhelming majority of researchers in natural sciences and engineering wish for increased computational skills, as they need to have sufficient knowledge of what the software is doing and whether it is, in fact, doing what is expected (Hannay et al., 2009; Joppa et al., 2013; Skordaki, 2016). As society's important scientific decisions rely on accurate scientific software application, "the scientific community must ensure that the findings and recommendations put forth based on software models conform to the highest scientific expectation" (Joppa et al., 2013, p. 815). Thus, users who study global climate change or the migration of contaminants in the environment ought to be able to trust and confirm the software output in order to publish the data and inform the public responsibly. However, despite the abundance of training literature, there is limited research that looks at successful strategies to train professionals specifically on the use of scientific software.

Scientific software continues to advance as knowledge obtained through continued scientific endeavor progresses. As the cognitive density of the software increases, so does the risk of incorrect use of the software or insufficient validation of the software output by the user. Managing the risk of making errors in scientific software output interpretation and application is critical (Fischer, 2009; Hannay et al., 2009). Risk is here defined as the likelihood of unintended mistaken scientific and engineering decisions based on the incorrect use and/or misinterpretation of data output from the scientific software tool (Skordaki, 2016). With the development of new scientific software products, the issue that becomes central for the users is the effectual comprehension of the knowledge that is entrenched in the software—that is, its capabilities and limitations, and how these can affect the software output. Obtaining an in-depth understanding of the software product can enhance the accuracy and reliability of its application (Holton, 2004; Segal, 2005, 2007; Sloan, Macaulay, Forbes, Loynton, & Gregor, 2009; Fischer, 2009, 2011; Adams, Davies, Collins, & Rogers, 2010). Thus, the problem is that there is a growing need for the identification of a good framework for scientific software training that can help mitigate risk in its applications or interpretations, but there is insufficient literature regarding this topic.

As such, effective training on the use of scientific software is essential in order to ensure correct scientific decisions. Training here does not mean learning repeated, predetermined tasks, but rather it refers to establishing an effective collaborative learning environment that can ensure successful problem solving using the appropriate scientific software. This research adopted the definition of training by Dearden (1984)

as this definition provides a framework for investigating how dealing with things (in this case, dealing with scientific software), people (adult learners-scientific software users), and change (traditional and distance learning, effective collaborative learning) can influence the learning process within the community of scientific software users. Dearden (1984) gives a holistic definition of training and links it to learning: "But in every case what is aimed at is improved level of performance … brought about by learning" (p. 58-59).

This paper presents the results of a study on scientific software training in *blended learning* environments. Blended learning is considered here as the thoughtful integration of classroom face-to-face learning experiences with online learning experiences, as in Garrison and Kanuka (2004). Blended learning environments can afford opportunities for multiple forms of communications that can stimulate open dialogue, critical debate, negotiation and agreement (Garrison & Kanuka, 2004; Graham, Henrie, & Gibbons, 2014; Skordaki & Bainbridge, 2015a). This can be particularly important for open communities of scientific software users who may rely on peer collaboration for obtaining feedback on scholarly work.

The investigation focused on training approaches followed by scientific software users whose goal is the reliable application of such software. The *scientific software training cycle* that stems from the findings of this research is presented in the "Results" section. This training cycle encapsulates specific aptitudes and strategies that affect the comprehension and professional growth of scientific software users.

Scope of Research

The research looked into the needs of scientific software users as learners in their setting of practice. It examined the interactions of users with their professional environment, in traditional and blended learning settings. The main research question was: What software training approaches in a blended learning environment are chosen by users whose goal is to accurately apply scientific software to questions of research?

Methodology

This study followed a *grounded theory* research design in a qualitative methodology, as in Skordaki (2016). Grounded theory was selected because scientific software training is a field with limited existing research (Hannay et al. 2009; Howison & Herbsleb, 2011; Skordaki & Bainbridge, 2015b; Skordaki, 2016). The strongest cases for using grounded theory are in studies of comparatively unexplored areas (Corbin & Strauss, 1990; Strauss & Corbin, 1998; Moghaddam, 2006). As well, grounded theory was employed with a view to investigating scientific software training as a phenomenon in its natural context, without preconceived notions. This qualitative investigation did not seek to test a particular hypothesis on scientific software training or the learning needs of users; it aimed to explore this field of interest (Hoepfl, 1997). As Harrison (2015) pointed out, grounded theory methods allow "the researcher to 'listen to' the experiences of the participants as expressed freely without constraining prompts." The data collection continued until theoretical saturation was reached (Glaser & Strauss, 1999). In this investigation, observations in real-life settings, acquisition of insider accounts, and collection of empirical data in their naturalistic setting were used from which themes were identified and conclusions extracted. The analysis of the empirical findings

led to the construct of the scientific software training framework that is presented in this paper. As such, the emergent scientific software training concepts were grounded in the amassed data.

An eclectic foundation was created with elements that were drawn from previous studies. The studies that were pertinent to this investigation included: (a) qualitative research in software engineering by Lutters and Seaman (2007), and Robinson, Segal, and Sharp (2007); (b) research on adult training on computer use by Lowe (2004) and Hurt (2007); (c) research on hybrid learning experiences in geological sciences by Adams et al. (2010); and (d) research on distance learning in engineering programs by Bissell and Endean (2007).

Research Data Collection and Analysis

The recruitment of participants and the data collection took place in universities and industry sectors in Canada. Twenty female and male scientific software users were interviewed; the ratio was determined only by the availability and willingness of each respondent to participate in the study. The age of the participants varied from 20 to over 55 years old. The criteria for identifying the research study participants are listed below, as they were listed in the research ethics approval obtained for this study. Primary and secondary data were utilised in order to attempt to answer the research goal. The primary data were derived from unstructured, open-ended interviews with study participants in a familiar setting where the participants would not feel restricted or uncomfortable to share information (Miles & Huberman, 1994; Cohen, Manion, & Morrison, 2007). The interviews were approximately one to two hours long. They involved narrations of software applications and pertinent issues introduced by the users. Demonstrations of scientific software usage, reviews, and critiques of laboratory manuals by the users were also included. The informal, conversational nature of the interview technique offered substantial control to the interviewees (Turner, 2010). Hand-written notes were kept during the conversations with the interviewees throughout the data collection. Digital voice recordings were also kept when the interviewees consented to them. The interviews yielded 23 to 52 pages each, depending on their duration. Transcribing the audio recording of each interview took, on average, eight hours.

The secondary data were obtained from observations of scientific software users during training sessions, as well as reviews of published documents and literature that were relevant to the scope of this study. The latter included: (i) software training manuals; (ii) laboratory notes kept by students; (iii) journals kept by researchers; and (iv) course materials.

Study participants were identified according to the following criteria: (i) experience with scientific software usage; (ii) experience with academic research involving the usage of scientific software in science and engineering; and (iii) experience with industry applications regarding scientific software usage in science and engineering. Specifically, the recruitment of respondents for this study followed a two-layered strategy. Firstly, snowball sampling was employed in order to establish an initial pool of potential research participants. This sampling technique is used for identifying research respondents where one respondent gives the researcher the name of another potential respondent, who in turn provides the name of a third, and so on (Strauss & Corbin, 1998). Snowball sampling was suitable for the purposes of this investigation, which had an exploratory, ethnographic nature (Berg, 2001; Atkinson & Flint, 2001). Snowball sampling is also used to overcome the problems associated with studying concealed or hard-to-reach populations; these

groups—are usually small relative to the general population, and no exhaustive list of population members is available for them (Berg, 2001). The community of scientific software users has been described in the literature as being protective of their research ideas, laboratory practices and publication domains due to their competitive work environment in terms of publication records and funding resources. Thus, it can be considered a hard-to-reach population (Hannay et al., 2009).

As the data collection progressed, new knowledge-rich respondents with substantial experience in scientific software application were sought; as such, purposive sampling was employed after the initial data analysis and formation of categories in order to expand on or inform the initial data gathering. Due to the limited number of available respondents for this phase of the study, purposive sampling was employed in lieu of theoretical sampling (which normally requires larger sets of data) during this data collection phase. Previous research studies have successfully combined purposive sampling with a grounded theory design in order to collect rich, yet sufficient data for theoretical adequacy (Frazier, 2006; Bainbridge, 2013). The primary concern regarding employing purposive sampling is to obtain rich information from those who are in a position to provide it (Miles & Huberman, 1994; Cohen et al., 2007).

Given that this was an exploratory qualitative study, the data collection ceased when it was decided that the richness of the information gathered could support the formation of core categories and themes. In order to sufficiently ground the results of this study in the research context and as suggested by Cohen et al. (2007), the researcher ensured theoretical adequacy and ability to check emerging themes with further data by maintaining access to the participants and their information throughout the research study, in case further information needed to be collected.

The data analysis commenced with basic listening of the recordings as well as carefully reading the interview notes and memos in order to delve into the data and see if patterns emerge. The data analysis commenced during the data collection phase. An open and axial coding system of the information amassed during the interviews was employed. Documentation of this coding and the writing of memos functioned as an audit trail back to the sources of the research results and conclusions (Frazier, 2006), enhancing the dependability of this coding system and giving the authors the ability to confirm the research design. In grounded theory, open coding allows for both the exploration of the data collected and the identification of units of analysis in order to code for specific issues; axial coding allows for categories and themes to be interconnected (Corbin & Strauss, 1990; Saldana, 2008). Emerging trends and/or patterns in the data were identified and further illustrated in diagrams and matrices. Microsoft Office Excel spreadsheets were used for the organization of the data. After the core categories emerged from the information provided by the participants, selective coding was used to identify overarching themes in scientific software training (Corbin & Strauss, 1990; Saldana, 2008).

Two examples of the data analysis processes of this study are included in Tables 1 and 2, with excerpts from the interview data. Table 1 refers to issues associated with onsite learning. During one of the interviews, the participant was invited to describe his experiences with respect to learning from his mentors or supervisors in university or industry. The interviewee, a graduate student, responded:

> Every lab I have seen is different. Where I worked before, the supervisor sat there with me and showed me the basics. It is easy to ask questions when somebody is near. Some people might be

> shy, I just ask my lab mates, but if you cannot find the answer on your own, the best way is to find someone who knows.

Table 1

Data Analysis Example: Onsite Training

Text excerpts	Analysis: Elements of onsite training
"Every lab I have seen is different."	Emphasis on the environment in which the learner operates
"…it is easy to ask questions when somebody is near."	Learning from one another via instruction, imitation and modeling
"Where I worked before, the supervisor sat there with me and showed me the basics."	Relationship of the learner with the Mentor—positive learning experience
"Some people might be shy, I ask my lab mates…"	Motivation of learner—enhanced due to the social aspect of the learning process

Table 2 includes pieces of text that refer to the learning skills of the user and provides an example of the open coding process that was conducted during the initial stages of the data analysis. To the interviewer's question, "How do you see your role as a mentor in this lab?" the interviewee responded:

> I feel it is mostly up to them—if they are motivated, they will learn. And if they want to do some research … they ask, they know that they are in the driver's seat, they want to know.

Table 2

Data Analysis Example: User Learning Skills

Text excerpts	Analysis: Open coding
"…if they are motivated, they will learn."	Goal oriented learner
"But if they want to do some research… they ask, they want to know."	Internally motivated and self-directed learner
"…they are in the driver's seat."	Self-directed learning
"If they are serious about it…"	Internally motivated and self-directed learner

Figure 1, below, shows an example of a coding scheme in this study. The first categories that were created resulted from the axial coding process and had to do with topics related to the background and academic preparation of the user (e.g., type of knowledge, ability of the user to comprehend the research problem at hand) and their training needs. The second categories were developed during the selective coding process.

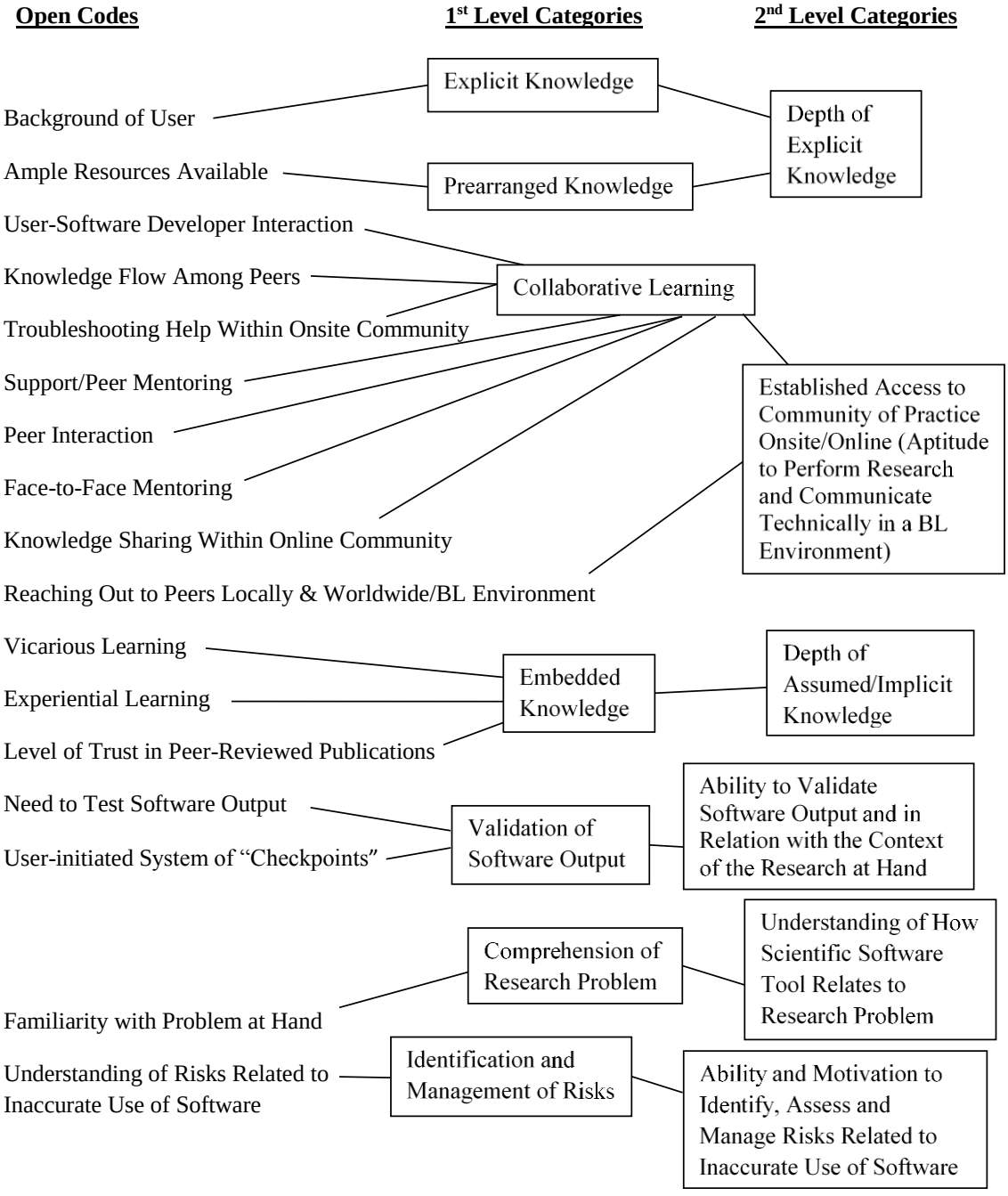

Figure 1. Example of coding scheme (Adapted from *Mobilizing knowledge in science and engineering: Blended training for scientific software users* (p. 66), by E. M. Skordaki, 2016, Athabasca, AB: Athabasca University. Copyright 2016 by Efrosyni-Maria Skordaki).

This study employed a key feature of grounded theory, the constant comparative method, in order to identify categories and relationships that exist among the data and generate concepts. The constant comparative method requires that the researcher compares each piece of data with data previously analyzed in all groups that have emerged (Glaser & Strauss, 1999; Cohen, et al., 2007; Frazier, 2006; Bainbridge, 2013).

Reliability and Validity Strategies During Data Collection

Ensuring rigor in a qualitative research study during its development is crucial (Morse, Barrett, Mayan, Olson, & Spiers, 2002). As such, the research design of this study incorporated strategies for reliability and validity checks during the course of the investigation. It is noted here that, due to very limited literature on scientific software training methods, the author obtained theoretical background knowledge during the research, which increased the credibility of the study (Miles & Huberman, 1994). Glaser and Strauss (1999) indicate that there is no need to review any literature of the studied area before entering the field, and this is in line with this research.

A first strategy used to achieve reliability and validity for this investigation was the ongoing analysis of the data collected, which subsequently directed the research path and specifically the application of the purposive sampling technique (selection of participants and interview themes/questions). Categorizing and comprehending (or "listening to") the data can influence the course of the investigation and enhance the quality of the research as well as its replication and confirmation (Glaser & Strauss, 1999). A second reliability and validity strategy was to interview the study's researcher prior to the commencement of the data collection; in this manner, the researcher confronted personal opinions and preconceptions about software training and could clearly compare these with the views of the actual study participants. A third strategy ensured the validity of the data collected by employing respondent validation; in this technique, a comparison was made between the accounts of different participants working in the same lab or work environment but in different roles. The emerging themes from the coding of the data were tested accordingly (Rajendran, 2001; Cohen et al., 2007). Additionally, reflective journaling ("memoing") was employed during the data analysis in order to accurately depict different realities and levels of understanding of the data collected. Reflective journaling was also used throughout the study as a tool to record ideas about the emerging themes and relationships between categories.

Further, the ongoing development of sensitivity and flexibility of the researcher with respect to the emerging themes from the data collected was also an important parameter in the study, as such development can enhance the verification process during an investigation (Berg, 2001).

Results

This section presents the core categories of the study as these emerged from the analysis of the amassed data in this investigation. These categories are:

1. Current training practices adopted by the community of scientific software users, and;

2. Main parameters that affect current scientific software training, as reported by study participants.

Current Training Practices

In total, the study respondents offered reviews of 13 scientific software products in terms of their training tools. Four of the software companies provided the scientific software manuals upon purchase of the product. Nine of them offered online video tutorials, demonstrations, and resources in addition to the product manual. Six of them offered in-classroom training to users and a suite of solved, generic examples in their online libraries. Two of them had research publications that used their software product available on their website. Each software product had specific strengths and limitations that could be revealed, according to the participants, only via the application of the software in particular research problems. The online resources and the manuals offered by the software companies were discussed during the interviews with the respondents with respect to their usefulness and effectiveness f updated information.

It is noted here that the respondents included users who had the ability to write code and build a numerical model as well as users who simply applied the software without interfering with its code. Various methods of training were mentioned by the participants. A major observation from the data is illustrated in the following statement made by a participant: “Understanding is more important than ease of use.”

Regarding current training practices, the results illustrated that there were users who were self-taught by primarily using software company website documentation and other relevant online asynchronous resources without receiving significant online/onsite peer support and feedback. There were also users who had the opportunity to sit side-by-side with a more experienced colleague and learn the basics of particular software products in order to expand their abilities as users before they explored these products by themselves. In addition, there were users who were introduced to the basic principles of a software product by their work supervisor before they were expected to work with it on their own. These users reported that they often felt intimidated to ask questions or seek clarifications because of the experience gap between themselves and their supervisor/mentor. Lastly, there were users who reported that they learned their software in a collaborative learning environment with peers at similar levels of experience and felt comfortable asking questions about the software freely. Table 3, below, depicts the various training techniques employed by scientific software users as described by the research participants. In the table, an onsite mentor refers to someone with substantial experience on scientific software products and with whom the software trainee can consult in their physical work environment. An online mentor can be a scientific software developer who offers support and advice to a new user. An onsite peer can be a colleague or fellow graduate student with equal or slightly higher experience in scientific software who works in the same physical environment with the trainee and they frequently exchange feedback on the application of the software. An online peer can be a software user who contributes to an online forum about a particular scientific software product.

Table 3

Current Training Techniques Followed by Scientific Software Users

Training technique	**Participation rate**	**Advantages**	**Disadvantages**	**Comments/Quotes from users**
Onsite tutorials	4 of 20	Proximity	Expensive; "packaged" lecture (i.e., generic)	Topics presented are not shared with participants prior to the tutorial presentations; "participants cannot prepare beforehand."
Onsite documents	20 of 20	Availability	Outdated	These may involve reiteration of assumed knowledge; "documents are prepared by experienced users who may not see the gaps in knowledge flow" (i.e., tacit knowledge) from the junior users' perspective.
Online documents (including Wikis)	15 of 20	Current information; flexible access	Issues with trust and reliability of information sources	Online documents are occasionally "difficult to understand" if substantial time is not spent previously by the junior user troubleshooting alone or searching in manuals.
Online tutorials	17 of 20	Free; updated	Inflexible; generic material	Online tutorials are often "impersonal and not applicable" to users' specific questions; they give good demonstrations on basic use of software tool.
Onsite mentor	8 of 20	Proximity	Intimidation	Lack of mentors' formal preparation on giving constructive feedback techniques and creating a positive learning environment / "not intimidating."

Onsite peer	18 of 20	Immediacy; lower anxiety levels	Propagation of wrong information	This can encourage the development of teamwork skills but can also lead in "new users relying on more experienced peers" instead of expanding their own knowledge base.
Online mentor	6 of 20	Different perspective; flexibility in communica-tion	Trust issues; mentor feels removed from trainee (i.e., impersonal)	The protection of "ownership of ideas limits online knowledge sharing and critical review of work." Still, the user may benefit from being exposed to the viewpoint of an online mentor; this viewpoint may be different from that of an onsite peer or mentor.
Online peer	9 of 20	Flexible access	Reliability of exchanged information; trust issues	If the exchanged feedback is reliable and trust in the peer collaboration is established, then the "validity of the research results is enhanced by constructive input from peers with no invested interests."

As seen in Table 3 above, onsite tutorials usually offered by software companies have not been a preferred mode of training due to cost considerations; as well, the "packaged" training material is offered by software developers who may not be aware of the various specific applications of their software product. As Participant 02 stated: "I have not really experienced formal training. It is expensive. The software company has seminars, to promote their software, sometimes I find these seminars online, but it is not as if you had someone talking with you about your specific questions."

Six respondents mentioned that if the tutorial materials had become available to them prior to the onsite presentation, then perhaps they would have been able to review it and develop their questions in order to make better use of the time with the company trainer. As Participant 15 mentioned: "We were not prepared. They gave us a generic presentation on what the software does but there was not enough time for all of us to ask questions on particular problems with the software."

The online documentation that was discussed by the study participants included information and support tools available on software companies' websites that were available to users for troubleshooting purposes. The respondents also mentioned wikis that were developed by other users and were available on the

Internet. From the analysis of the references made by the respondents, it appears that the onsite peer support is crucial at the beginning stages of the training. As training progresses, the user may explore the online resources more independently and with a higher ability to critique the reliability of the information. While an onsite mentor can be useful to a new scientific software user in the sense that he/she can effectively direct the trainee, study participants commented on having high anxiety and intimidation levels because often the mentor was also their evaluator (e.g., work supervisor or university faculty). Participant 03 (a graduate student) mentioned: "If you are nervous, if you feel that you do not understand the problem enough to ask a question… if you work in a place where everyone is a senior software developer and they do not have time to answer questions… it is difficult." Another respondent, Participant 14 (a laboratory supervisor) said: "Some people look for someone to ask, some others spend a week before they build the courage to come to us… They should not need encouragement because we told them so (to come to ask).

Through onsite peer support, new users felt more at ease asking questions, showing their work in progress and learning in a relaxed environment. Participant 02 mentioned: "For approximately one week a friend showed me the basics." Participant 14 stated: "My group is pretty big…Very friendly people…If I talk to them, it will take me two minutes…If I keep looking for the answer myself it will take me two weeks."

The Main Parameters of Current Scientific Software Training

Three main parameters are involved in scientific software training: (a) the personal skills of the user, and the (b) onsite, and (c) online training environments.

Personal Skills of Users

The usefulness and successful outcome of the training environment is impacted by the profiles of the users. Specifically, the training is affected by:

1. The individual learning preferences of the users;
2. The degree of responsibility and knowledge-building goals of the users; and
3. The undergraduate preparation of the users.

Onsite/Online Training Environments

The work/training environment of the users is affected by:

1. Mentorship and instructional considerations;
2. Collaborative learning activities; and
3. Challenging assumed knowledge.

The results indicate that the issue of informal learning with peers online/onsite was an important ingredient in the training process on scientific software. Participant 02, a Master's student, stated: "The supervisor sat beside me for a week, gave me an introduction to their software and then I figured things out myself." Participant 04, a Master of Science student close to his graduation, also indicated that "if you stumble on something, go ask someone, it is much faster… There is also an online community that shares ideas, we help each other, it speeds up the process." Participant 09, a doctoral student, pointed out: "With my lab mates I feel a lot more comfortable asking questions than if you work with a senior software developer, because they may not have time to answer questions at your level." Participant 06, a master of science student with some experience in computing, also added: "I have not really experienced formal training like industry seminars. It is expensive…. After you learn the basics, there is an online community of users that you can go to."

It is important to note that the online environment is intertwined with onsite peer support throughout the training of all interviewees. The majority of the respondents used both modes of knowledge transfer during their typical work day. A prevailing observation from the interviews was that online documentation (from software company sites) can complement onsite laboratory resources (manuals, short courses) and support the needs of the users regarding expanding their knowledge. As Participant 17, a user with over 9 years of experience in scientific software applications, stated: "The students socialize online with a common issue; the exposure that they have to their professors is minimal to the one they get through online means. But they need to know how to filter the information."

However, 17 out of 20 participants suggested that posting questions in online discussion sites can wait until the users have confidence in their ability to critically review feedback from online peers. Also, the majority of new users that were interviewed for this study claimed that lack of proper terminology, at the beginning of their training, hindered their ability to use the online community as a resource as they would not be able to accurately articulate technical questions. Participant 20, a researcher working for the government, commented: "Pretty pics are posted now and you think you go somewhere but perhaps you may have gotten nowhere. The pace of research today moves too fast." "Understanding is more important than ease of use," mentioned Participant 15, a physicist with over 30 years of experience in scientific software.

The Blended Learning Environment

Figure 2 depicts the results of the data analysis regarding the efficacy of the blended learning environment in scientific software training. Parameters (1) to (9), listed in Figure 2 below, are linked with pieces of text from the interview data. All interviewees commented on the use of the Internet as a resource for their knowledge expansion in addition to onsite laboratory training sessions and onsite peer support, which was considered the starting point in scientific software training for most users—parameters (1) and (2) in Figure 2. There were 15 out of 20 participants who mentioned issues of trust, familiarity with technology, and not feeling sure about how to critically analyze the vast information on the Web; in Figure 2 these are referred to as issues that affected their independence as learners (4) in seeking specialized knowledge online. Academic preparation (5) regarding formal scientific software training was considered insufficient by all of the interviewees: "In my undergrad, we did not do much…We had one lab in third year…I learned most of what I needed after I graduated, I worked in an engineering firm for a while…then came back to do my master's." The interviewees who were the most confident in using online discussion forums to cross-check

and test their ideas with online peers were the ones who demonstrated a solid background on their subject—parameters (8) and (9) in Figure 2—saying, for example, that "the open community we work in, you can submit your data so that they can simulate it, you can see what the reviewers have said." Motivation in sharing data and receiving feedback from online peers indicates a drive to seek further knowledge (3) about a particular problem and, hence, improve as a scientific software user: "If they are motivated, they will learn…They are in the driver's seat." Adequate ability to articulate technical issues/questions (7) and communicate this to online peers (6) was an issue that was brought up by eight participants ("They need to read enough…to know to communicate in short what they need to ask"). Furthermore, the cost of resources and training was an issue for all interviewees; comments on the time and resources required to develop online tools were made, as well ("To do video tutorials and narrate what I am doing…The problem is that it takes several days to make a tutorial video, this is why they are usually not up-to-date").

The Internet is free (or low cost) and this can make it a popular tool. However, it is up to the users to develop the degree of sensitivity necessary to establish a solid level of understanding of the topic at hand; this can be accomplished by reading, investing time to develop their knowledge base, and critically analyzing pertinent information so that Internet resources can be used to their full capacity. Training on science- and engineering-specialized software appears, from the interviewees' perspectives, to be a flow diagram, as shown in Figure 3. The more the users understand, the more they can improve the interpretation of the software output and their research results. As well, the usefulness of the Internet as a resource appears to be connected to the degree of responsibility of the users, their degree of sensitivity regarding the topic at hand, as well as their ability to direct their own learning.

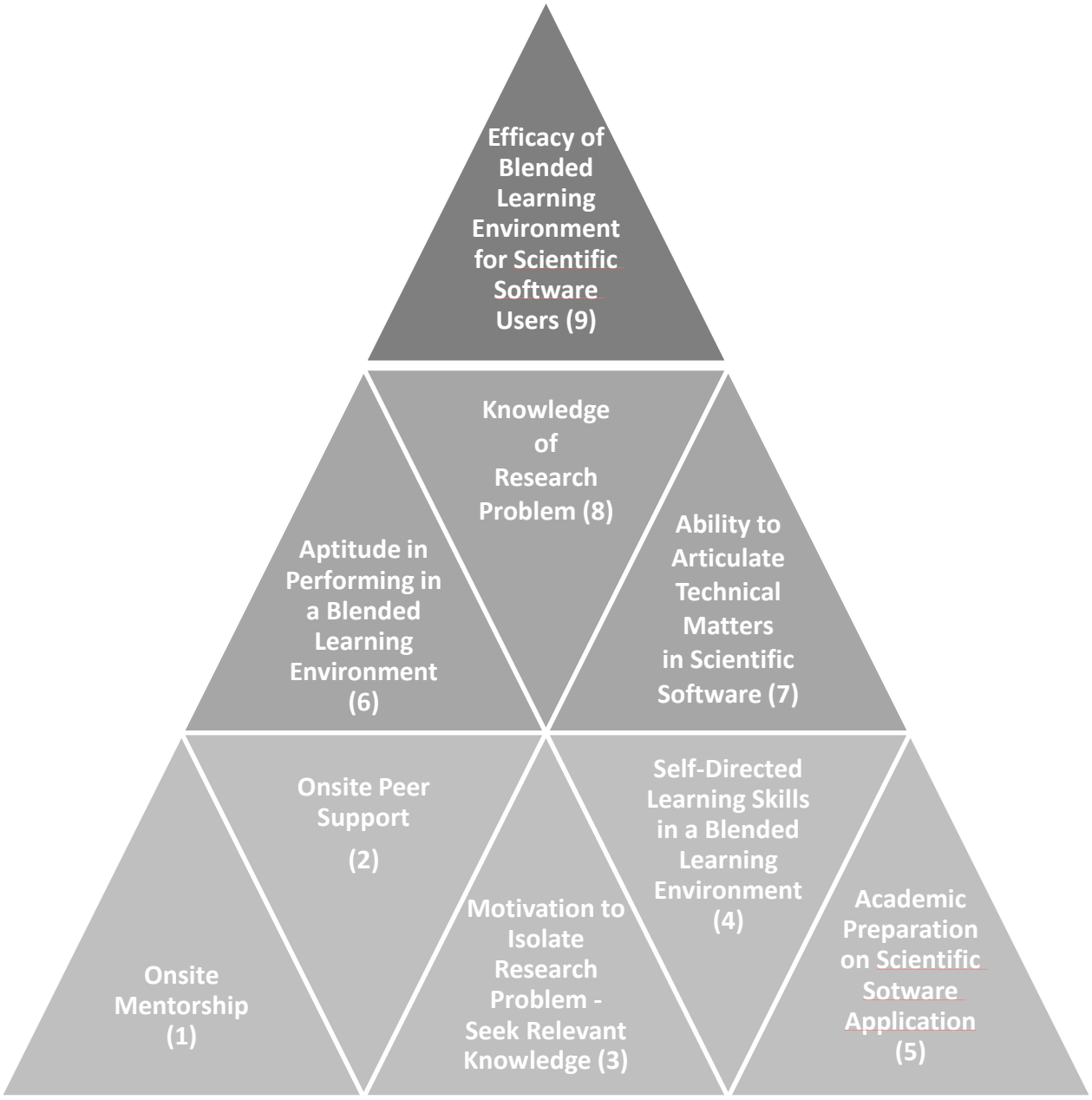

Figure 2. Parameters influencing the efficacy of blended learning in scientific software training.

As indicated by the data analysis of this study, once the learners become familiar with the blended environment, the mode of knowledge delivery does not affect them anymore. At this stage, they have become able to concentrate on the quality of the transferred knowledge, and not on the profile of the online peer or their level of familiarity of technology or the degree of social presence in their online interactions. This can significantly enhance their ability to learn by focusing and critically analyzing the core of the information rather than its mode of delivery.

A Systematic Training Cycle for Scientific Software Users

Figure 3, below, presents a systematic training cycle for scientific software users, as it emerged from this study. The data analysis in this investigation showed that the optimal training framework is an ongoing, methodical cycle that starts with: a dedicated user who makes a substantial investment of time on the software and topic at hand in order to expand his or her knowledge base, followed by the onsite peer support and guidance, which can progress to effective use of online resources (documentation and discussion forums) as the user becomes more and more independent. This leads back to the first step, with the user reflecting and dedicating time to absorb new knowledge, critique available information, and develop sensitivity about the research question at hand. As one of the interviewees noted: "It is good to explore your area."

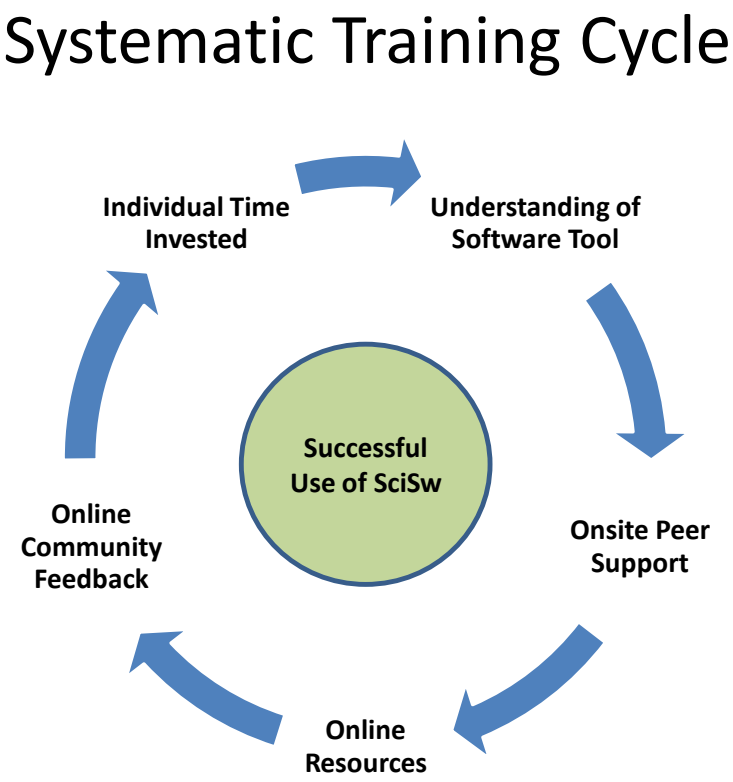

Figure 3. A systematic training cycle for scientific software users.

The study participants pointed out that the limitations of the systematic training cycle for scientific software users, as presented above, include issues involving different levels of collaboration, potential intimidation, reliability of resources, as well as assumed knowledge in scientific software application environments where users receive training. For example, when asked to describe the collaborative learning design in their lab, participants responded that it really depended on the personality and background of the professor or mentor. As Participant 17 mentioned: "Well, this environment is totally built on the attitude of the

professors…" This improvised situation often exists in research laboratory settings and was described as a deeper issue by respondents who were young software users. The contributions of the respondents indicated that this ad hoc situation can impede their overall learning and confidence in their research results because of the following reasons: (a) the mentor (often supervisor) has uncertain previous training on constructive feedback techniques, teamwork, or teaching in a positive learning environment; (b) the student/trainee does not have adequate interaction time with mentors or colleagues; and (c) the student does not have previous formal training in working and learning within a team. Overcoming personality and interpersonal issues can often impede the development of the learner.

The reliability of online resources as well as the feedback offered by the online community were two elements that raised concerns among the respondents. This is in agreement with the findings of Pawlik, Segal, Sharp, and Petre (2012) who also raised the question of trustworthiness and reliability of the online sources from which the scientists learn about various aspects of software development. In their study, the scientist-participants did not have specific criteria with respect to assessing their online resources and whether these addressed their needs best or what type of online sources would be trustworthy and reliable for their work.

Discussion

The results of this study indicate that there are three key themes in the design of a training technique for successful application of scientific software. These themes are:

1. Responsibility in comprehension;
2. Discipline (and systematic validity procedures); and
3. Ability to adapt.

Figure 4 illustrates the relationships among these three key themes.

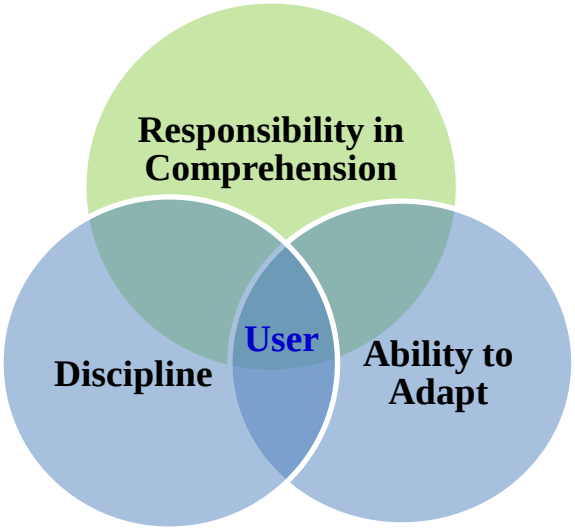

Figure 4. Key themes in scientific software user training.

The theme of responsibility in comprehension refers to the degree of ownership that the users demonstrate regarding the depth of their knowledge base in their area of study and the applicability of the scientific software tool. The latter would include the limitations or capabilities of the software and its usefulness in the problem-solving process of the research question at hand. Comprehension is defined here as having a solid background in the field of the problem that a user attempts to answer by using the scientific software product. Comprehension also refers to the degree of sensitivity that the users have developed regarding the context of the research question they are attempting to solve and how the software output relates to this context (Skordaki, 2016).

The theme of discipline refers to the ability of the users to build methodical strategies into their work and to diligently test their software programs. Also, it relates to the degree of responsibility of the users to systematically invest substantial time in updating their knowledge by reviewing current literature and software documentation that are pertinent to their research problem. Parnas (2010) pointed out that teaching students how to work in disciplined ways and to thoroughly test their software programs are critical elements in formal science and engineering education.

The theme of ability to adapt refers to a skill that is important to every scientific software user, as it empowers the individual with the aptitude to conduct his or her work regardless of the type of learning setting (traditional, online, or blended). Further, with distance technologies and software engineering continuously progressing, the users are expected to keep up with new information in their field of interest and collaborate in blended environments (Garrison, Anderson & Archer, 2001). As one of the research participants stated, "…our work is meaningful if the rest of the world can see it." Bereiter (1997) highlighted the importance of "learning how to function in a community of practice whose work is work with knowledge." McGreal (2009) indicated that reaching skilled professionals in today's global, dispersed work world remains a serious concern. Lingard (2010) pointed out that university students seldom receive any specific training on how to function collaboratively before group assignments are given, and little attention

is given to how teams are formed. Experienced users that were interviewed during this investigation reported that they had to "retrain" many times in order to stay current and understand how their field of interest continued to evolve in conjunction with their professional environment.

Through the careful analysis of all data that was available in this study, both from primary and secondary sources, it became evident that if any one of these three factors is missing, the user may not be in a position to employ the software reliably. The accurate application of scientific software requires that the users develop, in a responsible manner, a solid background both in the problem at hand, as well as the software tool of choice. If users are familiar with software validation procedures and have the ability to adapt to new learning environments but their knowledge of the topic at hand is insufficient (due to their undergraduate preparation or low degree of sensitivity in the subject), then the software application can be problematic because it may be used in the wrong context.

While this factor is necessary—i.e., knowing the dimensions of the problem at hand and the software—having the discipline to invest time to read pertinent documentation and follow software updates is equally crucial. By methodically keeping notes about software procedures and maintaining checkpoints to review the results during the software application, the users ensured that they were in control of the entire process, and that the software (with its capabilities and limitations) does not manipulate the research at any time. Current literature has indicated that the software product selection and usage are parameters that can influence the course of a research undertaking and, as such, there is a requirement for systematic reviews of the software output as well as careful analysis of the context within which the software product is employed (Lutters & Seaman, 2007; Joppa et al., 2013; Zacharia et al., 2015; Queiroz & Spitz, 2016).

Further, the results of this study show that the learning environment changes continually. This means that the users are expected to keep up with information that becomes available through various modes of delivery. As a result of this, the ability to adapt to new learning environments and modes of interaction becomes an indispensable parameter. Software evolves and knowledge is embedded in continually updated documentation that is shared through blended communications with various stakeholders; the skill to continually retrain becomes vital to the successful application of the software. Users of scientific software who wish to apply the software correctly need to constantly expand their ability to learn in Internet-supported environments and maintain their desire to enrich their knowledge base in their field of interest. As mentioned by research participants, self-paced learning and independent review of online resources and onsite documentation is often required from scientific software users working in industry and Higher Education. However, as Harrison (2015) indicated, this can be confusing if progress indicators and structure are not in place. Online resources such as video tutorials and e-learning documentation need to be carefully designed with accurate and updated information in order to support the learner and enhance the "quality of experience" (Ljubojevic, Vaskovic, Stankovic, & Vaskovic, 2014; Hsin & Cigas, 2013).

Conclusions

The purpose of this investigation was to explore current approaches regarding scientific software user training. The data analysis revealed that the optimal training framework is an ongoing cycle that

commences with the dedication by the user to explore the software tool and problem at hand, then seek onsite peer support and guidance, and progressively learn to use online resources effectively as the user becomes more and more independent. The cycle closes—that is, restarts—with the user reflecting and dedicating time to absorb new knowledge in order to develop sensitivity about their research question. The scientific software training framework that emerged through the amassed information of this study encapsulates various parameters that affect the development of the user knowledge base in a blended learning environment, including peer collaborative learning activities, methodical practices in checking software outputs with support from onsite/online communities of practice as well as user degree of sensitivity in the research problem and its associated context.

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Empirical Analysis on Factors Impacting on Intention to Use M-learning in Basic Education in Egypt


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Abstract

It is apparent that m-learning will continuously have a massive role in terms of development in teaching and learning methods for education. Student's intention to use this technology is the main factor that eventually leads to a success in implementing m-learning. The objectives of this particular research are to come up with the development and examination towards a research model to uncover the factors that have important effects on the intention to use mobile learning for basic education in Egypt. A research model was developed through extending the unified theory of acceptance and use of technology (UTAUT) by incorporating two additional factors namely; learners' autonomy (LA) and content quality design (CQD). A quantitative approach based on cross-sectional survey was used to collect data from 386 respondents.. The methodology used in this study was a Partial Least Squares (PLS) that was expected to test the model empirically. The results showcased that learners' autonomy (LA), performance expectancy (PE), facilitating conditions (FC), and social influence (SI) are significant in relation to behavioural intention (BI) to use m-learning while effort expectancy (EE) did not show the impact on intention to use mobile learning. The research also found that content quality design (CQD) affects significantly on performance expectancy (PE) and effort expectancy (EE). The possible development in future research and the limitations of the findings are also discussed later in this paper.

Keywords: content quality design, education, Egypt, intention to use, learners' autonomy, m-learning, mobile learning, unified theory of acceptance and use of technology (UTAUT), schools, students

Introduction

With the continued development in the field of mobile technology, a new paradigm in education has been appeared called mobile learning or m-learning. According to Hwang and Tsai (2011), m-learning is described as using mobile technologies to facilitate learning. Generally, m-learning can be viewed as any form of learning that takes place when mediated through a mobile device (Winters, 2007). Technology is not necessarily the most important factor that affects m-learning; according to Freitas and Schlemmer (2013), the perception of mobility is the most crucial factor. One of the most popular forms of m-learning in education is the usage of the applications (apps) of m-learning. Apps can be defined as a small program with accessibility via a wireless network that can be downloaded onto smartphones or tablets. The utilization of apps will provide accessibility to learning resources, interesting activities (that include interactive educational games and quizzes), and it also allows sharing among learners when it comes to educational information.

There are so many advantages that m-learning may offer its users, including interactive learning activities, self-managing learning, corporate learning, personalized learning, and an effective methodology of sending and receiving knowledge (Bidin & Ziden, 2013; Jeong & Hong, 2013; Martin & Ertzberger, 2013; Viberg & Grönlund, 2013). Mobility is deemed as the strongest feature of mobile learning in comparison with the traditional education (Coursaris & Hassanein, 2002; Liu, 2011) as it allows students to have access and exchange information wherever and whenever they need to. This will help solve the problems regarding students' transition to access learning resources. Apart from that, it is also believed that m-learning has the ability to manage collaborative learning via interaction. The presence of mobile devices helps achieve interaction and improves the accessibility of learning materials (Liaw, Hatala, & Huang, 2010). SMS, WhatsApp, and Viber are some of the communication platforms that allows for interaction. Three possible interaction forms of m-learning include, interaction among the students themselves, between students and educators, or between students and content (Alshalabi & Elleithy, 2012; Dyson, Litchfield, Raban, & Tyler, 2009). With the help of this interaction, it is possible for the students to exchange and share information, knowledge, and ideas (Kuo, Walker, Schroder, & Belland, 2014) and this allows the learning process to become a lot more attractive. The use of edutainment applications, such as educational games and e-books, through mobile technology, allows the learning process to be more enjoyable and interesting (Ali & Arshad, 2016). Apart from that, m-learning also makes situated learning feature available. As the students carry their mobile devices wherever they go, it is possible for them to capture their own materials using cameras for pictures and videos, eventually exchange and share them with other students and lecturers (Ali & Arshad, 2016). M-learning improves responsible behaviour and autonomous learning, and this allows the students to become the focal point of the learning process and manage their learning as well. Based on that, it can be concluded that m-learning is a complementary activity to the traditional learning.

Galal (2016) stated that currently, the educational system in Egypt is in a critical state. Based on the "quality of the education system" index in the World Economic Forum's 2015-2016 Global Competitiveness Report, the country only ranked 139th out of 140 countries. Some of the reasons why the rank is so low are the limited flexibility of the curriculum, being highly dependent on rote memorization instead of scientific research, overcrowded classroom, and low availability of classrooms, lack of laboratories, and low-quality

teachers. On the other hand, some students leave schools to avoid transportation costs. . In addition, the poor teaching quality and lack of student participation negatively effects knowledge transfer as well.

Sureephong, Sirichai, and Winya (2015) also stated that m-learning is a solution tool that allows changes in the education system, transforming the traditional teaching into modern teaching. To a certain extent, mobile learning also represents a way to solve numerous educational issues (West, 2013). In accordance, m-learning has an objective to be a learning tool with novelty that may solve the issues the Egyptian education system currently suffers from.

In Egypt, children between eight and 18-years-old download or use entertainment apps more than education and learning apps. A study by GSM Association and NTT DOCOMO (2014) shows it is also accordingly imperative to identify the factors that affect the level of students' intention to use mobile technology in learning instead of playing games and browsing entertainment. The objectives of this particular research are to come up with the development and examination towards a research model to uncover the factors that have important effects on the intention to use mobile learning for basic education in Egypt. Finally, the paper tries to shed light on the basic education context in Egypt where most studies are done on university education.

Literature Review

In the world of information systems, there are numerous models developed to analyse individuals' acceptance and intention to adopt new technologies. Davis (1989) attempted to figure out the reasons of people's acceptance and rejection of information technology. The technology acceptance model (TAM) is the most highly adopted model in the field of technology (Davis, 1989). TAM has the ability to provide a theoretical basis that helps explain the impact of external variables (i.e., objective system design characteristics, training, computer self-efficacy) on internal beliefs, attitude toward use, behavioural intentions, and actual system use (Ibrahim & Jaafar, 2011). The unified theory of acceptance and use of technology (UTAUT) is another popularly used and also one of the most recently developed model in regard to information technology acceptance. Venkatesh, Morris, Davis, and Davis (2003) proposed this theory and attempted to channel and empirically compare elements from numerous technology acceptance models in technology acceptance.

In UTAUT, there are four determinants of IT user behaviour and four moderators that are able to moderate the effect of the four determinants on the behaviour intention and user behaviour. UTAUT develops a theory that says performance expectancy, effort expectancy, social influence, and facilitating conditions are direct determinants of behaviour intention or user behavior. The fact mentioned above allows great improvement to the explanatory power of the model. Apart from that, the moderating variables (gender, age, experience, and voluntariness of use) are very crucial when it comes to understanding the characteristics of different user groups (see Figure 1).

UTAUT is able to explain around 70% of the variance in the intention Venkatesh et al. (2003) stated. Also, it was also indicated that UTAUT has shown the superiority to outperform the previous models (Venkatesh et al., 2003). Additionally, the model can act a beneficial tool for managers that is able to assess the success of the new technology (Ibrahim & Jaafar, 2011).

Many studies discussed the factors that have an impact on students' intention to use m-learning. Table 1 showcases some of the latest studies on intention to use m-learning employing UTAUT. The results show that student's intention to use m-learning is the main key to developing a successful m-learning system. Therefore, it is believed that there will be a need to investigate the factors that affect their intention to use m-learning and to solve all issues that may hinder the success of the factors.

Table 1

Recent Studies on M-learning Intention to Use

Author	IS	Sample	Results
1. Kuciapski (2016)	M-learning	370 university students	This research argued that in contrast to UTAUT model, it is believed that facilitating condition does not have to be necessarily connected with use behaviour. Moreover, a correlation between other UTAUT variables as effort expectancy and performance expectancy has been
2. Badwelan, Drew, and Bahaddad (2016)	M-learning	400 university students	Performance expectancy, effort expectancy, lecturers' influence, personal innovativeness, and self-management have shown significant effects on behavioural intention.
3. Jawad and Hassan (2015)	M-learning	159 university students and lectures	The research suggested that the strongest indicator of the behavioural intention is performance expectancy. It was then followed by self-management learning, effort expectancy, perceived playfulness, and social influence. On the use behaviour aspect, the strongest indicator is the behavioural intention and the second strongest factor is facilitating condition.
4. Ng, Ibrahim, Ahmad, and Ng (2015)	M-learning	400 university students	The author decided to remove the moderators of the UTAUT, facilitating condition, and extended it with self-management of learning and perceived playfulness. The results showcased that performance expectancy and self-management of learning are strongly related to behavioural intention to use m-learning while effort expectancy, social influence, and perceived playfulness do not necessarily indicate a significant relationship with Intention to use m-learning.
5. Bere (2014)	M-learning	196 university students	This study identified that performance expectancy (PE), effort expectancy (EE), social influence (SI), student-centric learning and hedonic motivation are the determinants of behavioural intention and use of mobile learning using WhatsApp. PE, SI, and hedonic motivation is later moderated by marital status.

6. Abu-Al-Aish and Love (2013)	M-learning	174 university students	The research suggested some results that indicated that performance expectancy, effort expectancy, the influence of lecturers, quality of service, and personal innovativeness have a significant impact on behavioural intention to use m-learning. It was also found that prior experience of mobile devices was able to moderate the effect of these constructs on behavioural intention.

Research Model

UTAUT is used in this study as a basic platform and some modifications are also added to the traditional UTAUT model. The reason of doing so is to predict the actual behaviour in the most accurate manner (Davis, 1989; Sheppard, Hartwick, & Warshaw, 1988; Venkatesh & Davis, 2000). In addition, the dependent variable of the intention to use of m-learning was the behavioural intention. Apart from that, the actual use or the construct of user behaviour was eliminated. Furthermore, this study will evaluate the intention to use m-learning in regard to completely voluntary usage and by employing a population of students of the same age and same level of experience. Therefore, it was decided that voluntariness of usage, age, and experience should be eliminated as moderators. Furthermore, this study is not interested to test the gender as a moderator. This research combined two additional constructs into UTAUT in order to investigate the factors that might affect student intention to use m-learning in Egypt: Learners' autonomy and content quality design.

Research Dimensions and Hypothesis

Performance Expectancy (PE)

According to Venkatesh et al. (2003), performance expectancy and effort expectancy in UTAUT are similar to perceived usefulness and perceived ease of use in TAM. Performance expectancy (perceived usefulness) can be described as the level to which an individual perceives using the new technology will help them achieve a benefit in regard to the performance of a task (Venkatesh et al., 2003). In most cases of m-learning studies, it is suggested that performance expectancy (PE) affects an individual's behavioural intention to utilize m-learning in a positive way (Abu-Al-Aish & Love, 2013; Chang, 2013; Jambulingam, 2013; Nassuora, 2012). Involving concept of PE to the study will help investigate the intention of the students to use m-learning. They will have trust in m-learning as they believe the technology has the ability to help improve their performance. From the argument mentioned above, the following hypothesis is postulated:

H1: Performance expectancy has a positive impact on the intention of students to use m-learning.

Effort Expectancy (EE)

Effort expectancy (perceived ease of use) can be described as the level to which an individual perceives the new technology will be easy to use (Venkatesh et al., 2003). Many studies suggested there is a huge impact of the concept of effort expectancy on the intention of users to apply the m-learning technology (Abu-Al-Aish & Love, 2013; Al-Hujran, Al-Lozi, & Al-Debei, 2014; Chung, Chen, & Kuo, 2015; Jairak,

Praneetpolgrang, & Mekhabunchakij, 2009; Nassuora, 2012; Wang, Wu, & Wang, 2009). To adapt the effort expectancy, an evaluation of the students' intention to use m-learning showcases the students will utilize m-learning if they perceive that this new technology is user-friendly. Therefore, the following hypothesis is formed:

H2: Effort expectancy has a positive impact on the intention of students to use m-learning.

Social Influence (SI)

Social influence (SI), in regard to new technology and social influence, can be described as the level to which an individual perceives the new technology will be important according to others' belief (Venkatesh et al., 2003). Numerous studies identified experience has a moderating effect on the social influence on a user's behavioural intention to use m-learning (Venkatesh et al., 2003). Several studies in the related literature claimed social influence has a significant impact on a user's behavioural intention to use m- learning (Abu-Al-Aish & Love, 2013; Al-Hujran et al., 2014; Jairak et al., 2009; Wang et al., 2009). For the young students, it is believed that their parents, their friends, and their teachers are the individuals who encourage them to use m-learning, especially in the significance of educative mobile technology usage (Liu, 2011). Therefore, it is imperative to incorporate social influence in this research to investigate the opinions of parents and teachers in regard to intention to use m-learning technology. Based on the discussion above, the following hypothesis is proposed:

H3: Social influence has a positive impact on the intention of students to use m-learning.

Facilitating Conditions (FC)

A facilitating condition (FC) can be described as the level to which an individual that the technical aspects and existing organization infrastructure will be able to support the presence of the new technology (Venkatesh et al., 2003). Many relevant literatures investigating mobile technology showcased that a facilitating condition will have a positive effect on an individual's behaviour intention (Attalla, El-Sherbiny, Mokbel, El-Moursy, & Abdel-Wahab, 2012; Iqbal & Qureshi, 2012; Jairak et al., 2009).

An important necessity for young students who would like to use m-learning to own a mobile device as it will encourage the process of m-learning (Liu, 2011). In accordance, the support from the parents also plays important role in the success of m-learning implementation in schools. Furthermore, with the permission of their parents, students can also continue interacting with the system by using mobile devices at home (Liu, 2011). Therefore, it is important to incorporate this concept to m-learning. This showcases that the students have the perception of the availability of mobile devices. With the presence of parental support, m-learning will easily let them access to designated infrastructure and learning materials. This will also help facilitate interaction with their teachers and other students. Based on argument stated above, the following hypothesis is postulated:

H4: Facilitating condition has a positive impact on the intention of students to use m-learning.

Learners' Autonomy (LA)

Researchers suggested that in order to have a better experience in learning, it is imperative that the learners are actively involved in the system (Bidin & Ziden, 2013). Taking a more active role allows an increased

likelihood that students be more interested in taking part in learning experience the encouragement is highly present (Selfe, 1999; Watts, 1997). M-learning provides a chance for students to have major contributions in the learning process by getting involved and taking an active role right from the start and by ensuring they understand the goal at the point of evaluation (Makoe, 2010). A mobile device can be carried away all the times and it is possible for the users to take more control.

Learning autonomy, in the context of m-learning, means the ability of the students to have adequate and enough responsibility for their learning process via mobile devices (Yeap, Ramayah, & Soto-Acosta, 2016). A study conducted by Liaw, Huang, and Chen (2007) on instructor and learners' attitude towards e-learning, identified that the effective learning autonomy is a huge aspect in the acceptance of e-learning system. Thus, the following hypothesis is constructed:

H5: Learning autonomy has a positive impact on the intention of students to use m-learning.

Content Quality Design (CQD)

One of the reasons the students are not interested in mobile learning applications is the lack of content quality (Liu, 2011). Most of the systems only offer them with learning materials that are not attractive and enjoyable enough to them. Additionally, mobile devices involve the presence of unique features such as small screen size that make previous e-learning materials for personal computer (desk computer) usage are no longer suitable to be applied in these devices. Thus, it is crucial that we consider mobile application content quality as a factor in this study.

The content quality design is associated with the type and format of learning content (Lee & Kozar, 2006). The format of learning content is related to the students' perception on how the learning material content is showcased by the system. Liu, Han, and Li (2010) claimed that the type of learning content plays a huge role for learners. In addition, the study of Almaiah, Jalil, and Man, 2016 on the effects of quality features on mobile learning acceptance, found that the content quality design is a significant aspect in regard to mobile learning acceptance. Therefore, the following hypotheses are postulated:

H6: Content quality design has a positive impact on Performance Expectancy.

H7: Content quality design has a positive impact on Effort Expectancy.

Methodology

The questionnaire consisted of 24 items adapted from Almaiah et al. (2016), Venkatesh and Davis (2000), and Yeap et al. (2016) for measuring seven constructs and was conducted on public preparatory schools in Cairo, Egypt. The listing of all public preparatory schools' names in Cairo and the list of the names of all students in each class are known. Additionally, there are two types of public schools in Egypt, Arabic schools and language schools; therefore, this study used a stratified sampling technique to collect the data. The sample size determined from the population was based on the Krejcie and Morgan Table (Krejcie & Morgan, 1970). The public schools in Cairo were divided into two clusters according to the medium of study—368 Arabic schools and 216 language schools—then a random selection was conducted from these clusters. Next,

based on the number of all students in each grade and the sample size of 384, we defined the participated students in each school. A total of 400 questionnaires were distributed, with a total of 386 questionnaires completed. Paper-based survey questionnaires were used to collect the data. Before the students completed the questionnaire, the researcher provided them with a short description of the research purposes and what m-learning is all about. The characteristics of the participants are displayed in Table 2.

Table 2

Profile of Respondents

Profile	Frequency	Percentage
Gender		
Male	235	90.9
Female	151	39.1
Age		
11-14	255	66.0
15-18	131	34.0
Own Smartphone	177	45.9
Own tablet	95	24.6
Own both	114	29.5
Do you use m-learning in your studies?		
Yes	104	26.9
No	282	73.1

Data Analysis and Results

To analyze the research model, we utilize the Partial Least Squares (PLS) analysis technique using the SmartPLS 3.0 software (Ringle, Wende, & Becker, 2015). Dependent on the recommended two-stage analytical procedures by Anderson and Gerbing (1988), the measurement model (validity and reliability of the measures) was investigated and then followed by an evaluation of the structural model (testing the hypothesized relationships; Alzahrani, Stahl, & Prior, 2012; Hair, Sarstedt, Hopkins, & G. Kuppelwieser, 2014; Ramayah, Lee, & In, 2011). A bootstrapping method was used to check the significance of the loadings and the path coefficients (Hair et al., 2014).

Measurement Model Evaluation

We initially assessed convergent validity according to the suggestions by Hair et al. (2014) by investigating the loadings, average variance extracted (AVE), and composite reliability (CR). Hair et al. (2014) suggested that the loadings should be >0.70, CR > 0.7, and AVE > 0.5. As shown in Table 3, the AVE was greater than 0.5 and the CR was greater than 0.7. All loadings were above the cut-off value except for FC1, PE1, and SI1 which was respectively 0.695, 0.432, and 0.673

Table 3

Results for the Measurement Model

Constructs	Items	Loading	AVE	CR
Behavioral intention				
	BI1	0.715	0.62	0.83
	BI2	0.845		
	BI3	0.798		
Content quality design				
	CQD1	0.727	0.539	0.824
	CQD2	0.731		
	CQD3	0.72		
	CQD4	0.758		
Effort expectancy				
	EE1	0.765	0.587	0.81
	EE2	0.797		
	EE3	0.735		
Facilitating conditions				
	FC2	0.831	0.72	0.837
	FC3	0.865		
Learners' autonomy				
	LA1	0.842	0.666	0.857
	LA2	0.818		
	LA3	0.788		
Performance expectancy				
	PE2	0.773	0.604	0.82
	PE3	0.814		
	PE4	0.743		
Social influence				
	SI2	0.786	0.597	0.816
	SI3	0.759		
	SI4	0.773		

We assessed discriminant validity following Fornell and Larcker (1981), who compare the AVE with squared correlations or alternatively compare the square root of the AVE with the correlations. As shown in Table 4, the square roots of the AVE (bolded) are all higher than the off-diagonal correlation values, suggesting that there is sufficient discriminant validity. Thus, we can conclude that the measures used in this study show appropriate validity and reliability.

Table 4

Discriminant Validity of Measurement Model

	1	2	3	4	5	6	7
1. Effort expectancy	**0.766**						
2. Facilitating conditions	0.573	**0.848**					
3. Social influence	0.538	0.527	**0.773**				
4. Performance expectancy	0.484	0.454	0.455	**0.**777			
5. Learners' autonomy	0.472	0.47	0.415	0.466	**0.816**		
6. Behavioral intention	0.417	0.473	0.448	0.455	0.704	**0.788**	
7. Content quality design	0.53	0.621	0.601	0.528	0.555	0.558	**0.734**

Structural Model

Next step was to test the hypotheses developed for this study by running a bootstrapping procedure with a resample of 5000, as suggested by Hair et al. (2014). The results are presented in Table 5. The R^2 for performance expectancy was 0.278, effort expectancy was 0.281, and behavioural intention was 0.541, which were all acceptable based on the cut-off suggested by Cohen (1988). Content quality design (β = 0.528, $p < 0.01$) was positively related to performance expectancy. Additionally, content quality design (β = 0.53, $p < 0.01$) was positively related to effort expectancy. Next, we examined the predictors of behavioural intention and found learners' autonomy (β = 0.568, $p < 0.01$), performance expectancy (β = 0.097, $p < 0.05$), social influence (β = 0.125, $p < 0.05$), and facilitating conditions (β = 0.114, $p < 0.05$) had a positive effect on behavioural intention to use m-learning. However, effort expectancy (β = -0.03, $p > 0.10$) had no direct significant effects on intention to use mobile learning.

Table 5

Discriminant Validity of Measurement Model

Hypo	Relationship	Std. beta	Std. error	t-value	P values	Decision	R^2	F^2	Q^2
H1	PE -> BI	0.097	0.052	1.842*	0.033	Supported	0.541	0.013	0.310
H2	EE -> BI	-0.03	0.063	0.062	0.486	Not Supported		0.001	
H3	SI -> BI	0.125	0.06	2.067*	0.019	Supported		0.021	
H4	FC -> BI	0.114	0.06	1.909*	0.028	Supported		0.016	
H5	LA -> BI	0.568	0.06	9.431**	0.000	Supported		0.467	
H6	CQD -> PE	0.528	0.043	12.292**	0.000	Supported	0.278	0.386	0.158
H7	CQD -> EE	0.53	0.042	12.765**	0.000	Supported	0.281	0.390	0.155

* P< 0.05
** P< 0.01

As suggested by Cohen (1988), the effect sizes (f^2) for learners' autonomy and content quality design are large, while social influence has small effect size. effort expectancy, performance expectancy, and facilitating conditions have weak effect size. The Q^2 values were all greater than zero, which suggests that there is predictive relevance (Hair et al., 2014; Fornell & Cha, 1994).

Finally, Tenenhaus, Vinzi, Chatelin, and Lauro (2005) recently developed a goodness of fit (GoF) for PLS; in our model, the GoF is 0.478, which indicates a good fit. The final research model with explained variance and path coefficients is shown in Figure 1.

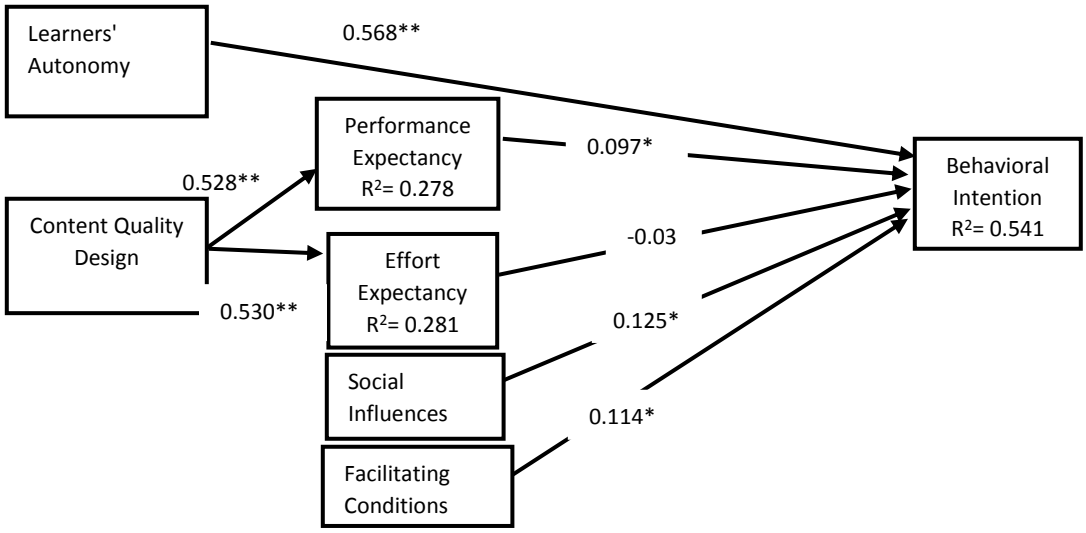

Figure 1. Testing result of the final model.
Note. * P < 0.05, ** P < 0.01.

Discussion

The discussion section presents the results obtained from the empirical survey. The results show that all of the hypotheses are significant except the relation between effort expectancy and behavioural intention. Subsequently, we will discuss the importance of each factor observed in the data. The study found that H6 and H7 were significant; therefore, content quality design affected both effort expectancy and performance expectancy of m-learning. This result was consistent with the study of Almaiah et al. (2016) that found content quality design has a positive effect on perceived usefulness and perceived ease of use of mobile learning applications. The relationship between learners' autonomy and behavioural intention is strongly significant; therefore, H5 is supported. This result is aligned with the previous findings of Liaw, Huang, and Chen (2007) in the context of e-learning. Among all constructs, learners' autonomy was found to have a greater effect size, with $f^2 = 0.467$. Interestingly, learners' autonomy has the highest path-coefficient with behavioural intention to use m-learning, which causes us to conclude that the learners' autonomy has a strong significant effect on behavioural intention to use m-learning. Higher levels of autonomy allow increasing the intention of the learners to use m-learning. In this study, performance expectancy (perceived

usefulness) was found to be significant on intention to use m- learning that corresponds with what Abu-Al-Aish and Love (2013), Chang, 2013, Jambulingam, 2013, and Nassuora (2012) found in the context of m-learning. Therefore, H1 is supported with β value 0.097. The P-value for effort expectancy (perceived ease of use) is 0.486, which is far greater than 0.05 at 95% significant level. Therefore, the H2 is not supported and effort expectancy is deemed as an insignificant factor in this study. It is believed that the reason being is the lack of user-friendliness and comfortable design of the system. Maniar, Bennett, Hand, and Allan (2008) claimed that several possible technological restrictions may hinder m-learning adoption, such as the quality of the screen (screen resolution) and the size of the screen. Kukulska-Hulme (2007) identified that some of the devices are not suitable for educational use of m-learning activity and that usability issues are also highly reported by the users. Park, Nam, and Cha (2012) developed a study on university students' behavioural intention towards the use of mobile learning and also agreed that perceived ease of use and perceived usefulness did not have any significant effects on students' intentions towards the use of mobile learning. Social Influence is considered to have a positive effect that can increase the intention of the learners to use m-learning. Therefore, H3 is supported. This result was consistent with Abu-Al-Aish and Love (2013), Al-Hujran et al. (2014), Jairak et al. (2009), and Wang et al. (2009) in the context of m-learning. Facilitating conditions was found to be significant on intention to use m-learning; accordingly, H4 is supported. This result is aligned with the previous findings of Attalla et al. (2012), Iqbal and Qureshi (2012), and Jairak et al. (2009).

Conclusion and Implications

This research paper provides an insight on the factors influencing intention to use mobile learning in Egypt. Additionally, this research assists m-learning applications developer to understand the factors that influence intention to use of m-learning apps by Egyptian students. Learners' autonomy is very crucial for increasing the intention of the learners to use m-learning. Therefore, if companies or schools want to develop m-learning apps, they should first concentrate on increasing the learners' autonomy elements such as exams and quizzes. Content quality design positively affected effort expectancy and performance expectancy of m-learning. Content quality design can be realized by providing students with up-to-date content with the effects of multimedia such as audio, video, and animation content. Performance expectation has a high impact on intention to use m-learning. Mobile learning designers have to design mobile learning applications that improve students' performance, such as design applications that are faster in browsing and downloading. Social influence has a positive impact on behavior intention to use mobile learning. To enhance the social influence, teachers and parents should recommend using mobile devices in study lessons and assignments as an effective way that is consistent with today's rapid development of technology. Additionally, facilitating conditions has a positive impact on behavior intention to use mobile learning and can be realized by providing learners with mobile devices, networks, and new and useful applications that can lead them to production and innovation.

Future Work

The findings of this research have been discussed and directions for future studies will be also proposed. Firstly, future study may include actual use behaviour or other external variables that will potentially influence students' behavioural intentions on mobile learning. Secondly, the study investigated public preparatory school levels in Egypt. It was suggested that the inclusion of secondary schools or primary schools in private or public schools would be beneficial. Thirdly, the study would be more effective if it included the parents' behavioural intentions toward their children using mobile learning.

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Online Hunting, Gathering and Sharing – A Return to Experiential Learning in a Digital Age

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Abstract

Learning through a collective experience by taking part in group activities, such as hunting, gathering, and sharing, has always been a natural, "organic," and "experiential" process where new skills and knowledge, if benefitting the whole group, are accepted, shared, and propagated. Nevertheless, in industrialized societies where specific knowledge and skills are an economical and societal necessity, the learning economy has largely moved to a model where the teachers "harvest" selected knowledge and "put it in a basket" from which students are expected to take from and learn. This learning model has permeated the 21st century digital world, where the main promoted advantage of these new learning environments is still the "individualization of learning," which can result in a very solitary and isolated endeavor; however, it doesn't have to be the case. An example of a successful online university course suggests that carefully crafted online instructional design strategies can contribute to a flexible and rich experiential learning environment. Although they might be physically disconnected, it is possible for learners and a teacher to remain closely interconnected, engaged, and accountable for both individual and group success in knowledge "hunting, gathering, and sharing" activities in a digital age.

Keywords: experiential learning, online learning, group learning, digital literacy, educational psychology

Introduction

Collective experiences, such as hunting, gathering, raising children, or storytelling have always been a natural, "organic," and "experiential" way of learning new skills and acquiring knowledge. If benefitting the group the individual belongs to, the new skills and knowledge have usually been accepted, shared, and propagated. Both applied research and anthropological intuition show that exploration and experimentation, and in particular knowledge and skill sharing, have always been a key to human learning, which has been understood for centuries as a social activity with individual and group benefits. Gray (2009) describes how hunter-gatherer children have learned and gained social skills largely though play among themselves but also by hearing stories from adults and elders about their experiences, while Geary (2007) similarly points out that children "show a preference for the activities that promote the cross-generational transfer of knowledge in traditional societies" (p. 15). Therefore, as Gray claims, the adults in hunter-gatherer societies

> do not concern themselves much with their children's education. They assume that children will learn what they need to know through their own, self-directed exploration and play. In play, hunter-gatherer children, on their own initiatives, practice the skills they will need for survival as adults. In their play, they also rehearse and build upon the knowledge, experience, and values that are central to their culture. (Gray, 2009, p. 505)

These spontaneous means of acquiring knowledge and skills are rather different from how we see learning and education today. In industrialized societies, which Harari (2015) reminds us are "the blink of an eye compared to the tens of thousands of years during which our ancestors hunted and gathered" (p. 40), the specific knowledge and skills are an economical and societal necessity, which resulted in a common model where the teachers "harvest" selected knowledge and "put it in a basket" from which students are expected to take from, and learn. Although still occupying the same physical space and time, in this kind of teaching and learning environment, each learner becomes largely responsible for their own learning success, in contrast with traditional group learning and knowledge sharing processes. In addition, in this rather one-dimensional exchange between a teacher (through content) and a learner, the latter often becomes deprived of experiences of exploration and learning by immersion in real-life situations, which require applying and testing the theoretical knowledge and newly acquired skills.

This learning model has permeated the 21st century digital world, which enables communities of learners to occupy a virtual space and thus become much larger and diverse than ever before, as well as to be constantly connected. However, the main promoted advantage of these new learning environments is again the "individualization of learning," through statements such as "study at your own pace, when and where it suits you." Although convenient, flexible, and without a doubt a more accessible learning experience, it can be a very solitary and isolated endeavor, but it does not have to be the case. Our experience in migrating an existing traditional face-to-face course online has shown that it is possible to create a sense of community and incorporate even more social activity in an online environment than in the physical classroom.

Teachers now have access to simple yet versatile online applications that allow them to design experiential learning activities where students are first prepared to "hunt and gather" in a digital space, and are consequently encouraged to reflect on their learning experience in the safety of their online community.

The experiential learning cycle is thus closed through the process of sharing the whole experience with a teacher and classmates.

The process of crowdsourcing course-related content, or "placing the collected fruit in the communal basket for everyone to use" instead of a "fruit basket assembled by a teacher/school," has several learning benefits. Firstly, individual students immediately put in practice what they have learned. Secondly, they are encouraged to reflect on the learning experience and the material they have "harvested," and they get prompt feedback, which provides an opportunity to self-check how well they have understood the notions and concepts introduced by the instructor. Thirdly, by uploading the collected material for a whole class to see, students observe their peers' learning processes and contribute course content, which therefore changes with every term and cohort, making the learning experience unique.

Furthermore, virtual learning spaces, situated in the realm of a digital world dominated by the Internet, require that students build knowledge and skills that allow them to *navigate* this space, in order to put in practice what they are learning in the course. The combination of related competencies is often referred to as "digital literacy," which the American Library Association's Digital Literacy Task Force defines as "the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills" (Digital Literacy, Libraries, and Public Policy, 2013, p. 2). Hence, the learning process in many of today's subjects and topics needs to incorporate experiences of searching for and critically evaluating information found online, as well as being able to communicate and share it in a digital space, while learning from the experiences *of* others, and *with* others.

Providing this kind of practice in a virtual classroom, which every learner can decide to join and leave at their will, is not a simple endeavour. It involves the design of some carefully guided activities that require a teacher to not only master the subject, but to also have a high level of digital literacy, and often collaborate with other professionals, such as instructional designers. As Kirschner, Sweller, and Clark (2006) emphasize, engaging students, and especially novices in the field, in learning activities without guidance is likely going to be less effective and can even produce negative learning effects. Furthermore, as Bates (2014) positions, "experiential learning approaches require considerable re-structuring of teaching and a great deal of detailed planning if the curriculum is to be fully covered" (Strengths and Weaknesses of Experiential Learning Models section, para. 4).

Experiential Individual Learning with Communal Benefits

Preparing students to have in-class informed debates about the sovereignty of Quebec was a major activity in the second-year course *Introduction to Quebec Society,* taken as an elective for the majority of students enrolled. Students researched primary sources and reviewed secondary sources to help prepare arguments for debate. These were individual activities where students would submit the collected resources to the instructor, as a demonstration of their learning and understanding of differences between primary and secondary sources. Towards the end of the course, students were invited to join either the Yes or the No side in a debate, and prepare arguments with the rest of their group using the material they brought to the

classroom. Most importantly, the students presented their position and defended it while using the findings of their debate group, while the instructor acted as the debate moderator.

In the online version of the second-year course *Introduction to Quebec Society*, which has been offered by the School of Indigenous and Canadian Studies at Carleton University (Ottawa) for five consecutive years, the objective was to create a space where such sharing and discussion would still be possible. Ideally, the classical Socratic teaching methods would still be coupled with the implementation of *learning through doing***.** To do so, we designed several communal and experiential learning activities in a Learning Management System Moodle application called Database Activity Module. A good representative of these activities are the *primary* and *secondary source* assignments, as well the *see, learn, compare, critique* activity, leading to the final debate on the future of Quebec.

The online teaching method allows for carefully guided successive and cumulative learning experiences. Students first learn the definition of primary and secondary sources through the online learning module designed using a Moodle lesson activity. The module includes the written definition, explanatory videos recorded by the instructor, and frequent formative assessment activities, which usually take the format of well-designed multiple-choice questions. The multiple-choice questions provide not only immediate feedback on the correctness of a selected answer, but also an explanation of the correct answer, ensuring that students do not acquire wrong information, and at the same time prompting them to revisit the previous content if they provided an incorrect answer. In addition, preamble to the Primary Source assignment, students revise the distinction between primary and secondary sources through a matching activity incorporated in a lesson activity module.

Some of the main learning outcomes in this course include analyzing and integrating information, and sharpening critical thinking and research skills. To accomplish this while practicing to distinguish between two categories of sources, students are sent to two virtual museum exibitions about New France and asked to criticaly analyze both, while learning about displayed objects that come from both of the source categories (Figure 1).

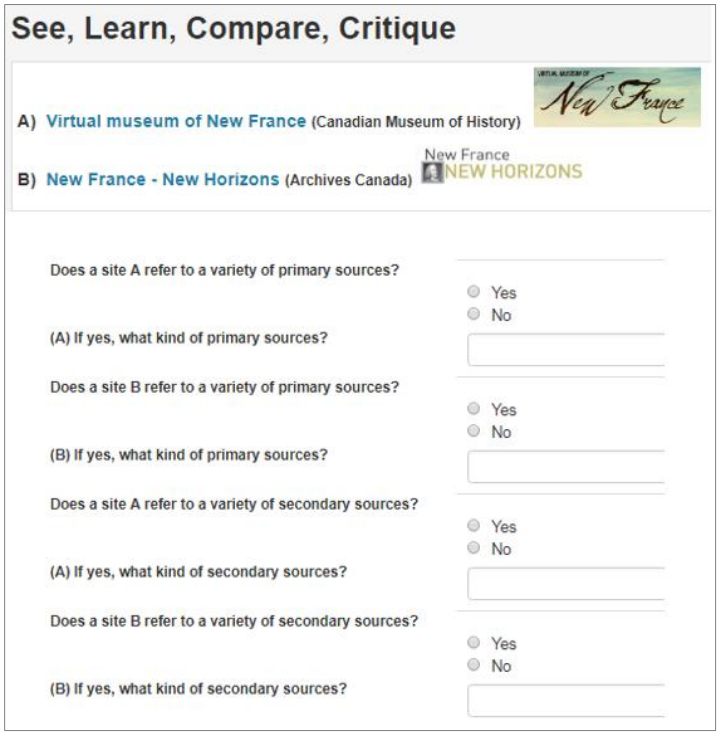


Figure 1. A selection of questions posed in the "see, learn, compare, critique" assignment.

In order to engage in an authentic individual learning experience, students cannot see the entries made by classmates until they submit their own, at which point all entries become visible so that a student can compare their responses with the rest of the class. Each individual submission is open for comments by the teaching staff and students, enabling continuous multi-level discussions between participants as an extension of the learning process (Figure 2).

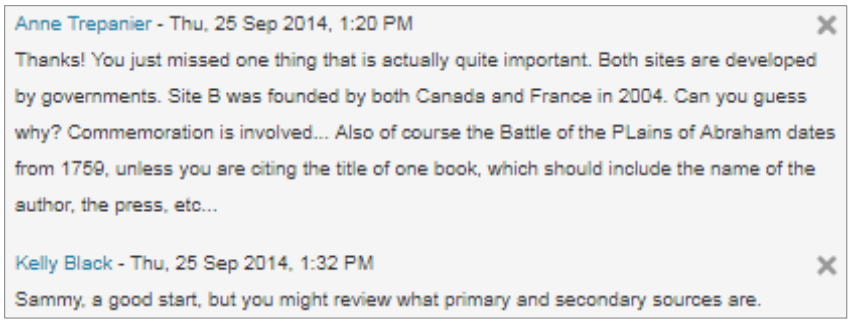


Figure 2. Open feedback for assignment submissions.

In the following weeks after this initial activity, students are asked to put in practice what they have learned by searching for primary sources that belong to one of the three main topics examined in the course: Culture and Identity, Economy, or Constitutional Relations, and to one of the main historical periods covered in the

course: the Quiet Revolution (1960s), the first referendum (1980), the second referendum (1995), or present time (Figure 3).

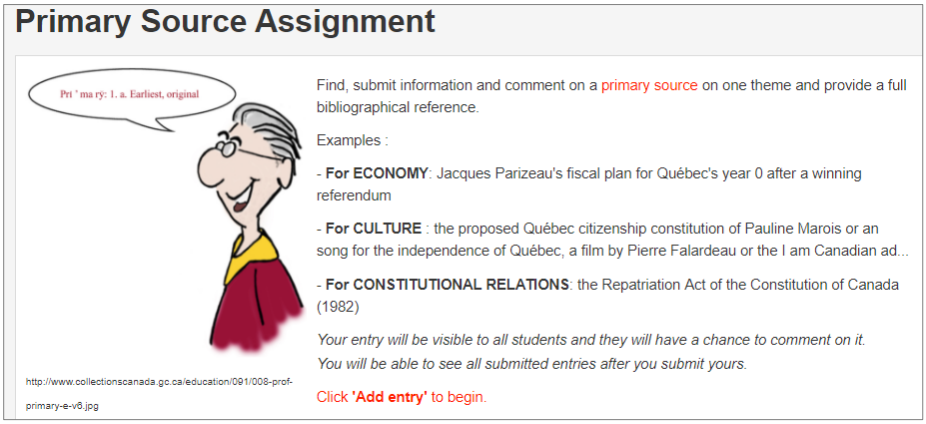


Figure 3. Primary source assignment instructions.

The Database Activity Module is designed to permit students to make a selection of the primary source attributes before uploading it into an activity, and also to offer a rationale for their selection as it relates to a certain context and topic (Figure 4). Students are also encouraged to upload an image related to the primary source.

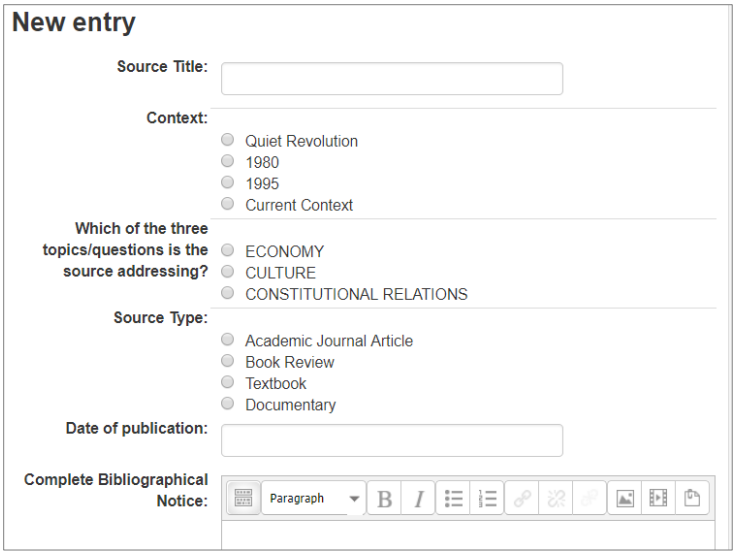


Figure 4. Entering data in the Moodle database module.

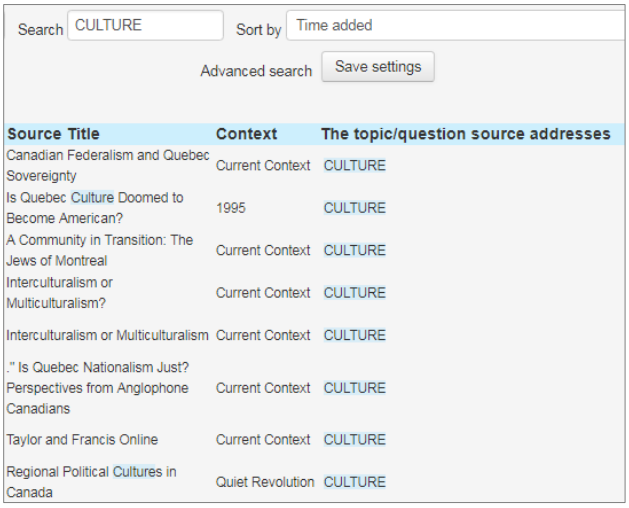
Similarly to the previously described activity, an important Moodle database activity feature used in these assignments is allowing students to see all entries immediatly after they upload their own (Figure 5). This feature not only minimizes chances of copying ideas from classmates, it also acts as an immediate reward

in connecting them to the "communal learning basket." Indeed, once the individual entry is made, it becomes visible to the whole class and open for comments from the teaching staff and classmates.

Student Name	Source Title	Image	Context	The questions/topics source addresses	More
M	Jacques Parizeau's fiscal plan for Québec's year 0 after a winning referendum		1995	ECONOMY	
Al	The Constitution Act of 1982		1980	CONSTITUTIONAL RELATIONS	
Th	Manifeste		Quiet Revolution	CULTURE	
Z			Current Context	ECONOMY	
Hi	Declaration of the King concerning		Current Context	ECONOMY	
Hi	Monnaie de Carte [card money]		Current Context	ECONOMY	
Je	Canada weekly / Department of External Affairs. : Vol. 8, no. 18 (Apr. 30, 1980)		1980	CULTURE	
G	October Crisis - FLQ Manifesto				
G	October Crisis - FLQ Manifesto		Quiet Revolution	CULTURE	
C	Quebec Act 1774		Quiet Revolution	CONSTITUTIONAL RELATIONS	
Je	De Gaulle, Charles. "Vive le Quebec Libre." Expo 67, Montreal City Hall, Montreal, Quebec. Speech		Quiet Revolution	CULTURE	
Si	Vive le Quebec Libre		Quiet Revolution	CULTURE	
Je	I am a Canadian		Current Context	CULTURE	
M	Gens du pays		1980	CULTURE	

Figure 5. Crowdsourcing and sharing the collected primary sources: List view mode.

One of the main advantages of this adaptable Moodle activity is that it allows the data to be displayed in an easy-to-browse and searchable format in a list view mode (Figure 6). This feature becomes essential when preparing for the capstone activity: a class final debate.


Search CULTURE Sort by Time added

Advanced search Save settings

Source Title	Context	The topic/question source addresses
Canadian Federalism and Quebec Sovereignty	Current Context	CULTURE
Is Quebec Culture Doomed to Become American?	1995	CULTURE
A Community in Transition: The Jews of Montreal	Current Context	CULTURE
Interculturalism or Multiculturalism?	Current Context	CULTURE
Interculturalism or Multiculturalism	Current Context	CULTURE
." Is Quebec Nationalism Just? Perspectives from Anglophone Canadians	Current Context	CULTURE
Taylor and Francis Online	Current Context	CULTURE
Regional Political Cultures in Canada	Quiet Revolution	CULTURE

Figure 6. Searching and sorting based on source attributes in Moodle database activity.

After identifying sources they want to read more about, based on selected attributes, students click on the "More" button (Figure 5) to view a full single entry (Figure 7). When reflecting on a source selection, students are encouraged to use proper citation and referencing.


Source Title:	The Constitution Act of 1982
URL:	
Source Image:	
Context:	1980
The topic/question source is addressing	CONSTITUTIONAL RELATIONS
Why I selected this source:	The Constitution Act of 1982 is a very important primary source to Quebec constitutional relations as well as Canada in its entirety. It was released only two short years after the 1980 Quebec Referendum and many pieces of it were greatly disagreed with by the Quebec population. This led to the Conservative government in 1984 running on a platform that promised to find a better way to ensure that the unique and distinct needs of Quebec were met within the Constitution Act of 1982. The Canadian Government wrote this document and its intended audience was all Canadian citizens. This document was written as the final step toward Canada becoming sovereign from England and was an act of partition. The Constitution Act, 1982 was the first Canadian constitutional document that could be amended within Canada as opposed to all amendments needing to be made by the British government as previously set out in the Statute of Westminster, 1931. The creator of this document being the Canadian Government shows us that it was most likely created with the English speaking population's interest put first as the dominant and majority language in Canada. This could be one reason that many Quebec residents were unhappy with various aspects of the Act and felt as though Quebec wasn't given the distinct and unique rights that it required. This is why the Conservative government ran during the 1984 election on the promise they would adjust what was needed to provide Quebec with what it needed to maintain its distinct culture. Citation: *Canadian Charter of Rights and Freedoms*, Part I of the *Constitution Act, 1982*, being Schedule B to the *Canada Act 1982* (U.K.) 1982, c.11.

Figure 7. Individual student database entry: Single view mode.

All previously described activities progressively prepare students for course capstone activities, such as an online class debate and final essays, where they are prompted to refer to primary and secondary sources collected by all classmates, and also to those shared by the instructor. Since the entries made in a Database Activity Module are easily searchable by either context or time period, students have a wide range of

crowdsourced, described, properly cited, and evaluated sources, which they can reference in the final class activities.

Based on student feedback, two aspects of the designed online activities play a large role in their learning experience. Indeed, knowing that individual work and contributions will be visible to the whole class, and being able to compare entries, serve as a motivational factor to improve the level of engagement and quality of submitted work.

Conclusion

Recent emphasis on providing more experiential learning opportunities for today's students comes as a natural reaction to a long tradition of school-based teaching and learning environments. For instance, situated in a physical classroom, students were expected to, often passively, intake the content provided by a teacher, while later engaging in learning activities, mainly at the individual level, and submitting assignments directly to the teacher. This typical learning method often did not provide much opportunity for individual students to observe and take part in the group learning process and compare personal learning outcomes with those of their classmates. When creating learning experiences in new modalities, there seems to be a value in reminding ourselves of our long-enduring learning and motivational contexts, and accepting the "need to delve into the hunter-gatherer world that shaped us, the world that we subconsciously still inhabit." (Harari, 2015, p. 40). Returning to historically proven effective learning opportunities that enable students to explore and immediately put in practice what they have learned, while sharing experiences with the group and engaging in a complex "student-student-teacher-content" four-dimensional interaction matrix, seems to be the natural progression of organized education.

These "new," albeit historically "old," types of learning experiences do not need be constrained by the mode of learning, they can only be constrained by the mode of thinking, teaching, and designing courses. In the digital age, the teacher can still guide towards selected orchards, but can also encourage a search for new ones and provide opportunities for learners to share their discoveries. This new approach to learning enabled by technology results not only in predefined and quickly validated learning outcomes, but also in those coloured in hues that reflect the unique community and context in which they have emerged.

Additionally, the growing need to improve students' digital literacy skills and prepare them for future careers requires teaching methods that provide opportunity for the development of both the skills and experiences they need to succeed in life after university. This means incorporating learning activities that include digital technology as "a gateway to a comprehensive, demanding, collaborative, and all-consuming interactive experience that stimulates learning of key skills" (Lee, 2015, p. 458). When designed with a focus on learning outcomes, these types of activities can be used to encourage students to engage in a process of online exploration and critical thinking, to share their findings with the class, and to help teachers "create a culture that can support those values and beliefs that they consider to be important for today's learners" (Bates, 2015, Culture and New Learning Environments section, para. 2). The nature of the individual undertakings enabled by technology allows for flexible and accessible learning, while experiential, authentic, and memorable activities can transform it from a solitary to a meaningful individually constructivist learning experience, as well as a collaborative experience, which should be the premise of higher education (Vaughan, Cleveland-Innes, & Garrison, 2013). The presented case confirms that carefully

crafted online instructional design strategies can contribute to a flexible and rich learning environment that transcends space and time, and yet keeps learners and the teacher closely interconnected, engaged, and accountable for both individual and group success in knowledge "hunting, gathering and sharing" activities in the digital age.

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Online Course Enrollment in Community College and Degree Completion: The Tipping Point


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Abstract

Recent research indicates that certain students are at risk of lower levels of academic performance in online settings when compared to peers who study only in the classroom. Community college students have been a population of particular concern. In this paper, we hypothesize that online course load and institutional quality may impact outcomes for such students at risk for lower levels of degree attainment. Using comprehensive data from the 30 community colleges (n=45,557) of the State University of New York (SUNY), we conducted a state-wide study to examine whether there is a "tipping point" at which online course load becomes problematic for community college learners seeking to attain a degree through a mix of online and face-to-face coursework. We also test the conjecture that some institutions may excel at supporting online learner success among more at risk populations who choose online study. Results indicate that community college students who take more than 40% of their courses online begin to lose the benefits of enhanced degree completion conferred through a mix of online and face-to-face enrollment. Moderating variables are also identified and discussed.

Keywords: online learning, community colleges, retention, degree completion

Introduction

Educational attainment is a significant predictor of a host of individual and societal benefits. Individuals with higher levels of education earn more, pay more taxes, and are more likely than others to be employed. As one recent report describes the relationship, "College education increases the chance that adults will move up the socioeconomic ladder and reduces the chance that adults will rely on public assistance" (Ma, Pender, & Welch, 2016, p.4). Online education has increased access to these benefits for many millions of adult citizens (Allen & Siemen, 2016). The flexibility and convenience of online learning can open doors to a better life for those who avail themselves of the opportunity. Community colleges have been particularly effective in offering online education with a higher proportion of these institutions enrolling online student than four year colleges (McFarland et al., 2017).

Copious research suggests that online and classroom-based instruction result in equivalent outcomes for student in most higher education settings. Reporting on 16 meta-analyses, Bernard Borokhovski, Schmid, Tamim, and Abrami, 2014) (2014) concluded that thousands of studies indicate that online learners and classroom learners succeed at equivalent rates at a wide variety of outcome measures. There is significant variability across studies, however, with many finding that online students succeed at higher rates, and just as many finding that classroom students succeed at higher rates. For decades researchers have been encouraged to investigate "what makes the difference?" in this no-significant difference literature (Zhao, Lei, Yan, Lai, & Tan, 2005). This study undertakes that goal with a sub-population already determined to be at risk for lower academic outcomes: community college students.

Our questions for this study grow out of an emerging line of inquiry that consistently identifies lower performance among community college students who take online courses compared to their classroom-only counterparts. The possibility of impaired academic performance among certain students is important as the likelihood of attaining an educational credential, and its individual and societal benefits, is jeopardized. This is especially concerning among the population studied here as community college serves as a leveler, and in many cases, provides access to higher education regardless of prior academic preparation.

Review of Related Research

A series of rigorous state-wide studies by Jaggars and Xu (2010) and Xu and Jaggars (2011; 2013) found that community college students in Virginia and Washington State had lower performance (higher course dropout rates and lower grades) in online courses in comparison to face-to-face courses and that these negative findings were amplified with certain sub-groups (male students, younger students, Black students, and students with lower GPAs).

Parts of this line of research are replicated and extended by Johnson, Cuellar Mejia, & Cook (2015) among the community college students in California who also found lower course grades, higher course withdrawal, and an amplification of achievement gaps between majority and minority students. More recent research in a large private-for-profit institution supports some of these findings (Bettinger, Fox, Lob, & Taylor, 2017) relating to exacerbated online achievement gaps.

Beyond course level outcomes, program level outcomes for online college students were also problematic in some large-scale studies. Students in both the Virginia and Washington State community college systems who took one or more online courses in their first semester were 4 to 5% less likely to return for the following semester (Jaggars & Xu, 2010). Students who took a higher ratio of credits online were also less likely to earn a degree or transfer to a four-year institution than students who took a lower proportion of online credits (Xu & Jaggars, 2011).

However, conflicting findings in this area of investigation exist. For example, Wladis, Conway, & Hachey (2016) found that while students enrolled in online courses were more likely to drop out of college, online course outcomes had no direct effect on college persistence. Other researchers, using a large, multi-state, federated data set of more than 600,000 students participating in the Predictive Analytics Reporting Framework (PAR) found that taking some online courses did not result in lower retention rates for students enrolled in primarily face-to-face community colleges (James, Swan, & Daston, 2016). The authors found no differences in retention between delivery mode for students enrolled in primarily face-to-face, four-year universities, while at primarily online institutions, students taking some online and some classroom courses had slightly better odds of being retained than students taking exclusively face-to-face or exclusively online courses. Consistent with studies in Virginia, Washington, and California online course load was a predictor of lower academic outcomes. Community college students who take a higher load of online courses are also less likely to complete their courses successfully with a grade of C or higher.

Additional research indicates that the program-level students who take online courses attain degrees at higher rates than classroom-only students, despite lower course-level performance. In studies at both the state level (Johnson, Cuellar Majia, & Cook, 2015) and national level (Shea & Bidjerano, 2014) authors found that students who took at least some online courses were more likely to earn an associate's degree or transfer to a four-year institution than those who did not. Further, Shea and Bidjerano (2017), investigating the 30 community colleges of the State University of New York, did not replicate the finding that online study amplifies achievement gaps between minority and majority students. While students in online courses had slightly lower grades in four of seven semesters compared to classroom courses they had taken, achievement gaps were equivalent to what they were in classroom settings. At the national level, students with some online coursework were not more likely to dropout compared to classroom-only peers (Shea & Bidjerano, 2016).

While disagreement exists regarding specific findings, taken together these large-scale studies firmly identify community college students to be at potential significant risk of worse outcomes online than in face-to-face settings. One consistent finding is that online course load appears to have a negative impact on academic performance. For example, in both Virginia and Washington State, students who took a higher proportion of credits online were less likely to obtain a degree or transfer to a four-year institution than students who took lower proportions of online credits (Jaggars, Edgecombe, & Stacey, 2013). Furthermore, among the many institutional studies in the PAR framework (James et al., 2016), odds ratio analysis indicated that students mixing online and face-to-face courses, or taking only face-to-face courses, had up to 1.6 times greater odds of being retained than fully online students. Shea and Bidjerano (2017) found similar results among students in New York State. The odds of degree attainment were about 1.5 times higher for SUNY students with a combination of online and traditional courses compared to students with

classroom courses only. However, the odds of degree attainment were about 2 to 3 times lower for fully online students relative to students with a mix of online and classroom courses. There appears to be a point at which the taking of online courses results in diminishing returns regarding the attainment of a college degree.

We know that taking some courses online assists students toward the beneficial goal of degree attainment, however, taking all online courses results in lower levels of retention across studies in which this outcome is assessed. This study seeks to investigate the "tipping point" at which the proportion of online course enrollment leads to impaired degree completion. Specifically this paper investigates the research questions below.

Research Questions

RQ1: Given recent evidence suggesting that online coursework may limit a community college student's chances for success, is there a threshold for online course enrollment intensity that jeopardizes one's prospects for successful completion of a college degree?

RQ2: Does the intensity of online coursework modify the effect of traditional predictors of degree completion such as enrollment status, qualification for remedial education, grades, course passing rates, etc.?

RQ3: Does an institution's demonstrated overall capacity to graduate students as compared to peer institutions impact graduation rates of students who take online classes?

Method

This study uses secondary data analysis to identify predictors of variance in degree attainment among community college students who registered in online coursework at varying levels. The goal of this method is to understand the impact of online course taking patterns on the completion of college credentials net of other known correlates of degree completion applying both single and multilevel regression analysis with a large sample.

Data Sources

The analytic sample consists of community college students who first enrolled in an Associate degree program in a two-year SUNY institution in Fall 2012 (n=45,557). Distribution of major demographic characteristics is given in Table 1. The sample is predominantly Caucasians but evenly split in terms of gender. The mean age of the sample at time of first enrollment was 20 years of age (*SD*=5.26, *Range* = 16.08 – 80.17). Race/ethnicity information was missing for about 1,500 (3.36%) sample members. In order to include these cases in subsequent analyses, I used single model-based imputation as executed in *Mplus*.

Table 1

Sample Demographics (n=45,557)

Characteristic		*f*	Pct.
Gender	Male	22,987	50.46
	Female	22,570	49.54
Race/ Ethnicity	Caucasian	29,281	64.27
	African American	6,832	15.00
	Asian	1,170	2.57
	Hispanic	6,502	14.27
	Other	1,772	3.89
Residency status	In-state	44,583	97.86
	Out-of-state	595	1.31
	International	379	.83
Military affiliation		698	1.53

The research questions were addressed by means of a series of single-level and multilevel logistic analyses. The outcome was defined as attainment of a degree of any kind (certificate, associate, or bachelor) for the first time within our 13 semester time frame from Fall 2012 to Fall 2015. The main factor of interest was online load, defined as the proportion of online credits attempted of the total credits attempted by a student. All models included controls for traditional predictors of degree attainment consisting of *demographic factors* (gender, age, caucasian vs. minority), *first semester indicators* (whether the student was a Pell grant recipient, qualified for remedial coursework, and first community college institution when he/she began an associate's degree program for the first time), *last semester indicators* (number of credits completed relative to total number of credits attempted in one's last semester, last semester GPA, last program (humanities vs. other), last institution's graduation rates, and sector of last institution (CC vs. other), and *cumulative measures* (whether the student ever transferred to a four-year institution, total number of semesters being enrolled part or full-time). Controls were chosen on theoretical and empirical grounds.

Results

In our first model, we examined the effect of first campus of enrollment in a single-level regression to roughly estimate the degree of variability in degree attainment attributable to the student's first campus. The institution of first enrollment was modeled as a predictor with 30 dummy variables, one for each campus and one omitted as a reference category. Results show that first campus has a significant effect on degree attainment: the extent to which a student has a chance to attain a degree partly depends on the specific community college campus attended while enrolled for the first time. Traditional indicators of success such as gender, age, minority status, grades, successful course completion, and number of semesters of full or part-time enrollment (see Table 2 for all significant effects) were found to be viable

predictors for the odds of degree completion. Controlling for all variables of the model, a higher online course load significantly decreases one's chances for completing a college degree.

Since campus and program variation in degree completion was substantial, remaining logistic regression analyses were carried out as cross-classified models with random intercepts. In these models, student first campus of enrollment (n=30) was crossed with student last campus of enrollment (n=57) while the student last known program of study (n=2,400) was nested within student last campus of enrollment. The intercepts of first campus, last campus, and last known program were allowed to vary.

The baseline cross-classified model (Model 2) preserved the direction of the effects from the single-level analyses but produced slight changes in the magnitude of these effects.

Table 2

Results from Multilevel Logistic Analysis (n=45,557)

	Model 1		Model 2		Model 3		Model 4	
Fixed effects	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Intercept	−5.476***	.154	−6.347***	.195	−6.421***	.195	-6.352***	.196
Tr_4yr	.116	.121	.135	.160	.134	.161	.144	.161
Female	.139***	.029	.169***	.032	.158***	.033	.155***	.033
Age	−.035***	.003	−.035***	.003	−.033***	.003	-.033***	.003
Caucasian	.277***	.034	.280***	.036	.272***	.037	.271***	.037
Pell	.052	.030	.055	.032	.059	.033	.060	.033
Remedial	−.517***	.031	−.562***	.033	−.567***	.034	-.601***	.038
L_Passed	2.578***	.074	2.685***	.078	2.702***	.079	2.704***	.079
L_Pr_Hum	−.269***	.031	−.145**	.056	−.135**	.057	-.131***	.057
L_GPA	.518***	.018	.553***	.019	.551***	.020	.552***	.020
Sem	.300***	.008	.337***	.009	.328***	.009	.327***	.009
L_InstGR	−.005**	.002	−.007*	.004	−.007	.004	-.008	.004
L_InstSec	.385**	.119	1.169**	.196	1.186***	.197	1.159***	.197
ONL	-.235*	.111	-.188	.123	1.597***	.268	.046	.445
Camp_F	*Omitted*[a]							
Onl x Onl					-2.778***	.195	-2.577***	.012
Onl x LInstGR							.047***	.254
Onl x Remedial							.553*	.196
Wald Chi (df)	7388.64(41)		7124.47(13)		5364.60(14)		5377.19(16)	
LL	-15,277.13		-15,332.60		-14,941.00		-14,902.75	
Random effects (variances and standard errors)								
Campus_F	—	—	.169	.061	.170	.062	.159	.059

Campus_L	—	—	.581	.091	.584	.091	.580	.091
Last_Program	—	—	.583	.062	.585	.062	.584	.062

**Note.* [a] Coefficients for campuses (n=30) are omitted for the sake of space. Tr_4yr = transferred to a 4yr. institution; Pell = ; Pell = Pell grant recipient in Fall 2012; Remedial = qualified for remedial coursework in Fall 2012; L_Passed = percent of courses with passing grade in last semester; L_Pr_Hum = last known program is in the Humanities; L_GPA = last semester Grade Point Average; Sem = number of semesters enrolled; L_InstGR = graduation rates of last institution; L_InstSec = sector of last institution; ONL = online load; Camp_F = campus enrolled for the first time in Fall 2012.

To address RQ1, we added a polynomial effect (quadratic term) of online load. The addition resulted in an improved model fit, LR (df=1) = 57.05, p< .001, indicating that steady increases in online coursework intensity improved a student chances for degree completion up to a certain point after which a sharp decline in the odds for degree completion occur (See Figure 1). More precisely, the threshold for beneficial online load is about 40% of all courses.

In reference to RQ2, we explored 2-way and 3-way interactions between online load and the remaining control factors. Interactions were tested one at a time. Initial estimates indicated that the effect of online course load depends on the graduation rate for the last institution attended (a proxy measure of institutional effectiveness), successful completion of courses in one's last semester, total number of semesters of full or part-time enrollment, and whether the student qualified for remedial coursework. When all significant interactions were considered simultaneously in the single model with the polynomial term for load, only two of the four retained significance (see Model 4). The model with all significant interactions included was significantly better with just a polynomial term for online load, LR (df=3) = 76.52, p< .00).

The interaction between the quality of the last institution attended and the online course load (depicted in Figure 1) is noteworthy. Figure 2 shows the predicted probability of degree completion as a function of an institution's overall average graduation rates (with categories of low, medium, and high) and proportion of online course load. In institutions with relatively low overall graduation rates, a student's chance for degree completion is low irrespective of the overall number of online credits attempted. At the same time, probability of degree attainment is associated with increases in online load growing exponentially for students enrolled in more effective institutions.

Lastly, as shown in Figure 3, the interaction between remedial status in a student's first semester and the online load was marginally significant; nevertheless, it suggests significant differences in graduation rates between students who qualify for remedial education and those who do not in the lower range of online course load.

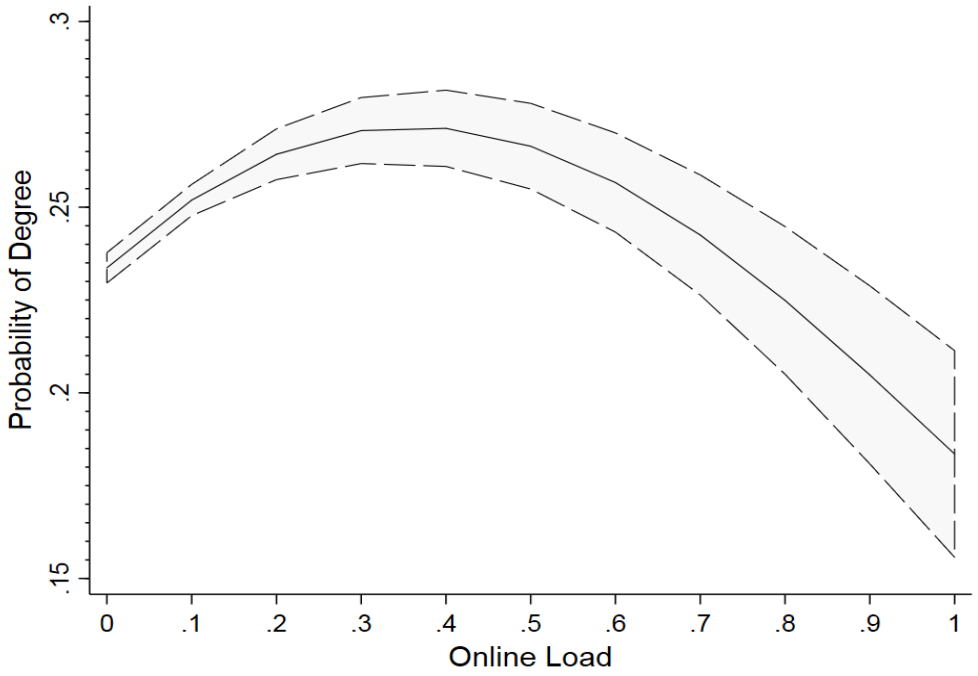

Figure 1. Effect of online course load on degree completion.

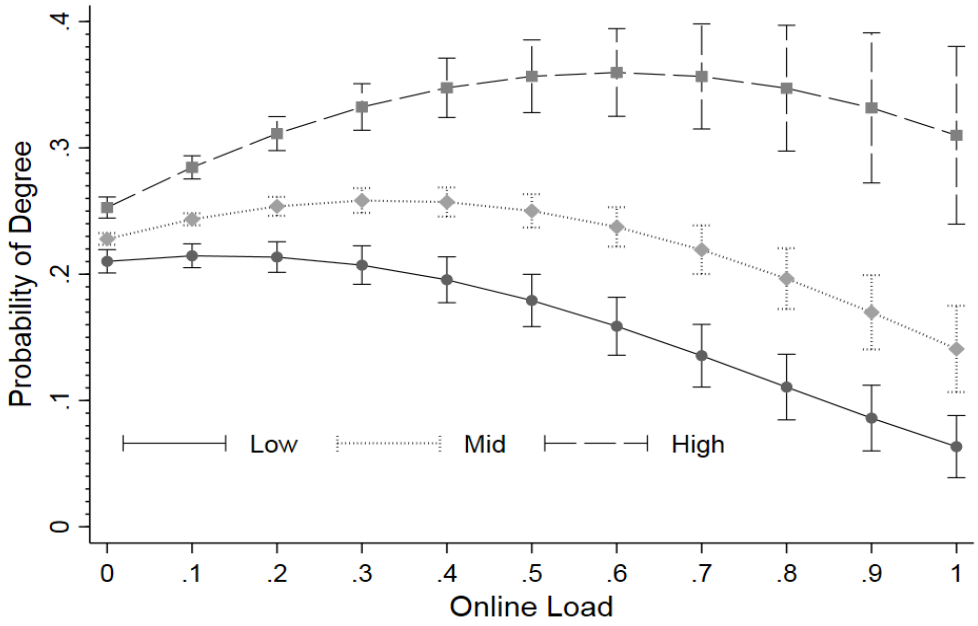

Figure 2. Interaction between online load and overall institutional graduation rates.

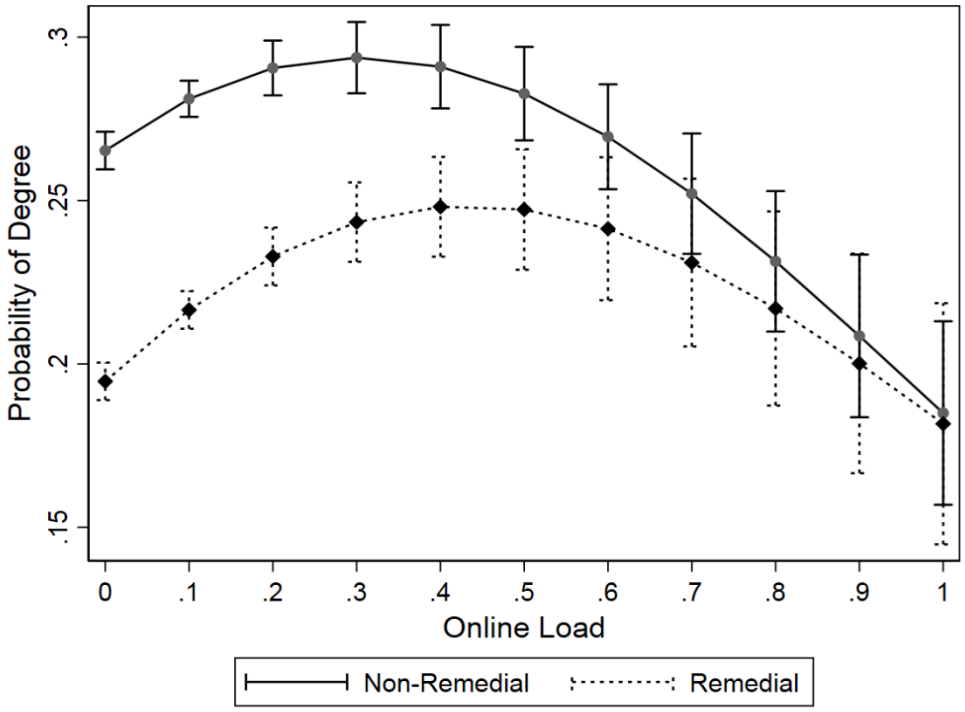

Figure 3. Interaction between remedial status in fall 2012 and online load.

Discussion

In this paper, we discussed the opportunity that online education represents in attainment of valuable college credentials. We presented a brief review of large-scale and rigorous research suggesting that community college students may struggle in online settings. We reviewed evidence that higher online course loads and exclusive online college enrollment (as opposed to a mix of online and classroom study) are predictive of reduced degree completion, while, paradoxically, a mix of online and classroom enrollment predicts higher degree completion. We sought to understand the "tipping point" for the beneficial effect of online enrollment on degree completion and whether overall institutional degree completion rates moderate the relationship between online course load and graduation. Results indicate that a load of approximately 40% of coursework is the upper limit for the beneficial effect of online enrollment on degree completion. Beyond that level, students attain college credentials at lower levels than their classroom-only counterparts. Overall, these results suggest that most community college students should be advised to enroll in face-to-face courses primarily and supplement these courses with online courses at a ratio of three face-to-face courses to two online courses for full-time students.

However, the overall graduation rate of the specific institution moderates this effect with less effective institutions representing particularly poor choices for online study as a path to college degree attainment.

Conversely, institutions with higher overall graduation rates have higher tipping points for mixing online and classroom study as a pathway to degree completion. Students who enrolled at more effective institutions with the highest graduation rates can mix up to 60% of online coursework with classroom study as opposed to the average of 40% at all institutions and only 10% at the least effective institutions.

Again, at a practical level, students enrolled in institutions that are generally more effective in graduating students may be advised to take a higher ratio of online to classroom courses – approximately three online courses and two classroom courses for full-time students. Students studying in institutions with lower graduation rates should be advised to enroll almost exclusively in classroom coursework, with perhaps one online course per term for full-time students.

Finally, while overall, students who qualify for remedial education tend to have worse graduation rates, they improve their chances for graduation through a mix of online and classroom instruction equivalent to students who do not qualify for remedial education. Non-remedial students have significantly higher rates of graduation than do remedial students until they hit a threshold of 50% online courses after which their chances of graduation equalize with remedial students as indicated by overlapping confidence intervals. These interactions are important for both remedial and non-remedial populations enrolled in online courses. Students who qualify for remedial education need not be advised away from taking online courses necessarily. Although graduating at lower rates in general, the benefits of mixing face-to-face and online coursework on degree attainment is equivalent for both remedial and non-remedial students. In general, remedial students can be advised to mix online and classroom courses on par with non-remedial students – approximately three face-to-face courses and two online courses appears to be the mix that confers benefits regarding enhanced degree attainment. All such recommendations need to be interpreted in light of the specific needs of individual students who may not always have an option for on-campus study.

Future researchers should examine the interactions between institutional ability to graduate students generally and remedial student online benefits. It is likely the case that remedial students at colleges with lower graduation rates in general may experience reduced benefits of online study in relation to degree completion. There are numerous other variables that may also mediate the online learning benefit, including the quality of course design, student support infrastructure, faculty development, and subsequent diligence of instructors in monitoring student progress. Future research should examine interactions among these variables and the mix of online course load on degree attainment.

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