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Editorial

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Welcome to the fifth and final issue of 2018. It has been a wonderfully productive and busy year for IRRODL. We have published 88 research articles along with our selection of "notes" from various areas of the field and book reviews. Keep those articles coming (while paying close attention to standards, formatting, and word length!).

When I first glance at the listed articles for publication in an issue, wearing my organizational hat, I am looking at their subject matter in order to find some coherence among topics. This choice is usually driven by numbers: for this issue, the numbers surely point to MOOCs.

King, Pegrum, and Forsey – all from Australia – consider the state of MOOCs and OER – together constituting a good portion of "visible" open in the Global South. From a literature review, they conclude that the "ongoing tendency for the research literature to pay little heed to the agency of the social actors with the most to gain from these innovations is noted," and they use this reality to call for more research into online learners in the Global South.

MOOCs are under study everywhere and in all ways. From Russia, **Sablina, Kapliy, Trusevich, and Kostikova** examined how MOOC learners perceive success. It is interesting to note that they "discovered that taking MOOCs often coincided with the time when an individual was planning to change career, education, or life tracks." In spite of not receiving formal credit for their studies, learners felt as though they had benefitted from their MOOC experiences.

van den Beemt, Buijs, and van der Aalst from the Netherlands and Germany, have also explored learning behaviours and progress in MOOCs. Using the process mining and clustering approach, they identified techniques for successful MOOC completion.

Another international team of authors – **Khalil, Prinsloo, and Slade** – considered the issue of user consent in MOOCS from micro, meso, and macro perspectives based on the examination of four MOOCs from varying contexts. They propose, in conclusion, that there is a need for greater transparency around the implications of users' consent during registration for a course.

Cisel's research on MOOCs considers interactions that take place outside of a course, illustrating a mismatch that can exist between course-prescribed and actual tasks. He found that friends and family often share MOOC activities, conceptualizing in-course activity as the tip of the iceberg.

Taking the broad view of "open," **de Langen** considered the issue of sustainability by looking at business models to analyze not-for-profit organizations in higher education. Although the four organizations he studied used different key activities and key resources (for example, management competencies, social skills, or design and teaching skills) for their continuity, community building provided to be important in all cases.

Moving away from MOOCs to the more general field of "online," **Rasmussen** considered boundaries in a different way by examining adults' experiences in choosing to study online. Using a phenomenological approach, she found that adults practiced an "expansion of the recognition of care" that extended from self-outward to community.

Coker, in her investigation into online learning, examined the lecturers' purpose, pedagogy, and philosophy and how they emerged in the dialogic patterns of the online space. Practice was shaped by the lecturers' epistemological positioning and their cultural values and beliefs. Coker's research illustrates the importance of online teachers understanding their own beliefs and how they bring those beliefs to their practice.

From Brazil, **Luz, Rolando, Salvador, and Sousa** examined a troubling aspect of online study, dropout, focusing their research on science teachers in that country. While socioeconomic data could not account for dropout patterns, a follow-up procedure revealed that a heavy workload and technological issues accounted for most of the reasons teachers left courses.

Examining another troubling area of online study, **Alessio, Malay, Maurer, Bailer, and Rubin** considered issues of quality and academic integrity in online exam-taking. Their results using a statistical model showed that, overall, the use of proctoring software resulted in lower quiz scores, shorter quiz taking times, and less variation in quiz performance across exams, implying greater compliance with academic integrity compared to quizzes that were taken without proctoring software.

Rienties, Herodotou, Olney, Schencks, and Boroowa conducted a study among 95 online teachers to explore their readiness for learning analytics and found skepticism and a need for training and support among participants. More professional development opportunities are called for.

Still in the realm of open learning, **Hood and Littlejohn's** novel study examined gender inequities noted in the process of editing Wikipedia entries - "editathons." Their research focused on the topic of the Edinburgh Seven and demonstrated the transformation of readers from being online information consumers to being active contributors (editors), prompting new critical understandings, and an evolving sense of agency.

Pimmer and Rambe's study of the roles of instant messaging applications, such as WhatsApp, they found that the realities of MIM use are socially constructed and the subject of conflictual negotiations requiring navigation among the interdependent dialectical tensions of immediacy versus delays (temporal dimension), intimacy versus detachment (relationship dimension), and task versus ludic orientation (intellectual dimension).

Chang, Shih, and Lu were also interested in the use of social networks by learners. Using the cloud-based platform CoCoing, they noted that the majority of input consisted of responses rather than concept construction, and they concluded that teacher intervention was needed to initiate concept construction. Both this study and Pimmer and Rambe's work shed useful light on the use of social media as an "outside" class tool.

Zhang's research on teaching language at a distance complements our many past publications on this topic of

global interest. In his case study based in China, he presents strategies to help language educators better assist their students to learn to navigate English literacy.

For mathematics teachers! In this Technical Note, **Ahn and Edwin** introduces a mathematical e-learning model based on social constructivism, social realism, and connectivity. Findings reveal that the platform offers a developer's tool for coding and customizing templates to attain higher levels of usage and interactivity in which learners can create and control learning objects.

So concludes our 18th year of global research publications! We are, as always, grateful for your support and readership. On behalf of IRRODL, I take this opportunity to wish you peace, health, and happiness in the New Year and a Happy Holiday, wherever you may be. Look for our first 2019 edition in just a few of months!

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MOOCs and OER in the Global South: Problems and Potential

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Abstract

This paper examines the problems and potential of Massive Open Online Courses (MOOCs) and Open Education Resources (OER) in the global South. Employing a systematic review of the research into the use of open online learning technologies in Southern contexts, we identify five interrelated themes emerging from the literature: 1) access to the Internet; 2) participant literacies; 3) online pedagogies; 4) the context of content; and 5) the flow of knowledge between North and South. The significance of Southern voice and participation is addressed in the final section, which concludes that on balance, the literature offers a qualified endorsement of the potential and actualities of MOOCs and OER in the global South. The ongoing tendency for the research literature to pay little heed to the agency of the social actors with the most to gain from these innovations is noted, opening up space for further research into the lived experience of online learners in the global South.

Keywords: online learning, MOOCs, OER, global South, international education

Introduction

The post-2015 global educational development agenda, outlined in the United Nations Sustainable Development Goal (SDG) 4, is to "[e]nsure inclusive and quality education for all and promote lifelong learning" (United Nations General Assembly, 2015, para. 4). A 2014 UNESCO report on the Education For All (EFA) goals states that "[f]lexible lifelong and life-wide learning opportunities should be provided through formal, non-formal and informal pathways, including by harnessing the potential of ICTs [Information and Communication Technologies] to create a new culture of learning" (UNESCO, 2014, p.4). Questions arise as to whether a "culture of learning" can be fostered in the global South using Massive Open Online Courses (MOOCs) and Open Education Resources (OER). In seeking to articulate the actual and possible opportunities MOOCs and OER can provide in Southern contexts, we pose two research questions:

- What are the key problems restricting the uses of MOOCs and OER for learners in the global South?
- What potential exists for MOOCs and OER to provide educational opportunities for these learners?

MOOCs, OER, and the Global South

MOOCs exploded into public consciousness in 2012 (Billsberry, 2013) and have come to dominate much of the recent discourse on online learning. Industry leaders such as Koller (2012) and Agarwal (2014) have highlighted the potential for learners in the global South to benefit from MOOCs offered by prestigious universities in the North, but critics have dismissed these claims as being variously exaggerated (Daniel, 2012), impractical (Liyanagunawardena, Williams, & Adams, 2013), absurd (Sharma, 2013), and neocolonial (Altbach, 2014). MOOCs have quickly evolved into a number of forms with various taxonomies proposed. For example, connectivist MOOCs (cMOOCs) are open-access and use Web 2.0 technologies, such as blogs and wikis, to share user-generated content, producing open-ended outcomes for the participants (McAuley, Stewart, Siemens, & Cormier, 2010). Platforms such as P2PU and Canvas Network exhibit cMOOC principles, creating open learning communities. Extended MOOCs (xMOOCs), made famous by Coursera and EdX, typically contain short videos, automated quizzes, peer-marked assessments, and online discussion forums. Their platforms allow course providers to use learning analytics to track participants' online activities, with potential benefit for both course producers and consumers, but with problematic ethical implications (boyd & Crawford, 2012).

OER are defined as "digitised materials offered freely and openly for educators, students and self-learners to use and re-use for teaching, learning and research" (Hylén & Schuller, 2007, p. 3). Examples of OER producers include the Khan Academy and OpenCourseWare (OCW) from the Massachusetts Institute of Technology (MIT), offering open online access to course content. Some authors include MOOCs under the OER umbrella (Rhoads, Berdan, & Toven-Lindsey, 2013); others believe MOOCs to be a progressive step in the evolution of OER (Boga & McGreal, 2014).

The global South is a term encompassing older designations such as "Third World" and "developing countries." Drawing on the work of social theorists such as Raewyn Connell, the global South refers to

"regions outside Europe and North America that are mostly (though not all) low-income and often politically or culturally marginalized" (Dados & Connell, 2012, p.12). In this review, the global South includes the countries of Latin America, Africa, Asia, and Oceania, but excludes Australia and New Zealand.

Methodology

Academic research on MOOCs and OER in Southern contexts was sourced by conducting searches of Scopus, Web of Science, the Education Resources Information Centre (ERIC), and Google Scholar databases in February 2017, using the terms "MOOCs" OR "OERs" AND ("global South" OR "developing countries" OR "developing world" OR "LDCs" [a term often used by the UN denoting Least Developed Countries] OR "low and middle income countries" OR "third world" [a term with limited contemporary currency]). Scopus returned 34 citations, Web of Science 15, and ERIC 18. Google Scholar returned over 8000 citations, reflecting the breadth of its search range; the first 120 citations were included before the results had minimal relevance.

Of this total of 187 citations, 38 were excluded as duplications, 36 were excluded due to their non-academic or "gray" nature, including blogs and blog posts, unreferenced newsletter posts, abstracts, speech transcripts, slides, and letters to journal editors. A further 17 citations were excluded for their limited relevance to the review topic, leaving 96 citations as the basis of this review.

The sources were coded according to the problems and potential for MOOCs and OER in Southern contexts, resulting in the emergence of five major themes:

1. Access to the Internet,
2. Participant literacies,
3. Online pedagogies,
4. The context of content, and
5. The flow of knowledge between North and South.

These themes frame the results of the review below.

Results

Access to the Internet

An obvious barrier to open online learning is the ability of learners in the global South to access the Internet, particularly due to infrastructure limitations (Chadaj, Allison, & Baxter, 2014; Christensen & Alcorn, 2014; Godwin-Jones, 2014; Literat, 2015; Patru & Ventakatamaran, 2016; Wang & Jong, 2016; Wilson & Gruzd, 2014). Examples of Internet access issues inhibiting MOOC and OER uptake are cited

in Bangladesh and Sri Lanka (Hatakka, 2009); Cuba, Guatemala, and Peru (Garrote, Pettersson, & Christie, 2011); Egypt (Aboshady et al., 2015); India (Chatterjee & Nath 2014a; Perryman & Seal 2016); Liberia (Madaio, Grinter, & Zegura, 2016); Mexico and Thailand (Yáñez, Nigmonova, & Panichpathom, 2014); Nigeria (Omonhinmin, Olopade, Afolabi, & Atayero, 2015); Rwanda (Nkuyubwatsi, 2013); and Tanzania (Mtebe & Raisamo, 2014).

Learners in rural areas are often underrepresented in MOOC participation figures in Southern countries (Alcorn, Christensen, & Kapur, 2015; Christensen et al., 2013; Quinn & Robinson, 2015) and access can be restricted by factors such as intermittent power supply and limited transport to locations with computers (Liyanagunawardena et al., 2013). The same authors also report a clear gender divide, with women often facing structural, gendered, "offline" barriers to access (Perryman & de Los Arcos, 2016). People living with disabilities in the global South also face considerable accessibility barriers (Altimay et al., 2016). Arslan, Bagchi, and Ryu (2015) find a positive correlation between regional bandwidth strength and MOOC certification numbers.

Another key access barrier is the large amount of data required to download learning content (Daniel, Cano, & Cervera, 2015; Larson & Murray, 2008; Nkuyubwatsi, 2013). Most MOOC and OER sites require a bandwidth far higher than that available to many Southern learners, and the gap is growing (Escher, Noukakis, & Aebischer, 2014; Haßler & Jackson, 2009). Southern learners may also have difficulty using online collaborative tools within courses (Warusavitarana, Dona, Piyathilake, Epitawela, & Edirisinghe, 2014).

Local learning hubs (Escher et al., 2014; Godwin-Jones, 2014) or acess hubs (Oyo & Kalema, 2014) provide physical spaces with Internet-connected computers for learners to access online resources. Other ways of improving access include the use of low-resolution video content (Liyanagunawardena et al., 2013), audio files and transcripts (Haßler & Jackson, 2009; Richter & McPherson, 2012), promoting off-peak bandwidth usage (Daniel & West, 2006), leveraging cloud-based technology (Jobe, 2013; Nabil, 2013), and making resources downloadable for use offline (Daniel et al., 2015) via Universal Serial Bus devices (USBs; Garrote et al., 2011).

For many in the global South, the growth of mobile ICTs for learning (mobile learning, or m-learning) can significantly increase access (Castillo, Lee, Zahra, & Wagner, 2015; Godwin-Jones, 2014; Ibáñez & Traxler, 2016; Wildavsky, 2014; Yáñez et al., 2014). Examples include:

- The New Economy Skills for Africa Program-ICT (NESAP-ICT) in Tanzania, which uses m-learning in combination with MOOC content to teach IT skills (Boga & McGreal, 2014); and

- The SocialEDU program in Rwanda, which uses a MOOC platform with mobile-compatible content (Wildavsky, 2015), with integrated social media allowing easier access to MOOC discussions (Patru & Ventakatamaran, 2016).

Analysis of the backgrounds of Coursera MOOC participants (Christensen et al., 2013) reveals that 14.8% are from Brazil, Russia, India, China, or South Africa (BRICS) and 19.9% from other developing countries. MOOC completers are already university-educated, revealing a widening educational divide between the global North and South, and also within Southern countries (Yáñez et al., 2014). More recent research reveals higher completion rates among participants from Southern countries (Garrido et al., 2016), although this is disputed (Kizilcec, Saltarelli, Reich, & Cohen, 2017). Reach does not always

equal accessibility (Nti, 2015), and many learners in the global South still struggle to utilise the necessary ICTs via a regular, stable Internet connection.

Participant Literacies

Learners need a range of literacies to benefit from MOOCs and OER, particularly in countries with an underdeveloped education system (Liyanagunawardena et al., 2013; Wilson & Gruzd, 2014). Resources in English can help learners looking to improve their English language proficiency (Ally & Samaka, 2013). Conversely, English-only content marginalises speakers of other languages (Oates, 2009; Sapargarliyev, 2015) and Southern learners may have difficulty understanding different accents and dialects, as well as technical and academic vocabulary (Nti, 2015).

A language audit of MOOCs created between 2012 and 2015 estimated that 75% of MOOCs are produced in English; however, there is evidence of growing diversity (Stratton & Grace, 2016). MOOCs are now presented in Arabic (Adham & Lundqvist, 2015; Castillo et al., 2015), Chinese (Godwin-Jones, 2014; Liyanagunawardena & Williams, 2014), and Spanish throughout Latin America (Valentin, 2015), in addition to courses in less common local languages (Varghese, 2016). Crowd-sourced translation, such as Coursera's Global Translator Community (GTC), has broadened MOOCs' international reach (Daniel et al., 2015; Godwin-Jones, 2014), and OER repositories such as Temoa provide a range of resources in multiple languages (Gómez-Zermeño & Alemán Lorena de la Garza, 2015).

Many Southern leaners need basic computer literacies to use a keyboard, screen, and mouse (Daniel et al., 2015), particularly those living with disabilities (Altimay et al., 2016), and participants need skills to use the online tools required (Chen, 2013; Liyanagunawardena et al., 2013; Warusavitarana et al., 2014). Mobile ICTs have the advantage of being familiar to many users, without learners needing to understand the workings of a desktop computer (Boga & McGreal, 2014), but resources such as cMOOCs require participants to interact across different digital spaces (Literat, 2015 p. 1170) while managing large amounts of information (Liyanagunawardena & Williams, 2015). Preparatory MOOCs (Liyanagunawardena et al., 2013) or face-to-face workshops for OER users (Hu, Li, Li, & Huang, 2015) could aid literacy development.

Online Pedagogies

The pedagogical foundations of MOOCs and OER are central to their success in providing quality learning opportunities. Many MOOC formats may simply repackage old, didactic pedagogies (Chadaj et al., 2015; Onah, Sinclair, Boyatt & Foss, 2014), and "freemium" xMOOC models, where basic content is free but premium features cost extra, can result in sub-optimal experiences for Southern learners (Kalman, 2014). Observers have noted a shift from teacher- to learner-centred pedagogy in OER (Kanwar, Kodhandaraman, & Umar, 2010), while some suggest that MOOCs need to encourage more problem-based (Ally & Samaka, 2013; Maitland & Obeysekare, 2015) and project-based learning (Nkuyubwatsi, 2014).These approaches can, however, sometimes be met with resistance (Liyanagunawardena & Williams, 2015), and participants may not trust new, unfamiliar online learning platforms (Garrido et al., 2016) or may be wary of commenting on course forums (Kizilcec et al., 2017; Onah et al., 2014).

The use of blended learning models, combining online resources with face-to-face interaction, is one means of maximising the educational potential of MOOCs (Cutrell et al., 2015; dela Pena Bandalaria & Javier Alonso, 2015; Madaio et al., 2016; Wildavsky, 2015) and OER (Larson & Murray, 2008; Mtebe &

Raisamo, 2014) in the global South. Nkuyubwatsi (2014) identifies benefits in local collaborative study groups, and the "meetup" function on some MOOC platforms encourages learner interaction offline (Bulger, Bright, & Cobo, 2015). "MOOC camps" run by the U.S. State Department help learner groups to access courses while being mentored by English-speaking embassy staff (Godwin-Jones, 2014; Maitland & Obeysekare, 2015; Wildavsky, 2014), similar to the MOOC+ model of peer-supported learning (Adams, Liyanagunawardena, Rassool, & Williams, 2013).

Issues of certification and accreditation are closely linked to the pedagogy of open online content (Yáñez et al., 2014). A comparative study found that Kenyan students valued a MOOC credential more highly than their Swedish peers (Jobe, 2014), while participants in Colombia, the Philippines, and South Africa see MOOCs as a path to professional certification (Garrido et al., 2016). Without accreditation, Southern learners will be unable to convert MOOC learning into improved employment prospects (Daniel, 2012, as cited in Castillo et al., 2015).

Some argue that the MOOC model needs to be re-engineered if it is to provide a cost-effective means of educating a large and growing Southern learner cohort (Patru & Ventakatamaran, 2016; Wildavsky, 2015). Examples of OER embedded within MOOC architecture includes:

- Open source, mobile ICT-compatible MOOC platforms using OER content to provide greater opportunities for Southern learners (Boga & McGreal, 2014);
- The Creative Higher Education with Learning Object (partially abbreviated to CHiLO) in a mobile open learning environment designed for limited bandwidth access (Hori et al., 2015); and
- A proposed Mobile Assisted Language Learning (MALL)- MOOC for Continuing Professional Development (CPD) for language teachers (Ibáñez & Traxler, 2016).

OER can be reused within different contexts (Liyanagunawardena et al., 2013), which has cost benefits for Southern resource producers (Mulligan, 2016); however, the initial expense of OER production can lead Southern countries to become net consumers of such resources (Leeds, 2013).

MOOCs and OER in Southern contexts have been designed or are proposed in agriculture (Hassen, 2013), computer science (Boga & McGreal, 2014), disaster management (William, Elzie, Sebuwufu, Kiguli, & Bazeyo, 2013), financial literacy (Siddike & Kohda, 2016), healthcare (de Ruijter, Ferreira, & Parsons, 2008; Liyanagunawardena & Aboshady, 2017), library and information systems (LIS; Pujar & Bansode, 2014; Pujar & Tadasad, 2016), medicine (Aboshady et al., 2015; Liyanagunawardena & Williams, 2014), and teacher training (Fyle, 2013). More research is needed into what pedagogical approaches work best across different disciplines in Southern contexts.

Context of Content

Contextualizing MOOC and OER content to local conditions is another important issue addressed in the literature. Local consultation is important when designing OER (Kanwar et al., 2010) and the use of generic resources can lead to higher participant dropout rates (Richter & McPherson, 2012). Critics argue that MOOCs are designed for consumption, not for adaptation (Czerniewicz, Deacon, Small, & Walji, 2014), and more consideration of local conditions and needs would benefit Southern learners (Castillo et al., 2015; Daniel et al., 2015; Nkuyubwatsi, 2014).

Cultural differences among learners should be an important consideration for MOOC producers (Chen, 2013; Liyanagunawardena et al., 2013), and critics claim much existing content is inappropriate outside the global North (Wildavsky, 2014, 2015). A study of cultural translation in five Coursera MOOCs found that course content could be contextualized in two of the five courses, and discussion forums in all of the courses provided opportunities for learners to relate content to a personal context (Nkuyubwatsi, 2014), a central element of good course design (Liyanagunawardena & Williams, 2015).

Richter and McPherson (2012) present an OER adaptation model, and resources have been successfully remixed in the Teacher Education in Sub-Saharan Africa (TESSA) programme (Connolly, Wilson, & Wolfenden, 2007), and in a South African university (Mallinson & Krull, 2015). A MOOC on the Ebola virus produced by MOOC platform Alison to raise awareness in affected countries (Liyanagunawardena & Williams, 2015) demonstrates that these courses can target regional problems.

The Flow of Knowledge From North to South

The final theme to emerge from the literature concerns the North-South imbalances of knowledge flows in MOOCs and OER. Critics argue that the predominantly Northern origin of MOOCs represents academic nationalism, limiting the development of local academic culture (Altbach, 2014), or neo-colonial paternalism (Godwin-Jones, 2014), which consolidates Northern hegemony (Czerniewicz et al., 2014), and threatens to create massive open educational homogeneity (Dumitrescu, 2015).

As key sites of learning and knowledge production, Southern higher education institutions (HEIs) need to lead the adaptation of existing MOOCs as well as the creation of new courses (Czerniewicz et al., 2014). Cox and Trotter (2016) discuss the challenges to OER adoption in South African universities, and highlight the importance of institutional culture in promoting or restricting OER production by academic staff. Barriers to MOOC and OER reuse in HEIs include copyright restrictions (Ncube, 2011) and lack of open access to scholarly publications (Anderson, 2013). Inter-university cooperation fosters Open Educational Practices (OEPs), which includes sharing OER and MOOC content (Patru & Ventakatamaran, 2016). North-South knowledge partnerships have been developed between Malaysia and Australia (Valentin, 2015), and are proposed in Papua New Guinea (Woruba & Abedin, 2015) and throughout Africa (Escher et al., 2014).

There are promising signs in the growth of OER production by some Southern countries (Ventakatamaran & Kanwar, 2015). The Virtual University of Small States of the Commonwealth (VUSSC) produces OER and supports other Southern universities to do the same (Daniel, Kanwar, & Uvalić-Trumbić, 2009). The University of the South Pacific's MOOC on climate change (Patru & Ventakatamaran, 2016) and the University of the Philippines Open University (UPOU) MOOCs (dela Pena Bandalaria & Javier Alonso, 2015) demonstrate the potential for course production in Southern countries.

There has been some caution around the wholesale adoption of OER within African HEIs due to further concerns of Northern academic elitism (Rambe & Moete, 2016) and issues of access, required literacies and cultural barriers (Woldegiyorgis & Carvalho, 2015). A survey of Chinese university students found almost 80% had accessed some form of OER over the course of their studies (Hu et al., 2015), although production is limited to a small number of institutions (Xu, Zhang, & Zheng, 2014). Projects incorporating locally produced or reused MOOCs and OER into university courses have been successfully instituted in India (Chatterjee & Nath, 2014a, 2014b; Kamat, Keleher, Patil, & Pujar, 2013;

Nath & Karmakar, 2014; Perryman, Buckler, & Seal, 2014) and Pakistan (Abidi, Pasha, Moran, & Ali, 2016; Pasha, Abidi, & Ali, 2016). A Nigerian university has invested in online learning platforms using OCW from MIT (Omonhinmin et al., 2015), and a Value Focused Thinking model has been proposed for Caribbean HEIs to guide strategic MOOC adoption (Barclay & Logan, 2013).

Discussion

Despite the numerous interacting structural barriers to MOOC and OER uptake detailed above, there is evidence to suggest that participation in open online learning in the global South is possible. MOOCs have demonstrated their potential to work at scale in Southern contexts (Laurillard & Kennedy, 2017) and both MOOCs and OER are helping countries progress toward SDG 4 (McGreal, 2017). The fact that some MOOCs and OER have been successfully tested in South Asia, sub-Saharan Africa, and China, suggests that qualified endorsement is warranted. However, the literature also reveals problems previously identified in the discourse of participation in development.

> One of the recurring themes within the participation literature is the use of the term 'top-down' both to criticise development initiatives and to explain their failure. It occurs time and again, in different epochs, reinforcing key ideals on which participation advocates depend. (Cornwall, 2006, p. 71)

We raise Cornwall's ideas about participation, based upon interrogation of development policy discourse regarding measures aimed at improving the lives of "the poor" over much of the 20th century, to highlight two notable and closely related problems in the literature reviewed here. The first is the unreflexive focus on MOOCs and OER as either an obvious "public good" or as yet another ill thought-through imposition upon peoples of the global South. This focus at best misses its targets, or at worst contributes to the ongoing reproduction of existing inequalities on global, regional, and national scales.

The second problem flows directly from the functionalist/criticalist dichotomy just highlighted in that the literature reflects an almost exclusive focus on the top-down, structural elements of MOOCs and OER. Given that the interwoven relationship between social structures and human agency is well-established as a sociological orthodoxy (Sayer, 1990), this sort of structural myopia is surprising. A number of authors argue that insufficient attention is paid to the desires, aspirations, and practices of those from the global South who are potential and/or actual participants in these online learning opportunities (Daniel et al., 2015; Garrido et al., 2016; Nti, 2015; Rhoads et al., 2013).

Cornwall's (2006) focus on the history of the idea of participation as continuing an unfulfilled trope of development policymakers serves to highlight, in her words, "the contingency of the normative ideals on which discourses of participation depend, which even the most trenchant of critics have left untouched" (p.79). In turn, this analysis serves to focus our attention on the ways in which development discourse all too often construes new developments as interventions imposed upon a lumpen mass of people at the end of a development pipeline. Even if construed as being ready to adopt the technologies of change, the potential and/or actual participants and consumers of MOOCs and OER are rarely brought into the picture. Exceptions include autoethnographic studies of MOOC participation (Liyanagunawardena, 2013; Nkuyubwatsi, 2013; Warusavitarana et al., 2014), and a study of archetypal Southern "learner personas" (Liyanagunawardena & Williams, 2015), but a focus on the structural

barriers to open online learning dominates the literature, to the exclusion of explorations of Southern learners as social agents.

What becomes clear from a systematic review of the literature is that more research is needed into the lived experiences of MOOC and OER users and potential users in the global South. This would help create insights into how they access and negotiate online learning environments within various structural constraints. Further, while the attempts of Northern countries to assist the South in improving education are laudable, more needs to be done to support Southern educators to create their own online resources in appropriate languages.

Conclusion

The key themes emerging from the research – access to the Internet, participant literacies, online pedagogies, the context of content, and the flow of knowledge between North and South – represent major barriers to MOOC and OER uptake in the global South. Despite the structural impediments, these forms of online learning have potential to meet at least some of the growing demand for education in the 21st century. Prominent among developments assisting the spread of open online learning are the rapid increase in mobile ICT use worldwide, opportunities for blended learning, and MOOC models which incorporate OER content.

What is less well-known is how individual Southern learners negotiate these barriers to learning online, and the literature is poorer for it. At present, much of the research reproduces 20th century top-down development thinking in the global North. The existing dominant mode of MOOC and OER production therefore needs rethinking, and Southern voices, those of both learners and educators, need to be heard. With further research into Southern learner and educator experiences, MOOCs and OER could create more learning opportunities which harness the educational potential of ICTs and the Internet.

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How MOOC-Takers Estimate Learning Success: Retrospective Reflection of Perceived Benefits

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Abstract

Massive open online courses (MOOCs) have attracted a great deal of interest in recent years as a new learning technology. Since MOOCs inception, only limited research has been carried out to address how learners perceive success in MOOCs after course completion. The aim of this study was to investigate the perceived benefits as the measurement of learning success. Narrative interviews were conducted with 30 Russian-speaking learners who completed at least one MOOC in full. By employing text analysis of interview transcripts, we revealed the authentic voices of participants and gained deeper understanding of learners' perceived benefits based on retrospective reflection. The findings of the study indicate that after finishing MOOCs, learners have received tangible and intangible benefits that in general justified their expectations. University-affiliated students, as well as working professionals, recognized the complementarity of MOOCs, but their assessments were limited to educational tracks. We discovered that taking MOOCs often coincided with the time when an individual was planning to change career, education, or life tracks. The results of the study and their implications are further discussed, together with practical suggestions for MOOC providers.

Keywords: online learning, massive open online courses, MOOCs, success, perceived benefits, qualitative research, narrative inquiry

Introduction

The educational landscape in the early 21st century is constantly changing due to global challenges. Competence building in education should prepare graduates for new digital economies and jobs that are emerging but not yet fully developed. For over 20 years, e-learning has been part of the process of redefining the purpose of education and addressing the needs of the digital generation. Massive open online courses (MOOCs) present a rapidly growing and potentially disruptive innovation in the field of online learning, as they are empowered with modern technology capabilities and the potential to impact the lives of millions (Karnouskos, 2017).

As MOOCs serve as a rich source of quantifiable information, most studies have concentrated on learning behavior, and other activities that can be explained with numbers (Littlejohn, Hood, Milligan, & Mustain, 2016; Rai & Chunrao, 2016). While enormously valuable for our understanding of the impact of the new technology, these numbers tell us only half of the story, as they provide little insight into learners' perceptions and do not necessarily explain what happens in learners' minds before, during, or after the completion of a MOOC. There are also no longitudinal studies investigating MOOCs' impact on graduates' skills and their potential for up-skilling (Calonge & Shah, 2016). This study aims to investigate through retrospective reflection how MOOC-completers themselves measure learning success, and what they see as benefits from completing a MOOC. It adds to existing research by focusing on unique experiences of individual learners who now have a chance to have their voices heard.

MOOCs are gaining popularity in Russia and post-Soviet countries, and the number of MOOCs offered through various platforms by Russian universities is growing (Kulik & Kidimova, 2017). However, their impact on Russian-speaking learners has not been sufficiently explored. Even though the findings might be more relevant within the former-soviet context, the use of qualitative approach is well needed to understand the perceived learner success.

Exploring Relationship Between Individual and Society in Post-Modern World

This research uses post-modernity theories to examine people's perceptions of personal success and benefits from completing a MOOC. The relationship between the individual and society becomes more complex in the postmodern world, which is characterized by the increasing uncertainty and experiencing forces and trends beyond the individual's control (Bauman, 2001). Societal institutes can no longer guarantee financial and professional security (Beck, 1992), and personal success is now linked to an individual's ability to discard irrational or ineffective life strategies and develop new ones.

In post-modern society, the role of educational institutions as the main source of acquiring knowledge is declining, and the initiative in learning is shifting to the individual. Learning becomes especially valuable as it forms the ability to adapt to the changing social reality and helps connect fragmentary elements of knowledge and experience into meaningful patterns (Bauman, 2001). Educational institutions are slow to respond to the needs of the post-modern society (Chandler, 2013), as they largely remain teacher-centered, distributing knowledge only in one direction on the conditions defined by educational institutions themselves. At the same time, distance learning formats, such as online courses and self-study materials, are more learner-centered and can flexibly adapt to the

changing needs of the society, thus making it an attractive option for self-development and becoming the central element of irreplaceable life-long "equipment" (Bauman, 2001). Universities are still invaluable in producing formalized proofs of education, as they continue to serve as an entry ticket into the labor market, but graduation certificates, diplomas, or certificates of any level are no longer sufficient to receive or maintain a job (Beck, 1992).

MOOCs in the Context of Post-Soviet Countries

The traditional model of higher education that is still widely used in post-Soviet countries involves students declaring their major as they enter the university, with most of the coursework determined by the department or program. Combined with the tendency to place the most emphasis on theoretical training, this lack of curriculum flexibility results in post-Soviet universities falling behind in equipping their graduates with the practical skills that are in demand on the constantly changing labor market. This skills gap phenomenon is not restricted to the post-Soviet space: a number of studies have revealed the discontinuity between the skills of recent graduates and the needs of the employers (Calonge & Shah, 2016). In these conditions, MOOCs present a viable alternative, as they have proved their significance for the development of professional competencies, including digital and management skills (Radford et al., 2014; Calonge & Shah, 2016).

At the same time, most employers in post-Soviet countries have limited knowledge of MOOC platforms and the specifics of MOOCs, as they have been a relatively recent development in the field of online education (Kulik & Kidimova, 2017). Employers still rely heavily on traditional diplomas and certificates to evaluate job candidates and give promotions. This local tendency is confirmed by the review of the current trends in the world labor market, which shows that employers worldwide are reluctant to consider certificates received through MOOCs, as they are either not familiar with the concept or unable to assess the quality of these courses (Radford et al., 2014; Thompson, 2016). Considering the gap between MOOC providers' orientation towards attracting potential learners with the prospects of receiving a certificate and current demand for such certificates in the labor market, questions need to be asked regarding associating learning success in MOOCs with tangible benefits alone.

Measuring Learning Success in MOOCs

As MOOCs are a relatively new technology, limited research has been carried out on some of their aspects, such as learning success and perceived benefits (Alraimi, Zo, & Ciganek, 2015; Karnouskos, 2017). Most studies employed primarily quantitative or mixed methods, such as analysis of course statistics, student survey data, and learning analytics. Learning success is traditionally measured by the total number of registered users; their engagement and intention to continue using MOOCs; the percentage of content viewed; the dropout, progression, retention, and completion rates; the scores on assignments; the number of certificates of achievement; or percentage of students who received a certificate of completion (Breslow et al., 2013; Littlejohn et al., 2016; Rai & Chunrao, 2016). According to MOOC providers, learning success may be measured by receiving a score and a certificate for completing a course.

This approach to success assessment of MOOCs resulted in very low reported success rates. Statistics of online platforms and research findings have revealed that MOOC completion rates hover between 5% and 12% and dropout rates have been recorded as high as 90% (Stich & Reeves, 2017). Considering the reported low completion rates for MOOCs (Hew & Cheung, 2014; Jordan, 2014; Watted & Barak,

2018), measuring success with conventional methods can be problematic (Stich & Reeves, 2017). However, there are other potential benefits from MOOCs that could be considered "intangible" (Zhenghao et al., 2015). First, open and accessible character of MOOCs allows individuals to follow their own personal learning paths, using strategies of their choice, which are adapted to their abilities (Milligan & Littlejohn, 2014). Secondly, MOOCs allow learners to become part of an international community with unique identity and dynamics that is strongly oriented towards self-development (Waard et al., 2011). Thirdly, taking a MOOC can positively affect an individual's self-efficacy: people start feeling more confident about their abilities and feel better positioned to make important life, education, and career decisions (Longstaff, 2017).

The potential diversity of learners, each with different prior experience, educational backgrounds and skill levels, and varied expectations and motivations for taking the MOOC (Kizilcec, Piech, & Schneider, 2013; Hood, Littlejohn, & Milligan, 2015), is followed by redefining the meaning of success which may not be focused on completion (Breslow et al., 2013). Instead, learning success for an individual learner may be viewed as a unique combination of tangible and intangible benefits that makes completing a MOOC worthwhile. It seems "legitimate to take the intention of an individual MOOC-taker as a starting point for measuring and interpreting success" (Henderikx, Kreijns, & Kalz, 2017, p. 354). Due to the fact that learner's perspective is not researched enough (Bozkurt, Akgün-Özbek, & Zawacki-Richter, 2017), qualitative studies could enrich the findings of previous explorations by providing insight into the individual stories of MOOC-takers.

Several studies were conducted using a short-term snapshot of MOOC-takers' perceptions (Hone & El Said, 2016; Azevedo & Marques, 2017). As Yang, Shao, Liu, and Liu (2017) note, more research is needed to understand the perceptions of learners as some time passes after they finish a MOOC. We know very little about how learning success is perceived by those individuals who can retrospectively look at how completing a MOOC affected their lives and evaluate what they consider as their life and career "gains." In this study, retrospective reflection on perceived benefits is associated with the learner' satisfaction with the impact of MOOCs on their career, education, and life. Hence, we focused on the following research questions:

1. How do the learners describe the impact of e-learning on their professional, educational, and life tracks after completing MOOCs?

2. What perceived benefits of e-learning emerge based on learners' retrospective reflections?

Research Methodology

Recruiting Participants

Research participants were recruited using convenience sampling among Russian-speaking MOOC-takers through announcements on discussion forums in the social network "VK.com" (https://vk.com/courserarussia, https://vk.com/coursera, https://vk.com/perevedemcoursera). Furthermore, personal messages were sent to participants of discussions with a high level of activity and to posts commentators on the main page of the online community. Thirty people replied and were willing to participate in an interview. All of them have completed one or more MOOC since 2012 on one of the platforms, such as Coursera, edX, Udacity, FutureLearn, Open Education, Lektorium, Stepik, etc. Successful completion of at least one MOOC, with or without a certificate and fluency in Russian, were the main selection criteria for participation in the study. At the time of survey, the informants lived in

different cities in Russia (Moscow, Saint Petersburg, Novosibirsk, Volgograd, Samara, Magnitogorsk, Stavropol, and Kaliningrad) as well as in Ukraine, Kazakhstan, Moldova, Germany, and Vietnam. First interviews were conducted face-to-face in Novosibirsk due to the location of interviewers and participants. Then, Russian-speaking MOOC-takers were recruited from other locations in Russia and abroad.

Most interviews were conducted via Skype with all ethical procedures overseen by the first author, who also managed the project. Data was collected between the end of 2016 and the beginning of 2017 resulting in 17 male and 13 female participants between the ages of 18 to 44-years-old. Among the Russian-speaking MOOC-takers were specialists in the area of information technologies, managers, engineers, teachers who use MOOCs to develop their own courses, and university students. Undoubtedly, based on the research of the international audience of online courses (Kizilcec et al., 2013), the interviewees did not represent all types of audiences.

Data Collection

Narrative interview was used as a data collection instrument in this study since "a person lives his or her life as a story to be told" (Bauman, 2001). This technique allows the researcher to focus on the stories narrated by the individuals who have experienced events and reproduced them (Schwandt, 2001, p. 171).

In order to establish contact and "warm up" the relationship, at the beginning of the conversation the interviewers shared their own story of acquaintance with online courses and encouraged interviewees to do the same. The interviewer's narrative helped to stimulate the informant's narrative, increasing the likelihood of receiving a frank answer in exchange for a true and sincere story of the interviewers. In addition, it served as a model narrative, which retrospectively – introduced some "inner logic" in the "narrated lives" (Bauman, 2001). To avoid a potential bias, the interviewers were sharing the stories of failing to complete a MOOC, which was the opposite of what was requested from the participants, and therefore their narratives could not have influenced the participants' answers to any significant extent. In addition, the technique was not used in the cases when MOOC-takers began to give details about their life and online learning experience without any stimulation.

The main part of the interview contained the informants' narrative about life as a sequence of events from the moment they first heard about MOOCs to the present time. During the conversations, the interviewers asked some follow-up questions to elicit commentary on the perceived benefits. These questions helped obtain explanation of the meaning intended by particular comments of informants.

Data Analysis

The interviews were recorded and transcribed verbatim to preserve the validity of the data. The names of the participants were removed to protect anonymity and a number was assigned to each interview (e.g., P1 stands for "Participant 1").

The transcribed interviews were analysed using thematic analysis, in accordance with the guidelines of Braun and Clarke (2006). The first stage of the analysis identified particular situations, events, and sequences of events within each interview that were meaningful to the informant. This allowed us to see how learners evaluated the impact of completing a MOOC at different stages of their life. The set of initial codes was determined. Then we looked for consistent and repeated patterns of meaning searching across interviews. As a result, potential themes were identified, verified, and cross-

referenced with quotations from the interviews (Braun & Clarke, 2006). This multi-staged analysis allowed us to explore MOOC-takers' explanations of perceived benefits as they retrospectively reflected on their completion of an online course. The possibility to match the periods of taking an online course with the participants' life events enabled the researchers to unravel the latent surface of perceived benefits. All researchers were involved in data analysis to ensure consistency, transparency and triangulation of findings (Johnson & Christensen, 2017). Combining interpretations of results attained by co-authors helped to avoid researcher bias.

Limitations of the Study

The present study has several limitations. One important issue to recognize is that the number of participants was very small. Another limitation of this research is focusing on the data from Russian-speaking participants, so the research findings are context-specific. However, MOOCs reception in the local labor market is consistent with the global trends, which should make the results of the study relevant for wider audiences.

The third limitation stems from the sampling method and selection criteria. The participants were recruited through online platforms, which suggest higher levels of digital literacy among those who were selected. In addition, it is possible that the individuals who responded to a call for participation in the study are naturally more active and motivated to discuss their experiences with MOOCs. In that regard, less active and less digitally literate MOOC-takers were not represented in the study.

Lastly, this study was conducted with learners who completed MOOCs in full. Nevertheless, users who only download materials or participate in other learning activities may benefit from a MOOC even if they do not complete it.

Research Findings

Despite the limitations, the study offers a new insight into the perceived benefits of MOOCs as the measurement of success based on retrospective reflection. The authentic voice of the learner is extremely important in education research. By offering MOOC-completers a chance to have their voices heard, we were able to appreciate their perceived benefits, which have potential implications for educational providers in Russia and throughout the world.

In general, positive impact of MOOCs on the subsequent events of their life predominates in the interviewees' opinions. Participants who have completed the course demonstrated commitment, despite any difficulties, to something that can also benefit their daily activities and/or work behaviors.

Several major themes have emerged from the interviews. First, our participants could be divided into two categories, working professionals and university students, and this factor largely determined their responses about motivation and life goals, although there was some overlap. Second, a retrospective analysis of perceived benefits revealed a common pattern consisting of fulfillment of expectations, justification of the investment of efforts, and expectation of future benefits or rewards. At the same time, perceived value of MOOCs extended beyond the certificates and included intangible attributes, such as sense of accomplishment, new knowledge and skills, positive outlook, and new social connections.

MOOCs Impact: Working Professionals

Through narrative inquiry, it was possible to match the periods of taking an online course with the participants' life events. It was revealed that taking a MOOC often coincided with the time when an individual was planning to change career, education, or life tracks. As one interviewee related,

> Something associated with self-development started to emerge in me. Then I wanted changes, it seemed that life began to stagnate. I do not know if it can be clearly associated with the online course, because I had it all at once, I rethought my life a little. (P25)

Causal relationships between different events in the life of informants were complex and ambiguous. One participant summarized it as follows: "plans somehow change by themselves, which is caused by the surrounding environment" (P12).

Moreover, interviewees did not overestimate the impact of MOOCs because of short duration and introductory information in most courses. Nevertheless, we discovered a complex configuration of factors, including MOOCs, which gradually accumulated their potential as the driving force of changes in people's lives. There was a variety of ideas about the contribution of online learning in the discourse of participants.

First, according to one of the participants, online courses made more educational and career options available: "If there were no online courses and I could not develop my knowledge in a different direction, I would have a really limited choice" (P5). Secondly, a number of participants noted that taking online courses increased their self-esteem and created a sense of self-reliance. As one interviewee explained, "I just felt confident… The courses gave me an opportunity to understand myself better" (P30).

Another similarly indicated, "MOOC gave me better understanding of my professional level. This gave me confidence to go to my boss and explain that I need more interesting and creative work. Now I have an employer who provides me with interesting tasks." (P23) Thirdly, some interviewees used online learning to complement the skills received though formal education to improve their career options: "I had this course long time ago at the university, but it was more theoretical, so all the basic practical skills were polished during the online courses" (P11).

Important cross-disciplinary competencies are not easily acquired through traditional modes of instruction (European Commission, 2014). Through MOOCs, constellations of such competencies can enable individuals to act effectively in complex situations and combine them to achieve the best result.

MOOCs Impact: University-Affiliated Students

Working professionals described MOOCs impact in the context of their professional tracks as "routes" of life, whereas university-affiliated students focused more on educational trajectories. First, MOOCs broadened the horizons and knowledge in different areas, often adjacent and not directly related to university majors. Interviewees commented that "[MOOCs were] just for general knowledge, for general understanding of some things" (P4) and "an online course is always a great way to understand something at least in general terms or to start learning something new" (P17).

Secondly, online courses helped decide on further plans related to continuing studies or changing the major at the next level of training. As one student said, "it is possible to choose another major for my

Master's program… I did not really think about this direction before the online courses" (P3). Thirdly, for people with special educational needs, this format of education is particularly beneficial and allows overcoming certain barriers:

> I have poor eyesight, so I cannot see the board even sitting in the first row; and in online courses you can stop the video, zoom it in: the screen can be either larger or smaller. It's very convenient for people with disabilities. (P2)

Fourthly, some participants' reported that taking MOOCs affected their academic achievement. As one student related, "[now] it is easier for me to solve integration problems, because I passed an [online] integration course" (P16).

Some of the participants noted that online platforms were providing high-quality learning experiences on as needed basis. In their view, MOOCs have a positive reputation and should be integrated into individual educational trajectories of students, since "knowledge that online courses give has similar quality to traditional classroom teaching at the university" (P19). In this sense, traditional degrees and online learning could be best understood as a continuum that involves interplay and overlap between different activities.

Perceived Benefits: Patterns in Discourse

The retrospective discourse revealed a common pattern of perceived benefits that included three elements: initial expectations, invested efforts to acquire new knowledge and practical skills, and expected benefits or rewards. If a person has received expected benefits after completing a MOOC, then it justified his or her efforts. The universal condition for success was that reality had to match initial expectations: "My expectations were met, there were a lot of courses, for the vast majority of them I got what I wanted: some new knowledge, or new skills, or contacts, which later were followed by offline communication" (P28).

Although it followed a common pattern, the combination of expectations and rewards was unique for each person due to several reasons. Firstly, despite the fact that among the interviewees there were only some categories of MOOC-takers, almost the entire palette of the goals and motivations described in previous studies (Barak, Watted, & Haick, 2016; Littlejohn et al., 2016) was represented in their expectations from online courses.

Secondly, the usefulness of acquired knowledge and practical skills was estimated in the context of personal career/education/life tracks: "To see the result, you have to understand why you are doing this, based on your specific life circumstances, where you can apply this" (P26). Thirdly, due to the gap between MOOC completion and the time of the interview, individuals' perception of benefits did not remain static, but changed as their expertise evolved. As one interviewee said, "I am developing… which is confirmed by my professional life and studies" (P29).

Crystallisation of Perceived Benefits in Participants' Minds

As a result, the current study reveals how perceived benefits crystallize in the minds of informants as they reflect upon their MOOC experience.

1. **MOOC completion.** This means that the learner completed all assignments without any certificate of achievement. It may be an indicator of personal satisfaction and/or development for

some participants: “even without a certificate, I have the right to add this course [to my resume] as independent coursework, that is, what I study when I have free time. People are more interested in your desire for self-study” (P11).

2. **Free or paid certificate for completing a course.** Informants who have experience working abroad or in international companies saw the value of certificates on the global labor market as an indicator of self-organization, responsibility, independence, and time management skills: “In the eyes of other people, this certificate gives you weight as a professional, so you can sell yourself in the labor market more expensively” (P15). Sometimes a certificate is important for improving self-esteem: “My goals are changing, I develop as a person. What is more, I develop as a professional. When you have a certificate, your importance grows in your own eyes: I completed a course” (P19).

In some cases, respondents reported how other people benefited from receiving a certificate*:*

> If you have certificates, from the standpoint of selling yourself as a professional, it will help you. I have a friend who presents himself as an internet marketing and brand specialist. If it’s written [in his resume] that he has completed certain courses, it increases [employers’] interest in him. (P24)

However, the majority of respondents treated learning very pragmatically and expected to obtain practical skills, necessary for their current or future line of work. To achieve this goal, a certificate is not required; the most important outcome is gaining new knowledge that can be applied in real life. Course participants saw receiving a certificate only as an additional motivational factor.

3. **New knowledge and practical skills.** Usefulness of MOOC, from the participants’ viewpoint, was often associated with additional practical skills for professional development and improving career opportunities in the future:

> Those things that I learned could be applied almost instantly in my work, even the same day. I began to understand how my decisions affected financial performance, (and) understood what my company needed. And since it helped my career, I continued to study nonstop. (P5)

4. **Positive outlook that helps in real-life crisis situations.** Taking a MOOC, people learned to overcome difficulties when they face them:

> There was a failure at work: there were no results, so I wanted to give up everything, stop working, and find another profession. But at that moment I started to take these courses, which was a pure coincidence, but they somehow pushed me: I became more optimistic about everything. (P9)

5. **Accumulation of social capital.** Depending on their interest, MOOC participants may establish interpersonal relationships and develop learners' networks in MOOCs and beyond. One of the research participants summarized this as follows:

> When I take courses, I try to find like-minded people and common ground between me, the author, and those who are also taking this course. While taking the most recent course, I was offered a job from its author. (P24)

The same person who completed several courses can describe different perceived benefits depending on life situation. In one case, the participant focused on "obtaining a mark of distinction [certificate], which will be waiting in the wings" (P23), but in another situation, the same individual aimed to gain practical knowledge and skills for changing a current job and preparing for a new one.

Indicators of Success for Online Platforms and for Learners

Since all of the informants had completed at least one MOOC in full, the majority of them viewed obtaining a certificate as one of the perceived benefits. However, most interviewees questioned the usefulness of certificates on the job market in Russia with the predominance of pessimistic evaluation: "Very few Russian employers would need this" (P8). The respondents cited lack of awareness about MOOCs and online learning among the employers in post-Soviet countries: "They don't know what those MOOCs are. That is true in most cases" (P14).

According to the informants, in the future there would be greater interest to certificates on the labor market in the post-Soviet countries. Participants predicted the relevance of MOOCs on CVs, proposing that they may be economically beneficial in terms of helping to secure future employment; something "extra" to distinguish job applicants from other candidates. Some interviewees felt optimistic about the usefulness of online courses in their future lives, although their potential has not been revealed in the past or in the present: "I hope that online courses will still give me some benefits in the next year or two, even though they have not yet brought any tangible result" (P28).

The usefulness of MOOCs for most working professionals was often associated not only with the certificate, but also with additional practical skills, future career opportunities, and with professional development: "This expanded my opportunities: not in terms of a certificate that I can hang on the wall, but it is the knowledge that I have received from these courses" (P21). The usefulness of new knowledge and skills that could be quickly converted into an appropriate reward was especially noted by programmers: "It is noticeable sometimes the next month after the end of the course if you are able to use the new knowledge" (P23).

The research findings lead to the conclusion that the perceived benefits reflect the fulfillment of the need for self-development, rethinking, or changing one's life. As one interviewee said, "Before the online courses my plans were very blurred, I did not quite know what I wanted. Afterwards, by chance, I realized what I'm interested in, what I want to do, and now I'm doing this" (P10).

Our findings revealed a variety of ways in which the learners described the impact of completing a MOOC on their professional, educational, and life tracks. Such diversity could be attributed to the complexity of relationships between different events in the informants' lives and by different stages of their educational and professional development. However, in general, MOOCs introduced new development trajectories to people's lives, broadened their horizons, and provided them with strategies for further development.

Discussion

According to Beck (1992), in "risk societies," each person is expected to use intelligence, resources, and diligence to achieve more satisfactory living conditions. Through the narrative interviews, our informants demonstrated that they were responding to the challenge of keeping up with the changing society by taking MOOCs. For working professionals, online learning was seen as a "cementing" factor,

forming the clusters of competencies for their professional life and career development. The necessity to stay competitive in the workforce served as an impetus for searching for new knowledge and practical skills.

While university students also recognized the ability of MOOCs to complement formal learning, their descriptions were limited to educational tracks due to a lack of experience in the labor market. These results are consistent with the previous studies (Brahimi & Sarirete, 2015; Schmid, Manturuk, Simpkins, Goldwasser, & Whitfield, 2015; Milligan & Littlejohn, 2017; Watted & Barak, 2018), and suggest that students use MOOCs to supplement or complement their formal learning with an additional source and improve their knowledge. In this sense, online platforms are becoming an important tool for the educational market.

The results revealed a continuum of perceived benefits in participants' minds: from tangible to intangible. As far as tangible benefits, MOOC completion, with or without the certificate, is viewed as a significant achievement that can "strengthen" one's CV and improve career prospects. However, some of the perceived impact is indirect: one can use MOOC completion to demonstrate commitment to life-long learning or to increase self-esteem. This finding supports the previous studies, which claimed that the MOOCs' impact should not be evaluated solely based on certification rates (Ho et al., 2014; Kahan, Soffer, & Nachmias, 2017).

Acquired knowledge and practical skills are seen as very important intangible benefits of completing a MOOC. In post-modern society, competent labor is the deciding factor, especially in the fast-paced knowledge-based economies (Karnouskos, 2017). MOOCs provide Russian-speaking learners with a flexible and accessible platform for acquiring new knowledge and immediately applicable practical skills.

When it comes to even less tangible benefits of completing a MOOC, one of the unexpected findings was the notion that taking online courses may change a person's outlook on life. A possible explanation could be that completing a MOOC not only opens new career opportunities, but also teaches self-organization and perseverance, which eventually become invaluable personal strategies that help in coping with difficult life situations (Hammond, 2007). As suggested by Longstaff (2017), people can be psychologically empowered by MOOCs.

Finally, accumulation of social capital is another less obvious benefit of taking or completing an online course. Unlike a traditional classroom, MOOCs enable learners to establish interpersonal relationships and develop learners' networks far beyond their geographic location and professional or academic field. Though in a massive online course, reaching out to other participants is often a personal choice, as Joksimović et al. (2018) noted, there is a greater opportunity to draw on and leverage the latent social capital that resides in such a learning environment.

At the same time, there seems to be a discrepancy between how MOOC users themselves perceived learning success and how these perceptions corresponded to the ideas of MOOC providers. Since all of the research participants were MOOC-completers, it was not surprising to hear that they viewed obtaining a certificate as one of the perceived benefits. In this case, a certificate of completion was an indicator of success both for the online platforms and for learners. However, as noted by the interviewees, in post-Soviet countries specifically, this certificate is considered more important on the educational market rather than anywhere beyond it, including the job market. This observation aligns

with the research by Karnouskos (2017) stating that participants complete courses mostly for personal satisfaction rather than for receiving widely accredited certificates. Employees doubt their value, whereas "employers do not seem to honor the credentials and certificates earned through MOOCs too much, as they are not linked closely enough to job-related learning" (Egloffstein & Ifenthaler, 2017, p. 69). The findings demonstrate that merely looking at course completion as a measure for success, especially for working professionals, does not suffice in the context of a MOOC, which is consistent with the research by Henderikx et al. (2017) and Littlejohn et al. (2016), which calls for a redefinition of "success" in a MOOC.

Conclusion

The significant gap in previous literature regarding the perceived benefits for learners completing MOOCs motivated the research team to conduct this study. The aim was to investigate the perceived benefits as the measurement of success in MOOCs. The perceived benefits in this case were relying on retrospective reflections from the participants of the narrative interview.

Research findings lead to the conclusion that learners' perceived benefits may be inconsistent with the measurement of success used by MOOC platforms. In addition to certificates of completion, learners placed value on intangible benefits, such as new knowledge, increased self-confidence, and social connections. It delivers an important message for the MOOC platform developers. Their interest in monetization determines the identification of learning success with course completion and certificate payment. The findings demonstrate that success in MOOCs should be interpreted with individual intentions in mind. The current study also revealed that perceived benefits of MOOCs in the minds of most Russian-speaking working professionals are often associated with professional development and improving career opportunities in the future. Yang et al. (2017) note that MOOC platforms should provide reliable services – different content choices and routes through the course – to meet the specific needs of each learner on a timely basis. Consequently, providers can leverage these results to attract more users if personalized trajectories of MOOC learning are supported.

Educational practices in a post-modern world are being deregulated and transferred to the area of individual initiative. In addition to new knowledge and skills, online learning can help resolve problems with self-determination, self-management, and self-assertion, which become the responsibility of every individual (Beck, 1992; Bauman, 2001). Due to its flexibility and easily renewable content, learning through MOOCs can have adaptive value and become an important element of life "equipment."

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Analysing Structured Learning Behaviour in Massive Open Online Courses (MOOCs): An Approach Based on Process Mining and Clustering



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Abstract

The increasing use of digital systems to support learning leads to a growth in data regarding both learning processes and related contexts. Learning Analytics offers critical insights from these data, through an innovative combination of tools and techniques. In this paper, we explore students' activities in a MOOC from the perspective of personal constructivism, which we operationalized as a combination of learning behaviour and learning progress. This study considers students' data analyzed as per the MOOC *Process Mining: Data Science in Action*. We explore the relation between learning behaviour and learning progress in MOOCs, with the purpose to gain insight into how passing and failing students distribute their activities differently along the course weeks, rather than predict students' grades from their activities. Commonly-studied aggregated counts of activities, specific course item counts, and order of activities were examined with cluster analyses, means analyses, and process mining techniques. We found four meaningful clusters of students, each representing specific behaviour ranging from only starting to fully completing the course. Process mining techniques show that successful students exhibit a more steady learning behaviour. However, this behaviour is much more related to actually watching videos than to the timing of activities. The results offer guidance for teachers.

Keywords: social learning analytics, constructivism, learning analytics, learning behavior, educational data mining, process mining

Introduction

Massive Open Online Courses (MOOCs) (McAuley, Stewart, Siemens, & Cormier, 2010) are usually built in a structured way from modules containing video lectures, quizzes, and discussion forums (Lackner, Kopp, & Ebner, 2014). Collecting and storing all online behaviour in MOOCs results in large amounts of data. Using these "digital traces" (Gillani & Eynon, 2014) about learners and their context to understand and optimize learning and teaching, is known as Learning Analytics (LA; Siemens & Baker, 2012). In the last few years, efforts have been made to relate LA explicitly to learning processes and learning theories (Buckingham Shum & Ferguson, 2012). The focus on enforcing and stimulating learning processes rather than on collecting and analysing large amounts of data, leads to a call for more personal and learner-centric LA (Buckingham Shum & Ferguson, 2012).

This paper explores patterns in students' learning behaviour and learning progress in a MOOC by looking at activity sequences. Learning behaviour in the context of MOOCs refers to how, when, and in what order students watch videos and process other MOOC resources; and when and in what order they make quizzes and assignments. Learning progress consists of results of these efforts in pass or fail of quizzes and in final results of the MOOC or course. The aim of this paper is to describe and explain sequences of learning behaviour, with the purpose of finding indicators for improving the quality of teaching and learning. We intend to increase understandings of how passing and failing students distribute their activities differently along course weeks rather than predict students' grades from their activities. We are looking for learning process models that represent the sequence of students' interactions with MOOC resources in relation to learning progress.

To investigate students' engagement with videos and quizzes, we formulated the following question: What patterns can be found in students' learning behaviour in a MOOC? We answer this question with an exploratory sequence analysis using Process Mining (PM) and hierarchical clustering as methods. Understanding these patterns helps to figure out which students are on a path to passing the course as well as supporting course design for MOOCs. Facts and details about patterns in learning behaviour offer useful tips for students to improve both their learning behaviour and their progress while they follow a MOOC. Furthermore, it can support teachers to make teaching more personal and learner-centric.

Background and Related Work

The fast-developing context of research on LA and MOOCs shows a variety of emerging themes (e.g., Peña-Ayala, 2018; Veletsianos & Shepherdson, 2016) such as MOOC design (Watson et al., 2016), student subpopulations (Kizilcec, Piech, & Schneider, 2013), or student motivation (Koller, Ng, Chuong, & Zhenghao, 2013). However, despite existing research on MOOC design (Watson et al., 2016), it appears that many MOOCs are developed without applying basic instructional design principles (Margaryan, Bianco, & Littlejohn, 2015) as formulated by Reigeluth (2016), for instance.

Furthermore, the "funnel of participation" described as going from awareness to registration, activity, progress, and for some learners, even completion (Clow, 2013), leads to attention toward student dropout (e.g., Kahan, Soffer, & Nachmias, 2017). High dropout numbers are a concern for MOOC providers and educational institutions. Dropout is studied, for instance, by investigating reasons why people are not able to reach their intended goals (Henderikx, Kreijns, & Kalz, 2017). Looking at

behaviour in retrospect helps to cluster students according to actions; and offers insight in how to support future students and avoid dropout.

To successfully obtain personal learning goals in a MOOC (Conijn, Van den Beemt, & Cuijpers, 2018), students need to regulate their learning more compared to traditional, face-to-face education (Hew & Cheung, 2014; Winne & Baker, 2013). Research from the perspective of self-regulated learning (Winne & Hadwin, 1998) indicates that successful MOOC students have high beliefs in their ability to complete academic tasks, and that previous MOOC experiences increase this self-efficacy (Lee, Watson, & Watson, 2019). Furthermore, successful MOOC students are reported to show more self-regulating activities that support them in actively constructing knowledge compared to failing students (Bannert, Reimann, & Sonnenberg, 2014).

Actively constructing knowledge relates to perspectives on learning such as constructivism (e.g., Bruner, 1996). According to constructivist theories, teachers should elicit students' prior conceptions on the topic taught and create a cognitive conflict in students' minds. This conflict confronts students with new phenomena or knowledge; or with conceptions of others (Bächtold, 2013). Science and engineering education literature distinguishes two kinds of constructivism (Loyens & Gijbels, 2008): personal constructivism (PC) or cognitive constructivism, and social constructivism (SC). In this distinction, PC focuses on individual learners; SC focuses on the social relations between teacher and student, or between students. PC considers the process of knowledge construction to be primarily based on interaction between student and learning materials. Both kinds of constructivism are considered complementary because students need guidance in developing an understanding of concepts (PC) before they can incorporate these concepts in other contexts (SC).

In MOOC context, PC activities include replaying videos and watching large(r) proportions of videos, which positively correlates with finishing a course (Sinha, Jermann, Li, & Dillenbourg, 2014). This leads to attention for sequences of student activities, aiming at predictions of student performance or increase of pedagogical quality of MOOCs (see Pena-Ayala, 2017), amongst others. Research analysing sequences of activities indicated that switching assignments, i.e., completing them in an order different from the course content, increases course failure (Kennedy, Coffrin, & De Barba, 2015). Furthermore, Wen and Rosé (2014) describe a case study where passing students showed a bump in engaging with lectures and assignments in the second half of the term, yet where failing students continued at a moderate pace.

Determining patterns from sequences of activities in MOOCs is becoming common to get a better understanding of underlying educational processes (Maldonado-Mahauad, Pérez-Sanagustín, Kizilcec, Morales, & Munoz-Gama, 2018). However, most of the traditional data-mining techniques focus on data dependencies, single events, or simple patterns (Bogarín, Cerezo, & Romero, 2018). This kind of research does not focus on the process as a whole and does not offer clear visual representations of overall learning processes (Trcka, Pechenizkiy, & Van der Aalst, 2011). PM is a robust method that supports the discovery of process models representing sequences of interactions between students and learning materials (Van der Aalst, 2016).

PM applied to raw educational data, with a process-centric approach and focus on sequences of events, is coined Educational Process Mining (EPM, Bogarin, Cerezo, & Romero, 2018). Research in this nascent field often combines PM with clustering techniques, for instance, to identify interaction

sequence patterns and groups of students (Emond & Buffett, 2015), or to optimise comprehensibility of the model obtained (Bogarín et al., 2018). Results of this kind of research show, for instance, that better-graded students have more effortful cognitive activities and use more varied learning strategies in the process of problem solving (Vahdat, Oneto, Anguita, Funk, & Rauterberg, 2015).

Maldonado-Mahauad and colleagues (2018), applying PM from the SRL-perspective, identified three clusters of learners: 1) comprehensive learners, who follow the sequential structure of the materials; 2) targeting learners, who strategically engage with specific course content to pass the assessments; 3) sampling learners, who exhibit more erratic and less goal-oriented behaviour, and underperform compared to the other clusters.

Analysing weekly engagement trajectories of students, Kizilcec, Piech, & Schneider (2013) found four types of learning behaviour:

1) *Completing:* students who at least attempted and completed the majority of assessments in the course,

2) *Auditing:* students who engaged by watching videos rather than assessments,

3) *Disengaging:* students who started off well with assessments but then showed a decrease in engagement generally in the first third of the course, and

4) *Sampling*: students who watched videos for only one or two periods, and then disappeared.

Approach and Added Value

Applying a data-driven approach, we looked at learning behaviour in retrospect to find patterns in knowledge construction resulting from interactions between student and course materials. We focused on sequences of watching videos and submitting quizzes, because interactions between student and medium are considered conceptualisations of higher-order thinking eventually leading to knowledge construction (Chi, 2000). This kind of data-driven approach suits both PM as explorative method, and PC as perspective; and lets us focus on the two variables of watching videos and submitting quizzes with a projection over time. Creating this projection should support teachers and students to improve learning and teaching rather than be a goal per se. The combination of PM and statistics is intended to visualize previously invisible learning processes.

We perceive MOOCs as a step in the development of online learning materials and pedagogies (Bali, 2014); this study is an exploration of how to support learning processes and pedagogies with data from the use of online learning materials. Further, this study is a step from descriptive LA towards explanatory LA (Brooks & Thompson, 2017) by offering a view of loopbacks, deviations, and bottlenecks; including quiz submission behaviour.

Methods

Case Study Descriptives

This study considered student data from the MOOC *Process mining: Data Science in action*, which has been running on Coursera since November 2014. The MOOC consisted of six modules, each counting up to nine videos. Videos were 15 to 27 minutes long, averaging 20 minutes per video. Each module ended with a weekly quiz, and the course concluded with a final quiz. Students that aimed for a "certificate with honour" needed to take a tool quiz (tutorial-style quiz to make them familiar with the tools used); and a peer assignment that asked them to analyse a real-world dataset as well as mimic writing a report by answering several questions. Each new module started one week after the previous, but the weekly quiz could not be submitted until two weeks after the start, to provide students some time to catch-up if needed. Because of a holiday period halfway through the term, the total run time of the MOOC counted 8 weeks. Table 1 shows details about students'and success rates.

Table 1

Global Statistics for the First Run of the MOOC Process Mining: Data Science in Action

Start date	Nov. 14, 2014
Registered	42,480
Visited course page	29,209
Watched a lecture	16.224
Browsed forums	5,845
Submitted an exercise	5,798
Certificates (course/distinction)	1,662
Course certificate	1,019
Distinction certificate	643
End date	Jan. 8, 2015

Note. Statistics were taken from the Coursera course dashboard, except for the "Watched a lecture"; and the final 3 certificate statistics, which were taken from the extracted dataset.

Analysis of learning behaviour was pursued through the stream of click events generated by students on the MOOC's content pages. A "clickstream" is defined as the trail students leave as they browse through video lectures or when they submit quizzes. Learning progress was measured by students' quiz results, final grades, and the type of certificate they get awarded after completing the course (Course Certificate for achieving a grade of 60 or better, or Distinction Certificate for achieving a grade of 90 or better) as well as whether they were on signature track, which means they paid for the course.

Process Mining

PM combines data mining and business process analysis; providing algorithms, tools, and techniques to analyse event data, consisting of traces of observed actions (Van der Aalst, 2016). PM offers three main types of analysis: process discovery, conformance checking, and enhancement (Van der Aalst, 2016). Discovery techniques learn a process model from the provided event log data. Conformance checking attempts to verify conformity of the data to a predefined model and identify deviations, if any; while enhancement provides for models to be improved based on the data in the event logs (Van der Aalst, 2016). Additionally, PM provides techniques and visualizations to further explore and analyse the event log data.

Event Logs

PM needs an event log with student behaviour data. Table 2 shows the minimal columns (case, activity, and timestamp) required as input for PM. PM distinguishes between cases that are following a process. In this paper, each student participating in the MOOC was a case, identified by the field "Student ID". Each student left a trace of observed actions, or events. Each event had (at least) an action that was performed, and a date and time at which it was performed. In Table 2, the lecture watched is the activity, and the timestamp is the time at which the lecture was opened.

Table 2

Example of an Event Log

Student ID	Lecture	Date Time
123456789	Lecture 1.1	2016-01-01 10:00
132456789	Lecture 1.2	2016-01-01 11:00
132456789	Lecture 1.3	2016-01-01 12:00
987654321	Lecture 6.2	2016-01-01 02:00
987654321	Lecture 3.4	2016-01-08 22:00
987654321	Lecture 1.3	2016-01-22 15:00

The event log was constructed using the Coursera data, as shown in Figure 1. For each user, the clickstream is extracted, focusing on lecture watching and quiz results. Note that no in-video action information (e.g., pausing, resuming, in-video quiz interaction) was recorded.

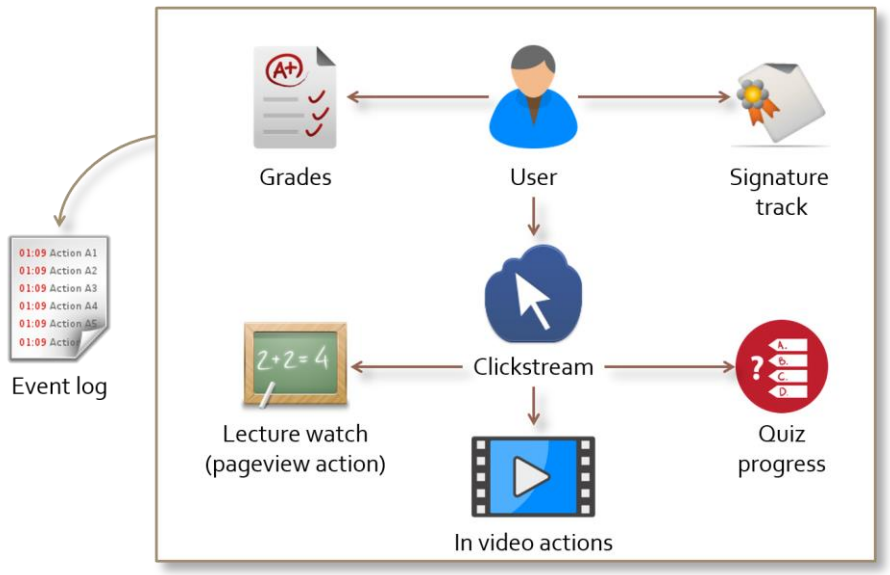

Figure 1. Generalized overview of Coursera data used.

Event Log Description

The extracted event log contains 16,224 students. Students that had no activity observed, belonged to the teaching or Coursera teams, or for which the obtained certificate was not recorded correctly were filtered out. For these students a total of 285,036 events were recorded within the timespan from

November 12, 2014 to January 31, 2015. Events were recorded for each of the 50 lectures, for the submission of weekly quizzes, tool quiz, final quiz, and the two introductory lectures. Figure 2 shows the number of recorded events per activity (e.g., lecture, quiz), sorted by the expected learning sequence. The first "real" lecture is the best-watched item, after which the view counts per video decreases over the course of the MOOC. The weekly quizzes were submitted more often than the average number of times a lecture had been watched in that week, which means that students often made multiple efforts for a quiz.

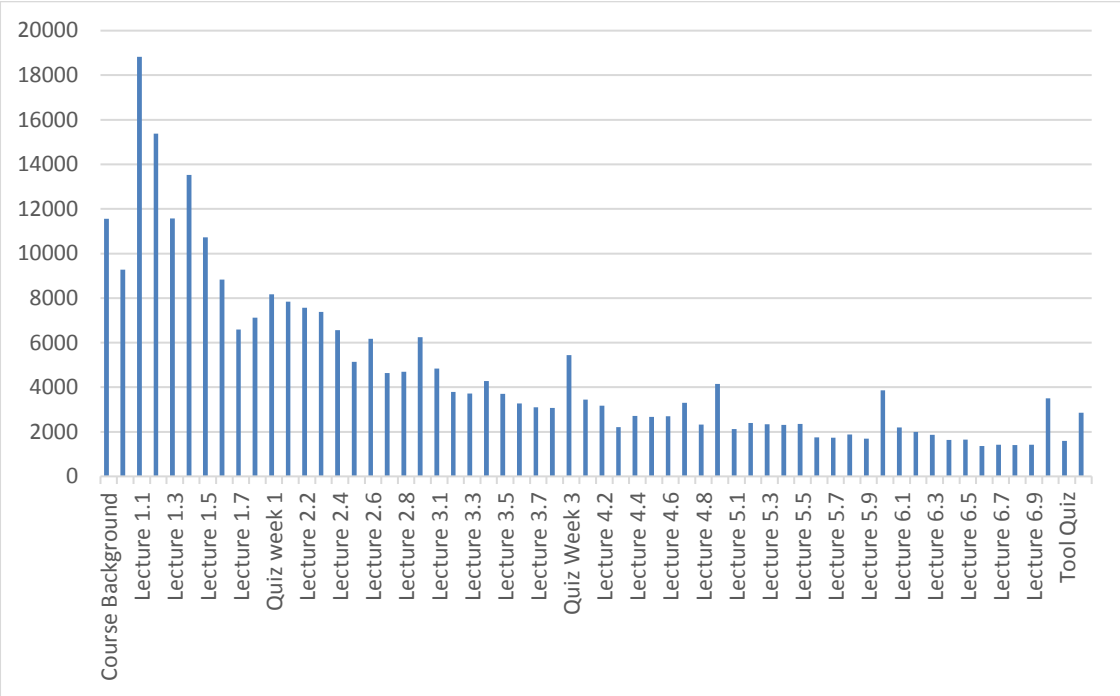

Figure 2. Number of recorded events per activity (e.g., lecture, quiz; sorted by order of expected execution). X-axis items show alternating materials; bars show all consecutive materials.

In Figure 3, the time of execution of the events is visualized using a dotted chart (Song & Van der Aalst, 2007). In a dotted chart, each recorded event is presented as a dot, where each row contain all events of a student; time is recorded on the x-axis. Colour indicates the activity, similar to the x-axis of Figure 2 (e.g., Lecture 1.1, Quiz Week 6). Each dot in the dotted chart of Figure 3 thus represents an observed event for one student, at a particular time. The vertical coloured bars in Figure 3 indicate the weekly rhythm of activities. The arch shows the first activity of students, ordered along the timeline. The density of the dots indicates overall student activity.

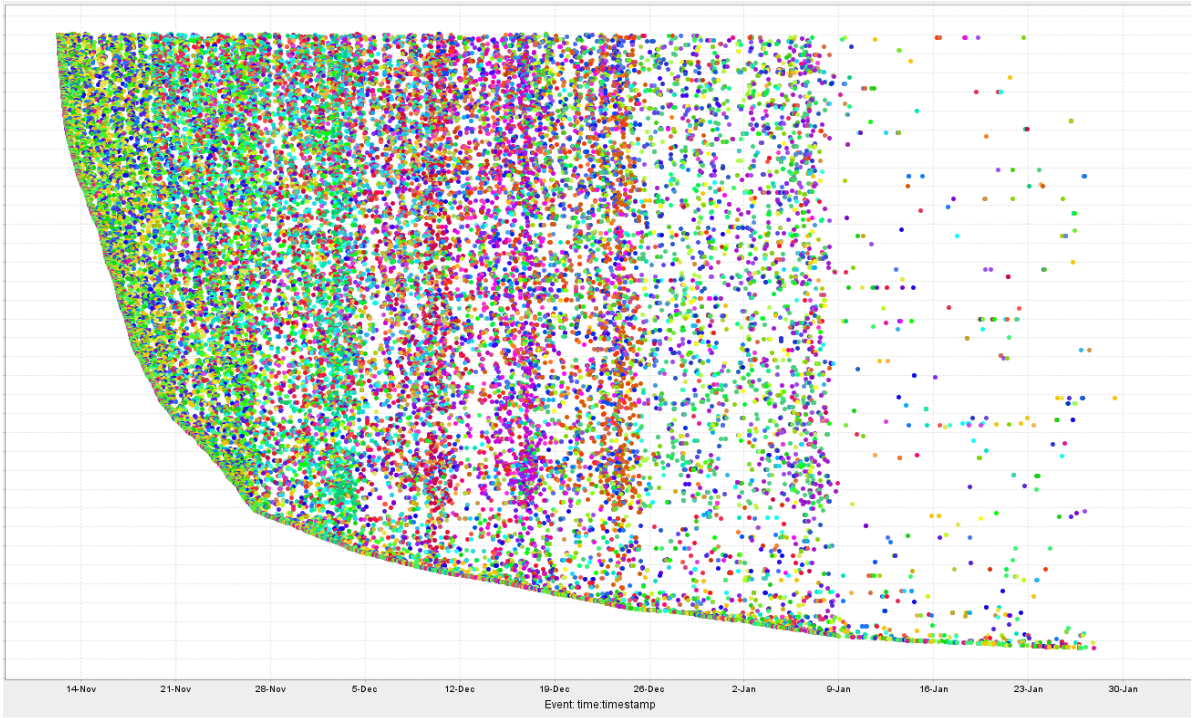

Figure 3. Dotted chart showing the events in the event log over time.

Process Model Discovery

Based on the event data, a process model can be discovered that describes the relation between observed activities, in our case, watching video lectures and submitting quizzes. We focus on the quiz submission process, because including all 60 possible activities would make the process model unreadable. **Error! Reference source not found.** and 5 show the process models that are discovered when considering quiz submission events, split over students that did not obtain a certificate compared to those that did obtain a certificate. Orders of activities followed by large numbers of students would be visualized in the model as sequences of activities, connected by arrows. Because the model immediately starts with a +-sign, indicating parallel execution of the branches, it can be concluded that no clear ordered pattern could be found. The numbers in the model represent numbers of students following a specific path through the model. The ordering from top to bottom has no hierarchical meaning, as all branches are executed in parallel, and is the result of the software package drawing the model.

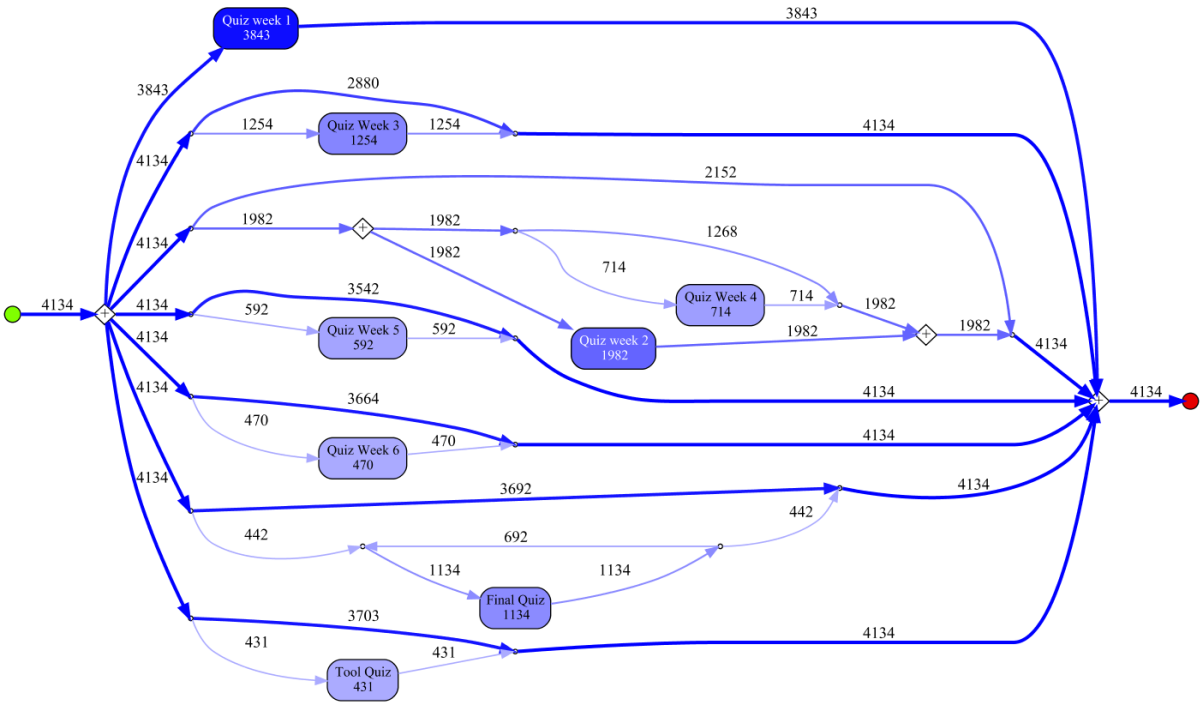

Figure 4. Quiz submission behaviour of students that did not obtain a certificate.

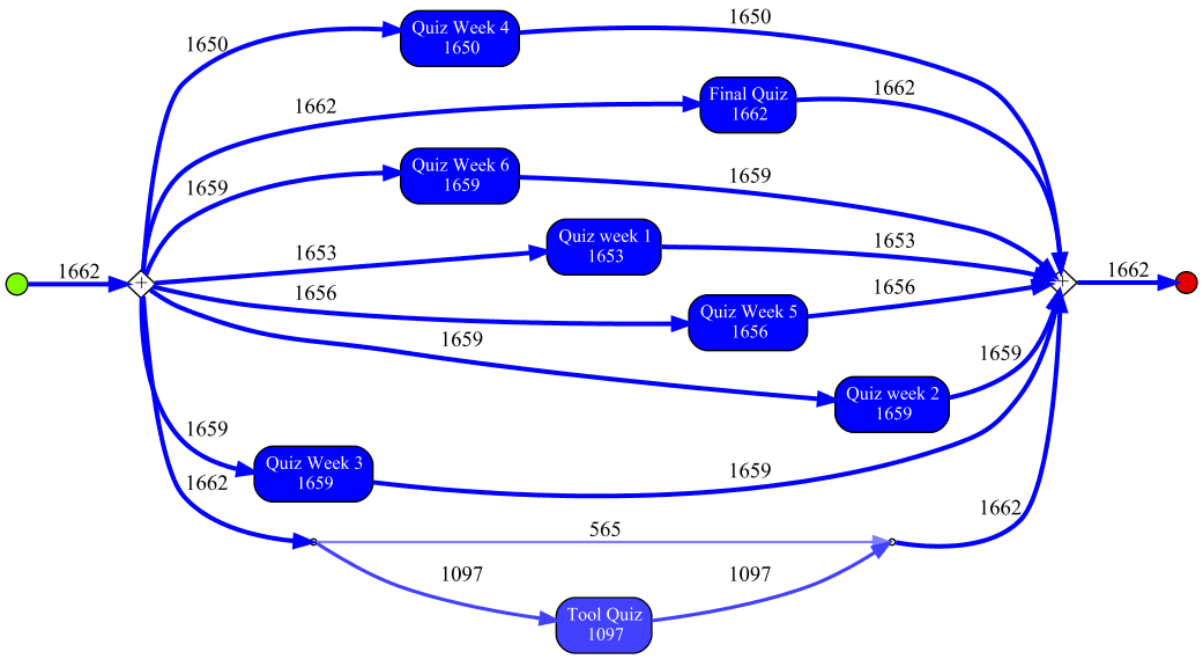

Figure 5. Quiz submission behaviour of students that obtained a certificate.

Conformance Alignments and Learning Behaviour

PM offers techniques to analyse event data in relation to the process model. Conformance checking techniques can verify the conformance of event data on a given process model (Van der Aalst, Adriansyah, & Van Dongen, 2012). In our setting, we can create a normative process model that

describes the ideal sequential study behaviour, i.e., starting at lecture 1, then 2, etc. Then, conformance checking can be applied to compare the actual behaviour with the ideal sequential behaviour.

Alignment-based conformance checking results in an optimal alignment of the observed behaviour of a student, as seen in the event log, and a possible execution of the process model.

Table 3 shows an example of such an alignment between the observed trace <Lect 1.1, Lect 1.2, Lect 1.6, Lect 1.4> and a possible run of the process model <Lect 1.1, Lect 1.2, Lect 1.3, Lect 1.4, Lect 1.5, Lect 1.6>. An alignment consists of a sequence of moves. Each move is either an activity recorded in the trace (but not executed in the model; move on log only), an activity that was executed by the process model but that did not occur in reality (move on model only), or a combination of both model and event log (synchronous move).

Table 3

Example of an Alignment Calculated between an Observed Trace and an Expected Sequence From the Process Model

Trace	Lect 1.1	Lect 1.2	Lect 1.6	>>	Lect 1.4	>>	>>	Lect 1.3
Model	Lect 1.1	Lect 1.2	>>	Lect 1.3	Lect 1.4	Lect 1.5	Lect 1.6	>>
Move type	Synchronous move		Move on Log only	Move on model only	Synchronous move	Move on model only		Move on Log only
Watch type	Watched regularly		Watched early	Not watched	Watched regularly	Not watched	Watched early	Watched late

Based on the order information, videos can be assigned any of these labels: *Watched Early*, *Watched Regularly, Watched Late, New or Not Watched* (bottom row

Table 3). By aggregating these labels, student behaviour and level of commitment in the MOOC can be defined; providing insights regarding PC. These labels were used to perform cluster analysis.

Cluster and Means Analysis

To explore a pattern of related watching behaviour among MOOC users, cluster analysis on the cases was applied. The independent variables consisted of mean scores of watching videos per week. Because there was no a priori classification scheme, hierarchical agglomerative cluster analysis was applied instead of discriminant or assignment methods (Everitt, Landau, Leese, & Stahl, 2011). To minimize the variance within clusters, Ward's method was applied with squared Euclidian distance. However, because this measure is affected by variables with large size or dispersion differences, z-scores were applied as well. Within each cluster mean scores were computed for watching behaviour per week and for quiz scores.

Results

For each respondent included in the analysis, at least one video watching instant was available. The general image of student activities (Figure 3) shows a weekly rhythm, but also late entrance of some students, sometimes even after all deadlines had passed. It also appears from Figure 3 that the overall activity of students decreased during the run of the MOOC. However, some students who started early on, still showed observed activity after all the deadlines had passed.

Our data showed that certificate students did not necessarily exhibit structured learning behaviour (Figure 4). Non-certificate students showed even less structured behaviour with some quiz submissions being skipped. Similar results were found for video watching, where non-certificate students skipped many videos, and certificate students did so in the last few weeks of the course.

Cluster analysis resulted in four clusters describing types of learning behaviour (see Table 4). Different cluster solutions did not result in comprehensive groupings of MOOC students in relation to the weekly mean scores of watching videos. Cluster 1 (N = 11,875; 73.2%) represents students who enrolled in the course yet quickly dropped off. Cluster 4 (N = 1,293; 8.0%) represents students who enrolled and showed, on average, steady learning behaviour and progress, resulting in high pass rates. Cluster 2 (N = 1,795; 11.1%) represents students who enrolled, did an attempt to watch videos and submit quizzes, yet failed to continue their learning behaviour. Cluster 3 (N = 1,261; 7.8%) represents students who enrolled and did a serious attempt to watch videos and submit quizzes, yet often failed to continue their learning behaviour as well, albeit at a later stage during the course. The difference between clusters 2 and 3 was also found in the achievement levels that show, for cluster 3, an increase in Course Certificate and Distinction Certificate level. The small percentage of passing students in clusters 1 and 2 represents learning behaviour that resembles failing students' sequences of activities, yet turns out to be successful.

Table 4

Cluster Size and Achievement Level

	Cluster 1		Cluster 2		Cluster 3		Cluster 4	
	Count	%	Count	%	Count	%	Count	%
Fail	11,487	96.8	1,694	94.4	1,062	84.2	306	23.7
Course certificate	237	2.0	67	3.7	131	10.4	584	45.2
Distinction certificate	138	1.2	34	1.9	68	5.4	403	31.2
Total	11,875	100	1,795	100	1,261	100	1,293	100

Learning Behaviour and Learning Progress Within Each Cluster

The four clusters were compared for differences between mean scores on video watching, quiz submission; and mean scores for weekly quiz results (see Table 5 and Table 6). To compute mean scores on video watching and quiz submission, timestamps were translated into a 4-point scale. Video watching was computed as an average per student per week and subsequently for each cluster per week. Quiz submission and scores were computed as an average for each cluster per quiz. Members of cluster 1, on average, never watched videos regularly or early, nor submitted quizzes on time, and passed no single quiz. Some students in this cluster started watching videos and made an effort for the quizzes;

however, they dropped off massively after week 1. Cluster 2, on average, started watching late, and increasingly procrastinated watching videos and submitting quizzes. Quiz scores (see Table 6) for cluster 2 start off reasonably well, with many students passing at least the first quiz. However, results soared rapidly after quiz 2. Cluster 3, on average, also started watching late, however, students in this cluster prolonged their watching behaviour further, and made a greater effort to submit quizzes throughout the course. This cluster shows better average results up to week 3. Cluster 4 showed steady watching behaviour, although most videos on average were watched at a rather late point in time. The standard deviation (SD)of cluster 4 shows a wider dispersion of watching behaviour and quiz submission towards the end of the course, indicating less coherence in this cluster. Watching videos late, and submitting quizzes non-ordered however, did not negatively influence quiz results because cluster 4 shows, on average, steady quiz results; leading to passing the Tool Quiz and Final Quiz and eventually passing the complete course.

Table 5

Mean Video Watching Scores and Quiz Submission Scores (and SD) per Week

	Cluster							
	1		2		3		4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Video watching								
Week1	.40	.45	1.88	.68	2.09	.69	2.24	.55
Week2	.05	.18	.82	.69	2.21	.74	2.60	.54
Week3	.01	.08	.16	.37	1.15	.98	2.55	.54
Week4	.01	.06	.06	.22	0.46	.73	2.44	.65
Week5	.01	.05	.04	.20	0.26	.58	2.29	.78
Week6	.01	.05	.04	.20	0.23	.61	2.07	.98
Quiz submission								
Quiz 1	.40	.93	1.51	.1.26	2.04	1.03	2.35	.74
Quiz 2	.14	.50	.33	.74	.95	1.00	1.15	.99
Quiz 3	.19	.71	.40	.98	1.26	1.40	2.67	.81
Quiz 4	.16	.64	.29	.86	.74	1.22	2.45	.93
Quiz 5	.14	.62	.26	.81	.62	1.17	2.45	1.00
Quiz 6	.14	.61	.23	.76	.59	1.14	2.40	1.05
Tool quiz	.08	.40	.13	.51	.31	.74	1.17	1.00
Final quiz	.16	.67	.23	.79	.60	1.19	2.47	1.14

Note. Scores on 4-point scale; 0 = not watched/submitted, 1 = watched/submitted late, 2 = watched/submitted regularly, 3 = watched/submitted early.

Table 6

Mean (and SD) Quiz Scores and Grades

	Cluster 1		2		3		4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Quiz1	.65	1.49	2.53	2.08	3.56	1.71	4.21	1.14
Quiz2	.30	.98	.75	1.40	2.25	1.70	3.36	1.15
Quiz3	.19	.76	.37	1.00	1.27	1.55	2.91	1.24
Quiz4	.19	.82	.33	1.02	.88	1.54	3.30	1.41
Quiz5	.19	.82	.34	1.07	.81	1.56	3.39	1.41
Quiz6	.19	.85	.33	1.13	.86	1.69	3.55	1.56
Tool quiz	.30	1.60	.52	2.10	1.31	3.20	5.32	4.67
Final quiz	.71	3.25	1.11	4.02	3.10	6.40	13.43	6.71
Distinction grade	3.33	12.70	7.36	15.48	17.66	23.14	55.73	28.68
Course grade 5.09 16.98	12.13	20.84	27.96	29.10	75.19	26.14		

Note.The maximum score for the week quizzes is 5 points, 10 for the tool quiz and 20 for the final quiz. The course and distinction grades are on a scale between 0 and 100.

Cluster Analysis by Activity Frequency

6 shows how often each video or quiz was accessed, split per cluster. This basic analysis suggests that students in cluster 1 mainly accessed materials in week 1. Cluster 2 students also mainly accessed materials in week 1 and 2, but submitted quizzes after week 2 as well. Cluster 3 students seemed to be active until week 3, sometimes week 4, but afterwards showed less activity, except for quizzes. Students in cluster 4 showed activity throughout the whole course.

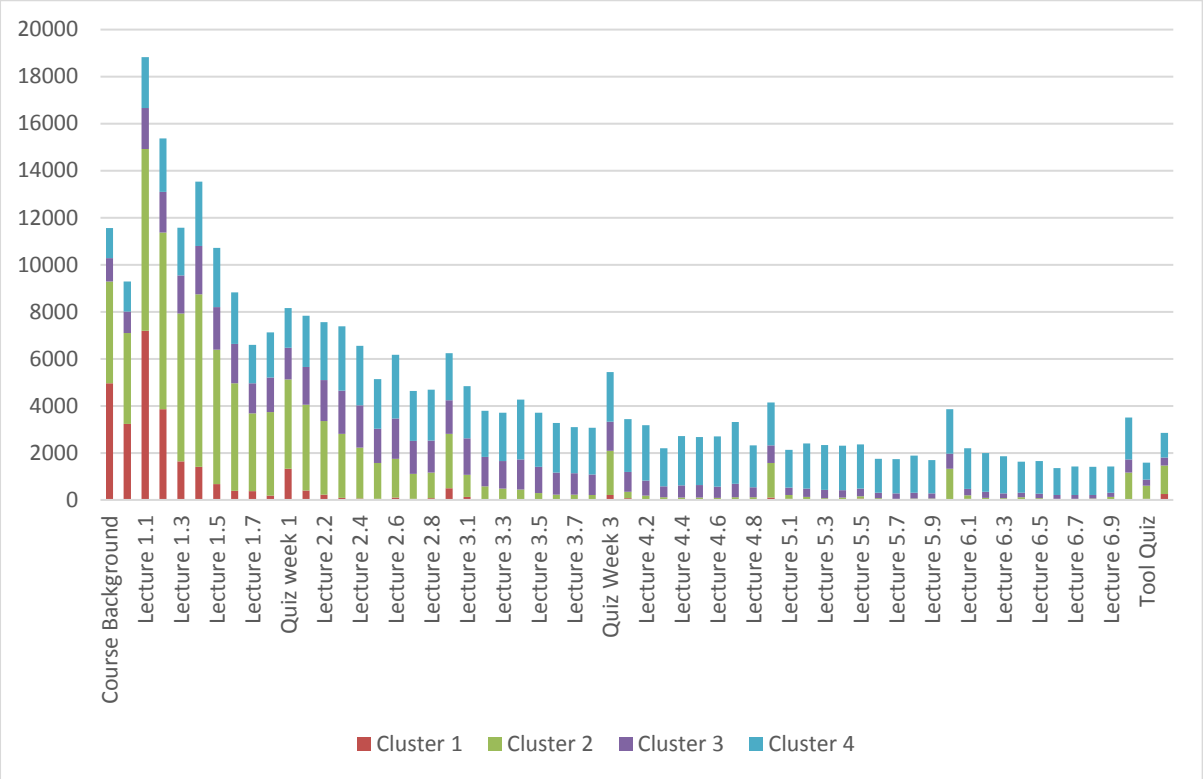

Figure 6. Activity frequency counts split per cluster.

Cluster Analysis Using Dotted Charts

The dotted chart visualization shows for cluster 1 (Figure 7) three types of students: those that started before the deadline of week 1, students that only have observations between the week 1 and 6 deadlines, and those students that started after the week 1 deadline but continued after the week 6 deadline still.

Figure 8 (cluster 2), indicates that more students started before deadlines, and fewer after. Students in cluster 2 also have, on average, 18 activities observed, indicating they were also more active. Figure 9 shows that, in cluster 3, even more students started before deadlines. This cluster represents students with on average 53 observed activities. Figure 10 shows for cluster 4 a pattern resembling cluster 3. Cluster 4 contains students with on average 98 observed activities.

The differences in density indicate that students in cluster 1 watched the least videos of all clusters. However, the colours show that mainly videos from the first module were watched. Each cluster shows a more dense distribution of dots, indicating that not only more videos were watched, but also closer after another. Furthermore, cluster 3, and especially cluster 4, have very little observed activity after the final course deadline.

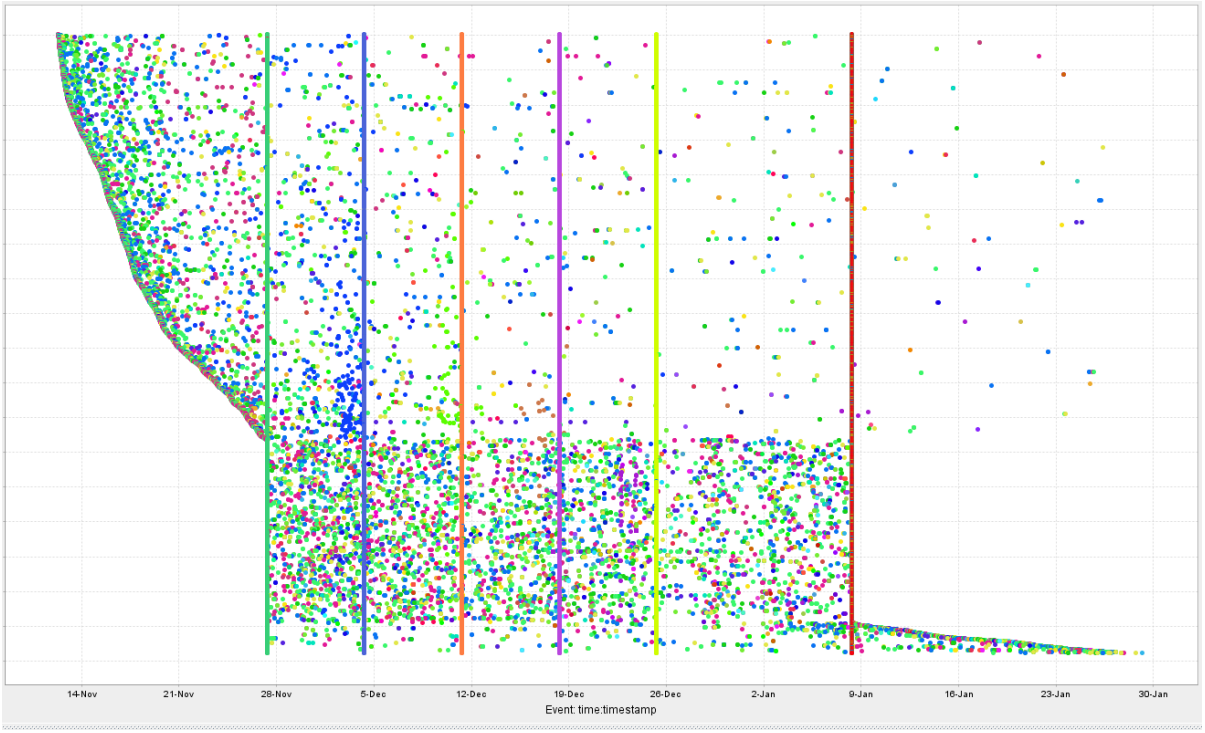

Figure 7. Video watching trends for cluster 1.

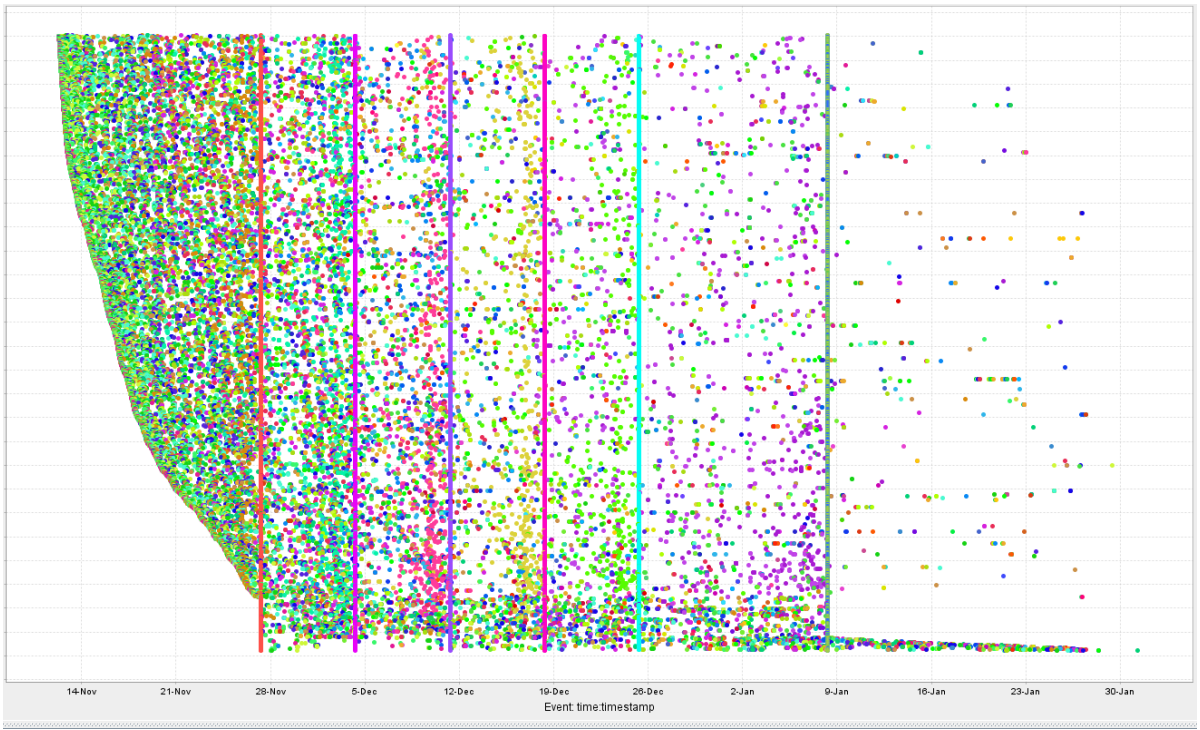

Figure 8. Video watching trends for cluster 2.

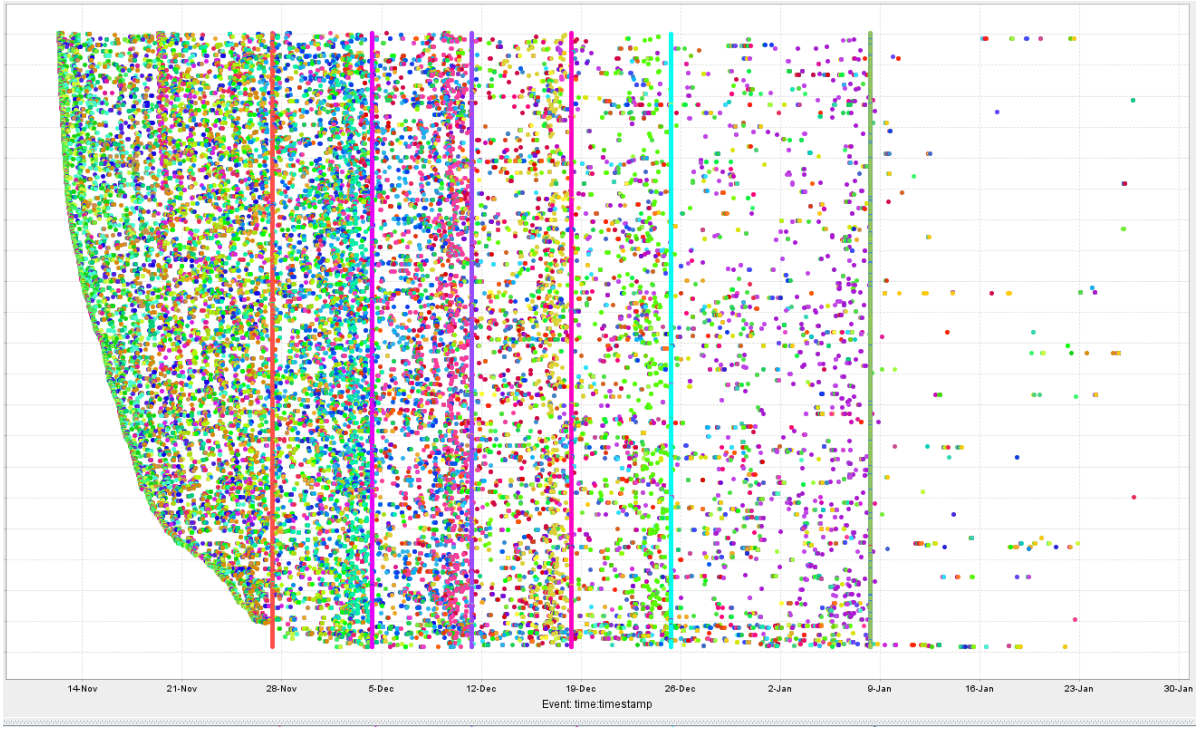

Figure 9. Video watching trends for cluster 3.

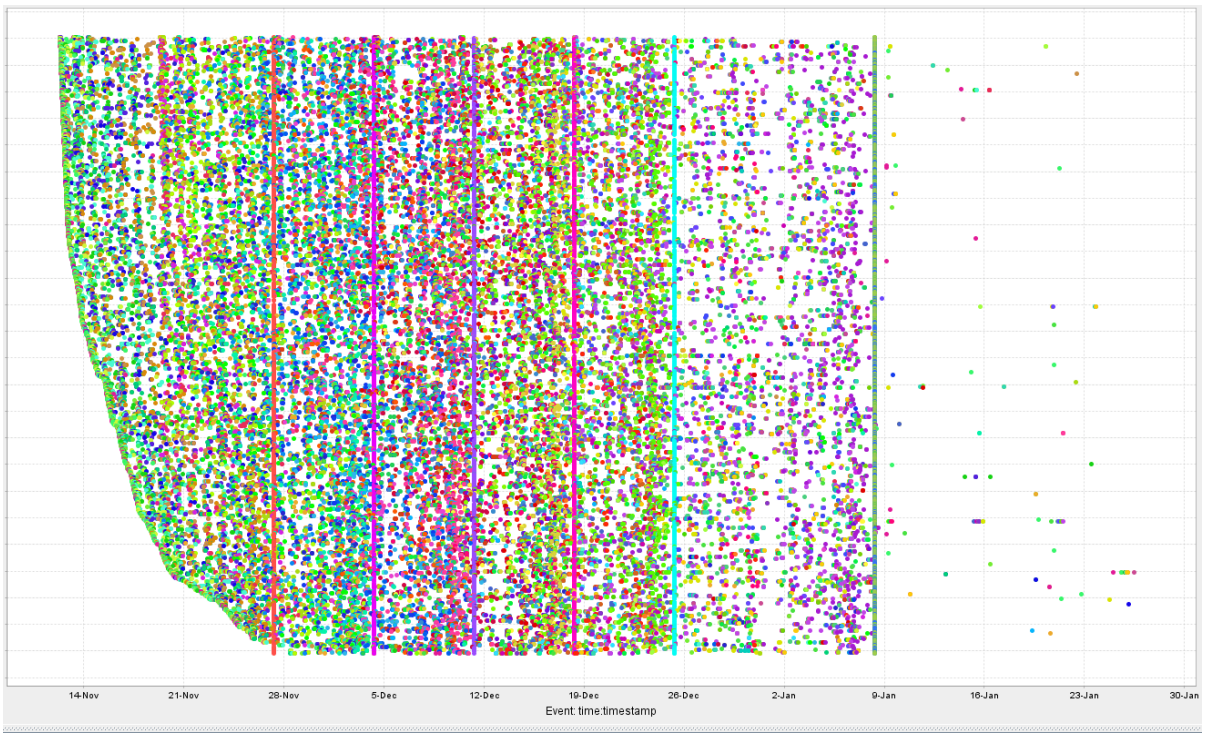

Figure 10. Video watching trends for cluster 4.

Process Models Discovered per Cluster

Guided by the clusters, the quiz submission process can be discovered. Figure 11 shows this process for cluster 1. The process model starts with submission of quiz 1, which was observed 932 times for 1127 students. Increasingly more students skipped the submission of other weeks (from 807 students not

submitting the week 2 quiz, to 1,101 students not submitting the quiz for week 6). Furthermore, the position of the final quiz – in-between quiz week 2, and quiz week 3 - is interesting with 246 students who tried it (less than the number of students attempting quizzes for week 3 or later).

Students in cluster 2 (Figure 12) submitted quizzes in a rather random fashion, with rapidly dropping submission numbers. The quiz for week 1 was submitted by 2,560 students out of 2,645; 687 students attempted the quiz for week 6; 643 students tried the final quiz. The quiz submission for cluster 3 (Figure 13) shows that the quizzes for weeks 1 and 2 are ordered, but during the course the quizzes were submitted without a clear order. Out of 894 students, 343 students submitted the week 6 quiz, while 318 submitted the final quiz. 14 shows the behaviour of cluster 4 regarding quiz submissions. Of the 1130 students, most submitted all week quizzes and the final quiz (1,033), while the tool quiz was only submitted by 725 students. The order of quizzes, however, was not very structured after week 1.

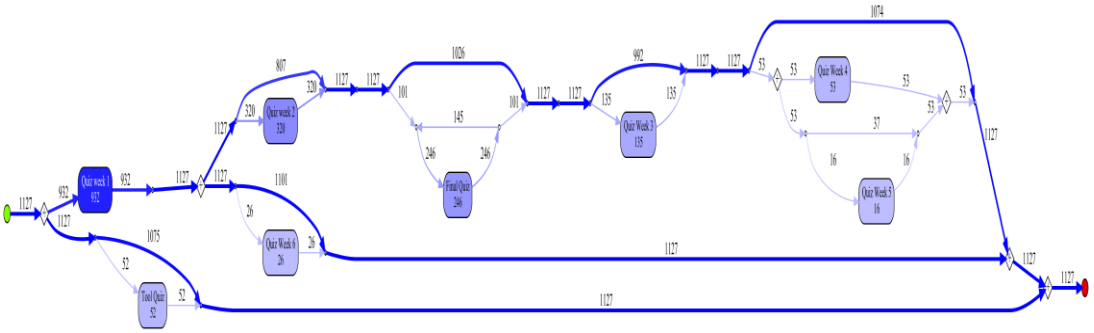

Figure 11. Quiz submission process model for cluster 1.

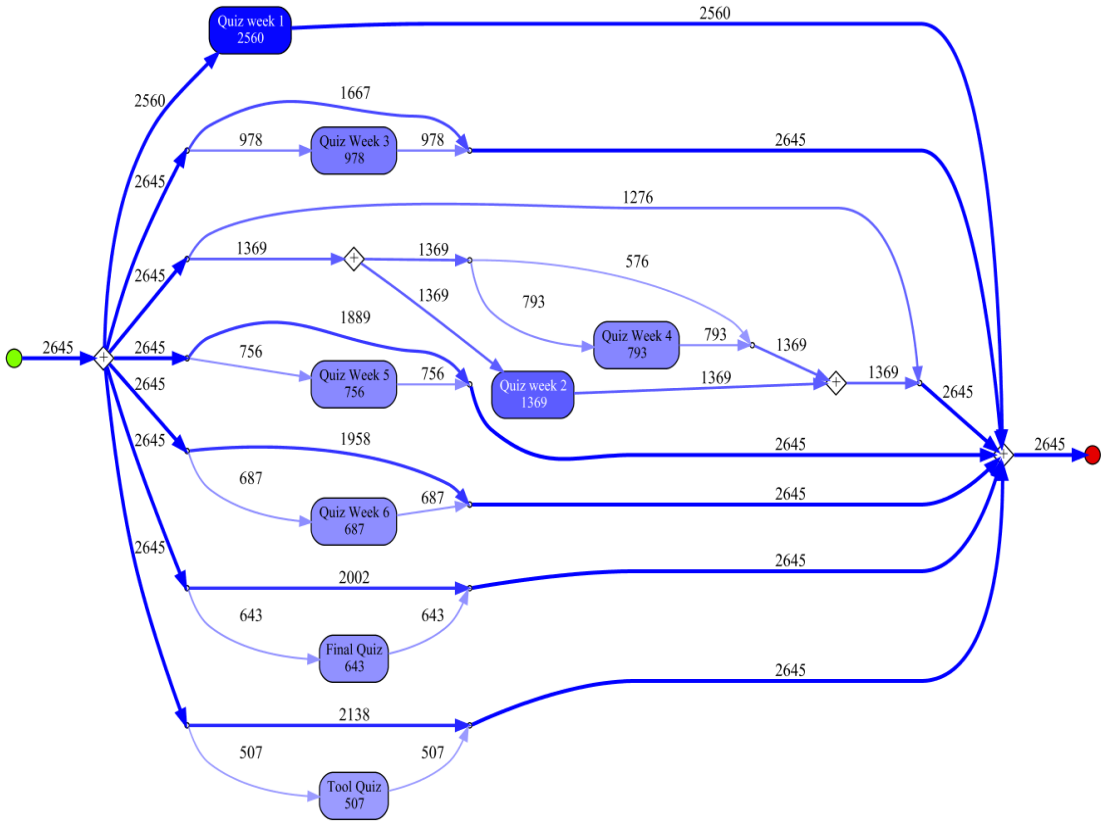

Figure 12. Quiz submission process model for cluster 2.

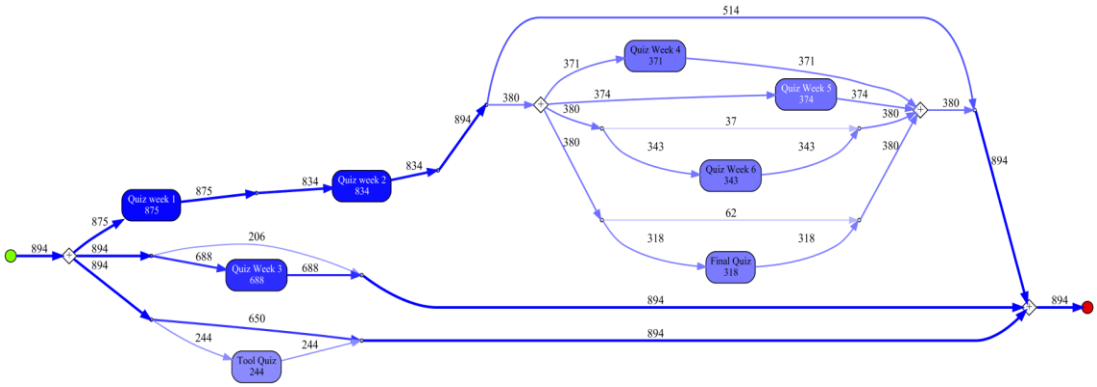

Figure 13. Quiz submission process model for cluster 3.

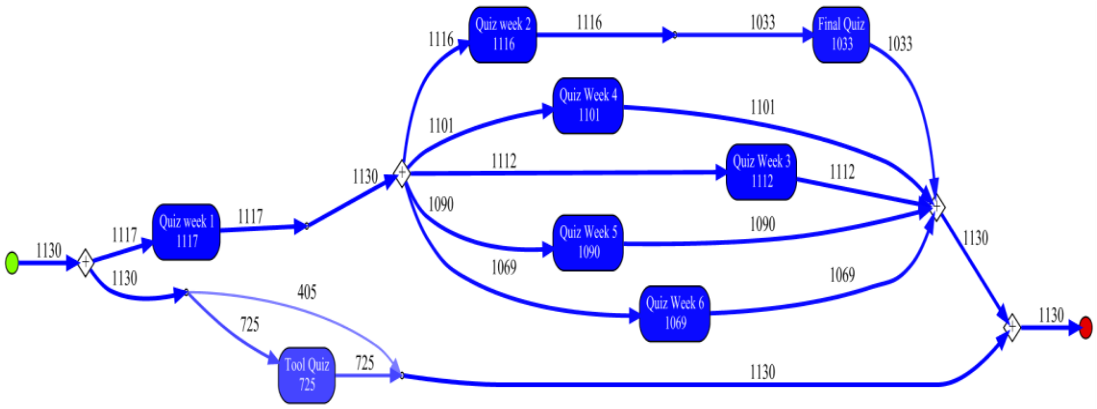

Figure 14. Quiz submission process model for cluster 4.

Discussion

To answer our research question, the results of cluster analysis in relation to learning behaviour indicate that regularly watching successive videos in batches leads to the best learning outcome. However, the results indicate that this behaviour is much more related to the order of watching videos than to the actual timing. This procrastinating behaviour is also found in other studies (e.g., Wen & Rosé, 2014). Passing a course obviously requires good quiz scores. However, the results do not confirm that refraining from "assignment switching" (Kennedy et al., 2015) leads to better results. Regarding quiz submission behaviour, both non-certificate students and certificate students showed irregular patterns, with non-certificate students more often skipping quizzes.

Students in cluster 1, represent the top part of the "funnel of participation" (Clow, 2013), because they were aware, had registered, had watched one or two videos, and then dropped off. Putting teacher effort into students of cluster 1 would result in little effect. The few students in this cluster who made quizzes, did this in a relatively ordered way. Following Kizilcec and colleagues (2013), and Madonado-Ahauad and colleagues (2018), these students can be labelled as "Samplers."

Cluster 2 students enrolled, made an effort, and then dropped off. A large number of these students submitted quizzes, but in a rather random order. Learning results soared rapidly from the second week on. This cluster had a large group of students that started early and dropped off gradually before the

end of the course, and a smaller group that started late and then gradually dropped off. This cluster can be labelled “Disengagers,”, in line with Kizilcec and colleagues (2013). Because these students passed at least the first quiz, they showed a certain level of understanding of the course topic. Therefore, giving them support in active knowledge construction could be beneficial.

Students in cluster 3 made a serious effort, however appeared to fail halfway through the course and onwards. They started watching videos late, but showed a more steady learning behaviour and continued to submit quizzes, on average,with better quiz results compared to cluster 2. However, the patterns of video watching and quiz submission were disordered after week 2, with quickly dropping submission numbers. Their behaviour looks like ‘Targeting” (Madonado-Ahauad et al., 2018), but our students often appeared unable to successfully complete the course. Interpreting this behaviour from perspectives such as the behaviour intention theory might shed light on student motives for enrolling and dropping off (Henderikx et al., 2017; Yang & Su, 2017). clusters 2 and 3 appear to be nuances of the disengaging learners (Kizilcec et al., 2013), with cluster 3 showing somewhat more ordered learning behaviour, and better learning results. Cluster 3 represents a serious endeavour and can be labelled “Venturers.” To decrease chances of failure, these students might benefit from guidance focused on personal learning goals (Conijn et al., 2018) and Self Regulated Learning (SRL) (Hew & Cheung, 2014), because their first quiz results suggest sufficient capacities to complete the course. Analyzing their progress through the stages of self-regulated learning could clarify how their goals were defined and might also shed light on how these changed according to their progress (Winne & Baker, 2013). Specific support in submitting quizzes regularly or early might improve their results.

Cluster 4 consists of students who showed high pass rates. They watched videos late, but steadily in batches of related videos and in course order. Towards the end of the course, less coherence was found in both watching and quiz submission. These are Madonado-Ahauad’s (2018) comprehensive learners, and Kizilcec’s (2013) completing learners; however, our students appeared to work increasingly disordered as time progressed. We labelled cluster 4 “Accomplishers” to reflect success with an effort. These students watched fewer videos in the final stage of the course, because they were at that time submitting and repeating quizzes, which might also be a cue for teacher guidance. Because they passed the course, these students showed the best self-regulating learning behaviour (Bannert et al., 2014).

Although cluster 4 has the largest number of passing students, teacher’s efforts might still be beneficial. Students in this cluster tried hard, yet could still improve their learning progress by focusing on less varied learning strategies (Vahdat et al., 2015). Furthermore, most rows in the dotted chart of cluster 4 end with purple dots, indicating activities in week 6. This suggests that most people made it to week 6 (irrespective of whether they obtained a certificate or not). This is also visible in the process models discovered for the four clusters.

Looking at learning behaviour within clusters and between clusters can inform teachers about locations for possible improvements in course materials and support for specific students. For instance, quiz results for clusters 2 and 3 in week 2 and 3 show remarkable differences. This can be compared with information about watching behaviour in those weeks, to find possible experienced difficulties in the materials. With added data such as whether in-video quizzes were passed on a first attempt, or whether videos were repeatedly watched, these analyses can be refined in future research.

Conclusion

Process mining, combined with traditional statistics, applied from a perspective of personal constructivism showed a fruitful approach to investigate learning behaviour and learning progress in MOOCs. It can be used to describe over time how student activities are ordered into patterns and to what results these sequences lead. This description in turn can inform teachers to improve course (re)design, and to support them in engaging students in the course. With an understanding of sequences of learning activities of groups of students, teachers can evaluate the content and the order of lectures and videos within a certain lecture. However, although analysing patterns can show where improvements in course materials are needed, pedagogical knowledge is necessary to indicate how to improve these materials.

This study knows limitations that also can serve as starting point for future research. First, our study was limited by distal data about video watching timings and order, and quiz submission and results. Additional proximal data about, for instance, personal learning goals

help to better understand the 4 clusters and underlying motivations. Personal learning goals could be measured with a pre-questionnaire (Henderikx et al., 2017) or during the MOOC, given that learning objectives might change over time. With personal learning goals specified, it could be determined how these goals influence the behaviour in MOOCs, which in turn can be used for more personalized improvements and student support.

Access to learning analytics data is usually restricted to teachers or management. With access to their own data, students can evaluate their learning process, which in turn supports self-directed learning and self-efficacy. This study suggests that LA can provide critical insights related to students' overall learning behaviour and its impact on performance.

Further research should focus on early detection of clusters of students based on their learning behaviour, combined with, for instance, personal learning goals. The purpose would be to replicate in other MOOCs the drop-off patterns found here, and to examine which effort is needed to keep cluster 2, and especially cluster 3 students on board. Furthermore, future research could also offer a better understanding of how students can be engaged in the course, with the purpose to increase a MOOC's success rate. Ideally, in educational research, these types of analysis are accompanied by controlling for background characteristics such as age, gender, level of knowledge, or motivation. This is also a consideration for future research for which process mining techniques provide a solid base.

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User Consent in MOOCs – Micro, Meso, and Macro Perspectives



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Abstract

While many strategies for protecting personal privacy rely on regulatory frameworks, consent, and anonymizing data, they are not always effective. Terms and Conditions often lag behind advances in technology, software, and user behaviours, and consent to use data for a range of unclear purposes may be provided unwittingly. As the commercial market for (student) data expands, so does the number of brokers who move, share and sell data across continents and legislative environments. This paper reviews four Massive Open Online Course (MOOC) providers from different geopolitical and regulatory contexts. It explores how consent to collect and use data is described to potential users, and how that consent applies at micro, meso, and macro levels.

This paper proposes a need for greater transparency around the implications of users granting consent at the point of registration. Further, it highlights that though MOOC providers have a responsibility to make clear the potential uses and sharing of user data, users themselves should also be more aware and consider how meaningful student agency can be achieved.

Keywords: consent, massive open online course (MOOC), micro, meso, macro, privacy, policy

Introduction

Within the broader context of discourses surrounding Big Data, educational providers are increasingly collecting, analysing, and using student information (Papamitsiou & Economides, 2014). Data are collected for marketing purposes and operational planning, to personalise the learning experience, and to determine the allocation of resources to individual students based on demographic and behavioural data (Gašević, Dawson, & Siemens, 2015; Leitner, Khalil, & Ebner, 2017; Long & Siemens, 2011b). There are increasing concerns regarding the expanding marketplace for student data (Russell, Reidenberg, Martin, & Norton, 2018) and the ability of big companies (e.g., Facebook) and data brokers to move user data outside the confines of new legislation (Hern, 2018). The introduction of the General Data Protection Regulation (GDPR) has vast implications for users' understanding of the purpose of the collection, analysis and use of their data, and user consent (Slade & Prinsloo, 2013; Khalil, Prinsloo, & Slade, 2018; Prinsloo & Slade, 2015; Sclater, 2018). While giving permission for the use of personal data has long been an issue for both end users and service providers, establishing user consent is complex given changes in international data regulation environments, growing concerns about privacy and the commercialisation of user data, and challenges in overseeing and regulating data exchanges and downstream use by a range of data brokers, collectors, platforms, and markets (Bennett, 2018; Cormack, 2016; Fairfield, 2017; Sclater, 2018; Tene & Polonetsky, 2012).

While student privacy and the use of student data on institutional learning platforms is relatively well-researched, there is little published research on the nature, scope, and implications of user consent in distributed learning environments such as MOOCs (Khalil, Prinsloo, & Slade, 2018; Drachsler & Kalz, 2016). Related research includes research by Young (2014) on the implications of the Family Educational Rights and Privacy Act (FERPA) for educational privacy in online classrooms, and research by Bennett (2018) on the potential of GDPR to be an "instrument for the globalisation of privacy standards" (p. 1). Sclater (2018) provides clear guidelines regarding the scope and practicalities surrounding user consent in the light of GDPR, though does not address its implications for *cross-border transfer* of student data. In online education, privacy can no longer be regarded as a *domestic* problem given "the increasing ease with which personal data might be transmitted across borders" (Bennett, 2018, p. 2), and the potential of data owners to move data beyond the reach of changing legislation (Hern, 2018).

In this paper, we consider the definition and scope of MOOC consent on three levels - the *micro level* of user or student consent; the *meso level* describing agreements between host institution and MOOC provider (e.g., regarding ownership of material, ownership/access to student data); and the *macro level* involving consent relating to external players (e.g., for access to the resources and data of a particular MOOC platform or course by others not directly involved in the MOOC). We critically consider these three different layers of consent by reviewing the practices of four MOOC providers from the United States and Europe, flagging issues for further consideration.

This study attempts to broaden the notion of consent beyond uses of student data for *learning* purposes. We propose that consent also includes uses of student and/or institution-generated *content,* as well as provision for the collection of student behavioural data for purposes outside the original *domestic* context for which consent was provided.

Mapping Consent in the Micro, Meso, and Macro Contexts of MOOCs

User Consent in Higher Education: A Brief Introduction

Collecting, analysing, and using student data has always been a part of (higher) education ranging from, inter alia, using formative and summative assessments as data to inform interventions and/or report on student progress, to automated recommender systems personalising student feedback and support. Traditionally, *user consent* for the collection, analysis and use of data was implied when students accepted the Terms and Conditions of the service provider. As Sclater (2018) indicates, most of the data currently collected, analysed, and used are lawful in terms of the institution's legitimate interests, or "necessary to fulfil your legal contractual obligations with the student" (Sclater, 2018, par. 6). There are two exceptions: Collecting, analysing, and using special category or sensitive data (e.g., ethnic origin) requires explicit, additional consent *before* the data are collected. Consent is also needed when specific interventions will be made to students' learning experience (e.g., additional assessment or alternative courses) based on their analytics (See Sclater, 2018; the European TeSLA project [http://tesla-project.eu/]).

With the increasing move towards online learning across borders and the proliferation of data brokers, service providers, and inter-institutional agreements, as well as an increasingly expanding market for student data (Russell et al., 2018), the consent students provide at the point of first registration has potentially far-reaching and unforeseen consequences.

User Consent as Layered

Until the emergence of learning analytics as a deliberate process to inform pedagogy at a student and faculty level, aggregated student data were used to inform functions such as funding, quality assurance, and policy, in what became known as *academic analytics* (for a full discussion see Long & Siemens, 2011b). Another way to distinguish between the uses and audiences of learning analytics is to reference three levels - namely *micro* (individual user actions); *meso* (institution-wide application and use); and *macro* (region/state/national/international) levels (Buckingham Shum, 2012). The micro level correlates with the definition by Long and Siemens' (2011b) that learning analytics is distinct from academic analytics, in that the latter is used by management for reporting and strategic planning purposes. In contrast to academic analytics, learning analytics is of "primary interest to *learners themselves*, and *those responsible for their success*, since it can provide the *finest level of detail*, ideally as *rapidly as possible* [emphasis added]" (Buckingham Shum, 2012, p. 3). At the meso level, Buckingham Shum (2012) defines academic analytics as learning analytics used alongside business intelligence, primarily to inform and optimise workflows and business processes. Macro-level analytics apply at an inter-institutional level and can be used for "'maturity surveys of current institutional practices or improving state-wide data access to standardised assessment data over students' lifetimes" (p. 3).

User Consent in MOOCs

Khalil, Taraghi, and Ebner (2016) argued that the use of learning analytics in MOOCs drives questions related to privacy, transparency, and consent. With a central focus on consent, this paper suggests implications for the scope and nature of consent for each of the levels of learning analytics, illustrated by the consent that students provide when registering for a MOOC (micro level). We consider how this consent is affected by the agreements of the content provider (e.g., a higher education institution) with

the MOOC platform (e.g., FutureLearn; meso level). And finally, the implications of the initial consent provided by students on the scope and nature of the sharing of personal data between the MOOC platform provider and other data stakeholders are explored in the context of the stipulations and guarantees (or lack of) in the MOOC's privacy or data-sharing documents (macro level).

Figure 1 illustrates the range of stakeholders and some of the actions taken at each of the micro, meso, and macro levels (A-C). Point A illustrates the stage (micro level) at which students enter into an agreement with an educational provider by accepting the Terms and Conditions. Students consent not only to have their *data* collected, analysed, and used, but may also cede the copyright and ownership of the *content* they produce on these platforms. The Terms and Conditions are, in turn, influenced both by factors in a given geopolitical context and regulatory environment, and by the purpose of the collection, analysis, and use of user data by the learning platform provider (e.g., FutureLearn).

Point B illustrates the boundary between the higher education institution as the MOOC *content and teaching* provider, and the MOOC *platform* provider (meso level). At this point, there is consent from the content and teaching provider to have *content* and *teaching* hosted on the platform. Additionally, there may also be agreement that allows the platform to harvest information from the instructors and for the teaching institution to cede the copyright of the materials. On a meso level, we may also find other complexities – for example, where the providing institution and the platform provider are in different geopolitical contexts governed by different regulatory frameworks and legislation.

The macro level (Point C) maps how the *initial* student consent at micro-level (Point A) may play out in the nexus between the MOOC *platform* provider and other data stakeholders. While third-party use is often included in the Terms and Conditions of MOOCs (Prinsloo & Slade, 2015), there are increasing concerns about the range of actors, whether human or algorithmic, having access to the content and data on these platforms, and who analyses and uses the data, often outside the scope and declared purpose of the initial consent provided by students at the point of registration (Point A).

In the light of this layered "lattice of information networking" (Solove, 2004, p. 3), it is important then to investigate the nature and scope of user consent at the initial point of contact (Point A), and how that notion of consent changes from micro and meso to the macro level.

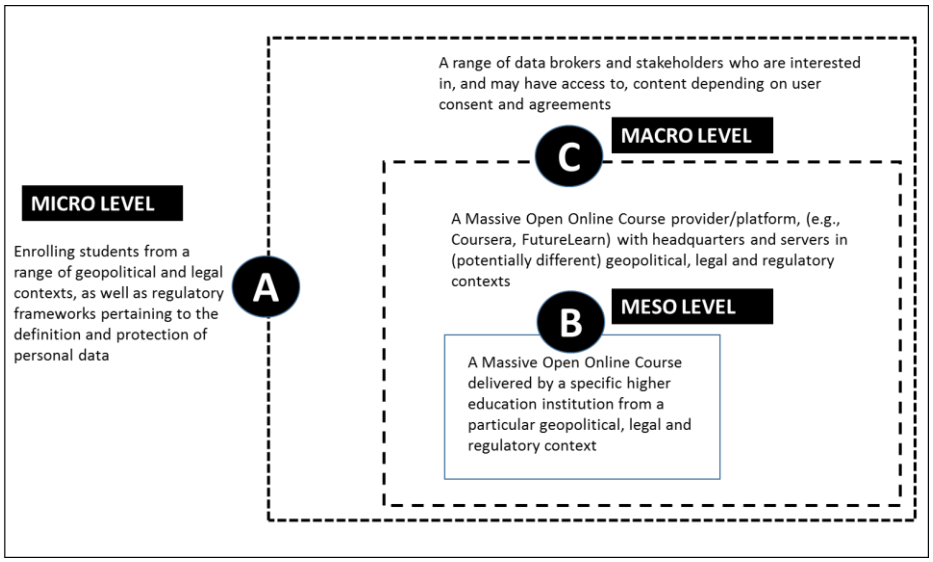

Figure 1. Mapping the micro, meso, and macro-levels of consent in MOOCs.

At the micro level (Point A), the issue of consent pertains specifically to the collection, analysis, and use of student data in learning analytics.

Learning analytics was initially defined as "the use of intelligent data, learner-produced data, and analysis models to discover information and social connections, and to predict and advise on learning" (Siemens, 2010, as cited in Ferguson, 2012, p. 9). Later, the Society for Learning Analytics Research (SoLAR) refined this to "the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Long & Siemens, 2011a). In the context of the collection, analysis, and use of student data, the issue of consent is a constant, however relatively, marginal issue (Prinsloo & Slade, 2017; Sclater, 2017a; Slade & Prinsloo, 2013).

Much of the current research on student consent refers to the context of higher education, and specifically, institutional learning management systems (Siemens, 2013). Consent in the context of MOOCs is less researched (Young, 2014). Typically, MOOCs are open to a broad set of students enrolling from a range of geopolitical, legal, and regulatory frameworks. Students from these different contexts and regulatory frameworks will have different epistemologies and cultural capital. The assumptions underpinning their understanding of "consent," privacy, and risk, will therefore vary. On a meso level (Point B) we need also consider the potentially different geopolitical, legal, and regulatory frameworks within which the content-provider (e.g., a university) and the host MOOC platform (e.g., Coursera, FutureLearn) operate. Consent here not only implies agreement related to educational content, but also to copyright, and responsibilities to ensure that course outcomes and materials are updated and of good quality. There may also be issues with how the behavioural data of course instructors are regarded by MOOC platform providers.

At a macro level (point C), MOOC platform providers may wish to share data (and content) on their servers with official entities (e.g., legal enforcement agencies and government), and with (un)specified data brokers and commercial entities. The macro level could also refer to a learner (micro level) enrolment in an institution's offering (meso level) via a social media account (macro level). In such cases,

with data flows between the social media platform (e.g., Facebook), the MOOC platform provider and the institution offering the course, consent becomes a potential minefield.

Consent at the Micro Level

Given increasing concerns around privacy and surveillance, coupled with changes in international legal and regulatory environments, the issue of user consent is of clear interest (e.g., Ball, Haggerty, & Lyon, 2012; Bellman, Johnson, & Lohse, 2001; Solove, 2013). While it falls beyond the scope of this paper to comprehensively map the many issues pertaining to user consent, the following broad issues apply here:

- Regulatory and legal frameworks often lag technological developments and, so reliance on regulatory and legal frameworks can only be part of the solution. The success of laws and frameworks depend largely on the ability of various institutions to oversee and enforce the regulations (Lane, Stodden, Bender, & Nissenbaum, 2015; Pasquale, 2015; Solove, 2004, 2013)

- Digital promiscuity appears to be an increasing phenomenon. While there is growing protection of individuals' right to privacy, and a general awareness of privacy and the collection, analysis, and use of personal data, there remains evidence of irrational sharing of (often) highly personal information in environments that may not be secure (Kehr, Kowatsch, Wentzel, & Fleisch, 2015; Payne, 2014)

- When individuals opt to share information, their decisions are based, inter alia, on how much trust they have in the online service provider to protect their information, how much control users have to change or delete their information. The relationship between trust, privacy and control, and perceived benefits is known as the "privacy calculus" (Krasnova, Veltri, & Günther, 2012).

- The length and inaccessibility of Terms and Conditions (Miltgen & Smith, 2015; Miyazaki & Fernandez, 2000) also impacts on user understanding and acceptance of the scope and purpose of the collection, analysis, and use of their data.

- While users may engage with the immediate implications of the collection, analysis, and use of their data, there are increasing concerns pertaining to the downstream use of data by a plethora of users; data brokers; individual, commercial, and legal entities; and platforms (Lane et al, 2015; Solove, 2004, 2013)

- The increasing role of algorithmic decision-making systems and concerns about, inter alia, the lack of human oversight and regulation (Pasquale, 2015). Interestingly, GDPR specifically addresses the issue of automated decision-making "that has legal or similarly significant effects on them" (Sclater, 2018, par. 24), requiring that "humans are involved in decisions with significant consequences" on data subjects (Sclater, 2018, par. 25).

Given that GDPR is flagged as an "instrument for the globalisation of privacy standards" (Bennett, 2018, p.1), Sclater (2018) stipulates a number of requirements at micro level (point A, Figure 1), namely:

1. Consent requests should be kept separate from other terms and conditions.

2. Clear and specific information must be given to the students about what they are consenting to.

3. Students should be informed of any third-party data controllers who will rely on the consent.

4. The consequences of both providing and withholding consent must be made clear.

5. Clear, affirmative action is required by the student; the use of pre-ticked boxes would not be acceptable.

6. Mechanisms must be put in place to enable students to easily withdraw their consent at any time–with the consequent removal of their Special Category Data from all databases or withholding of any interventions.

7. Records should be kept of any granting, withholding, or withdrawal of consent by students (par. 18).

The above requirements echo pointers expressed in one of the earliest published explorations of the ethical implication in learning analytics. One of the six principles proposed by Slade and Prinsloo (2013) refers to the issue of "transparency," which they later expand into a set of questions including "Who benefits and under what conditions?" (p. 1521) and how to deal with issues pertaining to consent, de-identification, and opting out.

Though GDPR provides much clarity on the scope, nature, and nuances of consent at the micro level, there are concerns that

> data protection law does not halt surveillance, it manages it. It may produce a fairer and more efficient use of and management of personal data, but it cannot effectively control the voracious and inherent appetite of modern organisations for more and more increasingly refined personal information, especially when those data are central to the business models of the platform economy. (Bennett, 2018, p. 8)

Research by Russell et al. (2018) confirms that even though GDPR may provide some safeguards and increase user understanding of the scope and nature of consent, it will not necessarily curtail the market value for personal data. The extent to which GDPR will impact on stemming the growth in the market for student data remains to be seen.

Consent at the Meso Level

Privacy is no longer a "domestic issue" (Bennett, 2018, p. 2) with data shared across platforms, and different geopolitical, legal, and regulatory frameworks within which the content-provider (e.g., a university) and the host MOOC platform (e.g., Coursera, FutureLearn) operate. There is, as far as we could establish, no published research on the implications of GDPR for data exchanges between the offering institution, the hosting platform provider (and its legal and regulatory environment), and the legal and regulatory environment of students. MOOCs may be designed and delivered on a platform based in a particular geopolitical and regulatory environment. The offering institution may then be in a different geopolitical and regulatory context, regulated by different rules and provisions. This raises complex new areas for exploration. Bennett (2018) states that "adherence to privacy standards is now regarded as a necessary condition for the international, networked economy" and that there "are certainly no geographical barriers to diffusion" (p. 7). He continues to warn that the existence of legislation and regulation does not, necessarily, ensure its effective implementation and that many laws

"are totally symbolic" (p. 8). In line with Bennett (2018) and Russell et al (2018), the existence of GDPR and its impact on transnational flows of data will have to be seen.

In research carried out by Prinsloo and Slade (2016) on student consent in the context of three MOOC providers, several issues were flagged which illustrate the complexity of consent on the meso level. For example, the authors note that "personal data" is defined differently on different platforms, or not defined at all, and that the scope and type of data collection methods are not always declared or defined. Although students had the option to disable selected installed cookies, such action will impact on the functionality of the services provided.

Khalil, Prinsloo and Slade (2018) refer to this as the "unbearable lightness of consent" in the context of later research on MOOC providers from different geopolitical contexts, noting that uses of personal data unrelated to the course of study were unclear and in general, that the scope, and implications of consent "remain(s) largely unsatisfactory."

Consent at the Macro Level

The implementation in 2018 of GDPR has dramatically changed the playing field. GDPR addresses the different complexities in the collection, analysis and use of data by a range of stakeholders, including, but not limited to, commercial providers and enterprises, governments, (independent) algorithmic agents, and in the context of education, providers of formal, informal, and post-formal education. Various authors explore the sharing, selling, remixing, and re-identification of user data outside the original consent provided by the user (Crawford & Schultz, 2013; Lane et al., 2015; Solove, 2004, 2013). Lane et al. (2015) claim that "privacy and big data are simply incompatible, and the time has come to reconfigure choices that we made decades ago to enforce constraints" (p. xii).

Within the context of developments in international privacy protection and regulation of data flows, we should not overlook the complexities that arise when stakeholders (e.g., students, content providers, and MOOC platform) are based in different geopolitical locations (Bennett, 2018; Khalil, Prinsloo & Slade, 2018; Sclater, 2017a, 2017b). For example, students from different geopolitical and regulatory contexts may enrol for a course offered by a specific institution, possibly in different geopolitical and regulatory context, offered on a platform in yet another geopolitical and regulatory context, who would then share user data with data brokers, third-party providers, and other stakeholders in other geopolitical and regulatory contexts. This is further complicated if we consider that the MOOC platform provider may provide access to user data to data brokers, third-party providers, and other stakeholders in other contexts.

In the next section, we review the approaches taken to user consent from four MOOC providers based in different geopolitical contexts, and identify issues related to the micro, meso, and macro levels.

Methodology

The methodology adopted for this study is a multiple-case study of the Terms of Use and the Privacy Policies of four MOOC providers with the aim of mapping the scope and content of user consent on micro, meso, and macro levels. The purpose of this multiple-case study is to explore and map how

consent, which has been provided to collect and use data, is a) described to potential users and b) how that consent applies at each level.

The research design entailed a qualitative, interpretive study entailing a directed content analysis (Bos & Tarnai, 1999) whereby authors transmit the meaning of a text through interpretive reading. Using a *deductive*, directed content analysis approach entails identifying key concepts of variables as initial coding categories, defined by theoretical frameworks and published research (Elo & Kyngäs, 2007).

Four cases were considered involving MOOC providers from the United States and Europe (see Table 1). Coursera (http://coursera.org) and edX (http://edx.org) represent the largest US MOOC providers with student enrolments of over 25 million (Coursera) and 10 million (edX) respectively, and FutureLearn (http://futurelearn.com) and iversity (http://iversity.org) represent the European MOOC providers with student enrolments of 7 million (FutureLearn) and 1 million (iversity), respectively. At the time of the study, the providers had offered a variety of MOOCs: Coursera (2,000), edX (1,750), FutureLearn (640), and iversity (110). The geopolitical locations of the studied MOOC platforms provided an opportunity to examine the ways in which European and U.S. legislation shape and approach user consent.

Table 1

Background Information of the MOOC Providers

Description	**edX**	**Coursera**	**iversity**	**FutureLearn**
Country	USA	USA	Germany	UK
Launch year	2012	2012	2013	2012
Enrolments	10,000,000	25,000,000	1,000,000	7,100,000
Documents analysed (effective and last update)	Terms of Service (Jan. 2016) Privacy Policy (Oct. 2014)	Terms of Use (April 2015) Privacy Policy (Oct.2015) Privacy Shield Policy (June 2017)	Terms of Use (n.d.) Privacy Policy (Feb. 2016)	Terms and Conditions (n.d.) Privacy Policy (n.d.)

The units of analysis included were the four providers' publicly available Terms of Use and the Privacy Policy. Each MOOC provider affords conditions which users must accept to use their service. Coursera and iversity describe this as the Terms of Use, edX as the Terms of Service, and FutureLearn as Terms and Conditions. The text of these documents was copied from the MOOC provider websites on (September 13, 2017). The analysis was performed in (February 2018). It is worth noting that the privacy policy of the MOOC providers was updated to reflect changes relating to the ways in which individuals' data will be handled and stored to be GDPR compliant. This study is based on an examination of documents obtained in September 2017.

The privacy policies and terms of use (or terms and conditions) for each provider were copied and pasted into separate text files using UTF-8 character encoding. Each file was labelled for identification purposes. In total, there were eight text files, totalling 120 pages and 36,965 words.

The text material was examined thoroughly with a view to reflecting issues relating to consent at the three levels (i.e., micro, meso, and macro) as informed by published literature, and specifically the framework of Buckingham Shum (2012).

Methodological Norms

The dialogical model proposed by Rule and John (2011) in which theory and research interact dialogically throughout the research process was adopted:

> Such an approach acknowledges that theory infuses research in all its aspects, including the identification and selection of the case, the formulation of research purposes and questions, the survey of literature, the collection and analysis of data, and the presentation and interpretation of findings. (p. 100)

We addressed the validity, reliability, and trustworthiness in the directed content analysis by transparency regarding the process including the selection of analytical constructs from the literature review, coding, member checking of the codes, constructs, and analyses (Elo & Kyngäs, 2007; Zhang & Wildemuth, 2009).

The researchers held regular virtual meetings and took responsibility for peer cross-checking of terms, levels, and analysis. An audit trail was kept of member comments and changes. As such, the suggestions by Rule and John (2011) of steps to ensure the *trustworthiness* (as an alternative to reliability and validity) of the analysis and findings were followed. In doing so, it is accepted that it is not only the final product that needs to be judged for quality, but also the process of inquiry. Thomas (2011) states that:

> Conclusions drawn from case study research become less pronounced when we realise that, to a greater or lesser extent, all forms of inquiry, especially social inquiry, produce knowledge that is provisional – in other words, good until we find out something else which explains things better. (p. 216)

Limitations

This research study covered four MOOC providers from the United States and Europe at a given date. We did not review the content of the privacy policy nor the terms of use from a legal perspective. This study attempts to examine the micro, meso, and macro perspectives of user consent in the studied MOOC platforms from a lay-person's dimension.

Results and Discussions

The analysis sought to establish and distil substantial points from the terms and conditions as well as the privacy policy of each MOOC provider at each of the three levels. The results of the analysis are presented below within three tables, which attempt to describe and categorise how consent is characterised in the policies of the four MOOCs at the micro, meso, and macro levels. It is worth noting that the context of the different levels occasionally overlap so that some issues are not exclusive to one level.

Micro Level

The micro level represents a narrow view within a limited direction of data usage between teacher(s) and student(s), that is, at a course level. This level typically involves student consent that their data are collected, processed, analysed, and interpreted to create interventions that affect learners and/or teachers. Many students would assume that the granting of consent would relate primarily to this level, that is, that data gathered about students would be used directly to support their own learning (Sclater 2017a, 2017b, Slade & Prinsloo, 2013). Table 2 shows the categorization of issues captured from policy documents at a micro level.

Table 2

The Micro Level of Consent in the Studied MOOC Providers

MOOC provider	Terms
edX	• Permission to copy, host, and modify user postings. • Consent to use the data for recommendation and personalization. • Receive newsletters and subscriptions. • Consent to collect and analyse online traces and learning patterns.
Coursera	• Permission to copy, host, and modify user content. • Consent to use the data to improve the education experience. • Consent for archiving, newsletters, and communication. • Verify identification. • Use and share of personal identifiable information and learner performance data with the instructor(s), teaching assistant(s), and the institution(s) with which they are affiliated.
FutureLearn	• Permission to exploit, host, and modify learner content. • Consent to collect entry data and traces for personalization and recommendation. • Receive newsletters and subscriptions.
iversity	• Permission to adapt and undertake user content (exploitation is prohibited). • Consent to collect and use data from: logfiles, cookies, web analytics for security reasons, and system optimization. • To receive newsletters and subscriptions, communication, and contact. • Consent to pass content data to instructor(s) and cloud-based teaching assistant(s).

The above analysis points to aspects to consider further in the light of published research on user consent. For example, when students enrol in edX, they provide consent for collection and analysis of online traces and learning patterns for recommendation and personalization. However, there is no further information regarding the specific criteria or data points used to identify learning behaviour, nor information on how students' learning journeys may change when their data are used to personalise their learning. Coursera shares personal identifiable information of learners with instructor(s), teaching assistant(s), and the institution(s) with which they are affiliated but does not provide an exact scope of what "personal identifiable information" may mean. It is also clear from Table 2 that users cede the right to the content they produce on these platforms. For example, users on Coursera consent that the provider may copy, host, and modify their content, while FutureLearn states that it will *exploit* student content. In stark contrast, iversity states explicitly that exploitation of student content is prohibited.

In considering suggestions by Sclater (2017a, 2017b), the initial consent provided by students does not, necessarily, cover agreement to having a learning journey changed or personalised. It seems that MOOC providers are inherently relying on students' trust that the provider will not abuse their data nor use it to their detriment (Prinsloo & Slade, 2015). Without knowing its exact parameters, consent may be, as Bellman, Johnson, and Lohse (2001) described "unbearably light."

Meso Level

The meso level operates at the institutional level (i.e., at the level of the whole MOOC platform). Consent for data collection and usage at this level often relates to building insight for accreditation, enhancing the online experience, and general website improvement. Table 3 demonstrates the categorization of the examined documents within the meso level. It would perhaps not surprise some students if their data were being used for some of these activities.

Table 3

The Meso Level of Consent in the Studied MOOC Providers

MOOC provider	Terms
edX	• To improve courses, do research, maintain security, archiving communication for future contact, etc.
Coursera	• For business purposes. • For demographic statistics, research, and to improve courses and online experience. • Transfer and process personal information on servers located outside the US. • Partner sites may share user's data with Coursera for improving Coursera's services. • Users have the option to log in to the Coursera website using their Facebook login details. This provides Coursera then with access to their Facebook data
FutureLearn	• Collect data for accreditation purposes and website improvement.

	• Consent to share data to the holding company and its subsidiaries.
iversity	• User consent, if logging using Facebook Connect, to allow iversity to collect, process, and use of all Facebook data (likes, profile picture, email, name of friends, cover photo, etc.).

At the meso level, the effects of the initial consent provided by students increase in complexity and potential impact. For example, Coursera explicitly states that it transfers personal information to servers located outside the United States. Coursera and iversity also record that they receive personal information when a user accesses or logs onto their sites using login details from a third-party site, for example, Facebook. A student accessing their site in this way also then provides access to his or her Facebook data. This has immense implications for students' understanding of the impact of the initial acceptance of the terms and conditions of the provider. Considering the recent public outcry regarding Facebook's data practices and its sharing of data with, among others, Cambridge Analytica, users should seriously (re)consider the scope and impact of their consent to providers' terms and conditions (Bennett, 2018; see also Meyer, 2018).

At a meso level, we get a glimpse of the unfolding and implications of the initial consent users provide. As the next section regarding the macro level illustrates, the scope and impact of the initial consent increases on macro level.

Macro Level

The macro level represents a broader view of sharing of data, analysis, and curricula with a wider community and with other stakeholders of similar disciplines (such as regional and international MOOC platforms or academic research institutions) and with (not obviously connected) stakeholders (such as governments, recruitment companies, and other third parties). Table 4 shows the categorization of the examined documents within the macro level.

Table 4

The Macro Level of Consent in the Studied MOOC Providers

MOOC provider	Terms
edX	• The collection, use, transfer, disclosure, and retention of information in and outside of the United States. • To transfer personal data between edX and third parties, affiliates, and subsidiaries. • To transfer applicable personal information to a jurisdiction which may provide a different level of privacy protection. • Third party payment processor when buying a certificate. • To use data for subpoenas, court orders, or other legal process; to investigate, or prevent, or take action regarding illegal activities. • To use anonymized data with public/third parties.

Coursera	• To transfer and distribute user content to share with partners or research purposes. • To share personal information with government authorities in response to subpoenas, court orders, or other legal processes. • Third Party Credit Card Processing.
FutureLearn	• To transfer and distribute learner content to display on the website or online content and courses. • Share data with third parties to provide services that one requested. • To an exchange of data in case of protecting FutureLearn against fraud. • To share data with partners for research and course improvement.
iversity	• To use anonymized personal data for research purposes with academic institutions. • To pass content data (profile and course data) to other platform users or other platforms (opt out is available). • Governmental and regulatory use. • Share content and inventory data with recruiting companies. • To allow third party tools like "conversion tracking tools" from Facebook and Google to track the effects of marketing measures.

The tables above demonstrate that consent is considered by MOOCs at all three levels. What might be surprising to users is the way that consent is employed to predominantly provide benefit to the MOOC providers. A huge amount of data is collected, much of which is not obviously associated with a learning experience. It is evident from Tables 2, 3, and 4 that the terms of use and privacy policies of the four reviewed MOOC providers emphasise issues far beyond student learning and insights for content providers. Even where it is stated that data will be used to improve learners' experience, it is not clear how this is done, how often, nor how learning analytics is employed for optimization purposes (i.e., interventions, recommendations, personalisation).

This largely confirms Sclater's (2017a) view that consent remains an issue when learning analytics is operationalised within education. In reviewing and mapping the policy documents, ambiguity was also an identified feature.

Despite the generous provision of "free learning," it seems clear from the reviewed policies that user consent is employed to gain significant insight into individuals' personal data.

(In)conclusions

User consent, and in the case of online education platforms, student consent, is often considered in the specific context of the providing institution. With the advent and continuing growth of MOOCs, this paper suggests that the initial consent provided by students at the point of registration has considerable potential for misinterpretation. This study highlights a need to more explicitly consider consent issues when data is used and shared on meso and macro levels in learning analytics. Given the range of uses to which data is put, consent needs to be more clearly seen for what it is—as allowing data to be used, re-used, and shared with a range of stakeholders and for a range of purposes well outside the original assumptions and understanding of those accepting the Terms and Conditions.

The implications of this study are far-reaching, for students, for higher education institutions offering courses on MOOC platforms, and for MOOC platforms themselves. MOOC platform providers should be more transparent about their definitions of personal data; the ways in which data are collected and the purposes for which data are collected and analysed; and who data will be shared with and under what circumstances. While it falls outside the scope of this paper to map the legal implications of GDPR for MOOC platform providers, students and higher education institutions should have a clear(er) understanding of how the initial consent of students (Figure 1, Point A) has vast implications for the downstream use of a range of data-collectors, users, and brokers.

Studies provide ample evidence that users do not engage with Terms and Conditions in any context, educational or otherwise. Given that higher education institutions have a fiduciary duty towards students, they should find ways to make Terms and Conditions pertaining to consent more understandable and accessible. For instance, MOOC providers can show a banner where students can opt in or out of certain personal data collection and processing prior to enrolment.

We believe that students can no longer afford to claim ignorance or have limited choices in accepting Terms and Conditions of any online service, including MOOCs. This also applies to situations when students are registering for what may appear to be free educational services. Student bodies and consumer organisations should scale up their efforts to increase student agency and literacy regarding the scope, nature, and implications of their consent.

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Interactions in MOOCs: The Hidden Part of the Iceberg

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Abstract

Interactions that take place between MOOC users outside of discussion forums, and out of the reach of course designers, have received little attention from the scientific community despite their potential influence on learner retention. Based on an online survey, we found that MOOCs are often used as an activity among friends and family, and not exclusively in the academics or in the workplace. Interactions between course users may continue beyond of the boundaries of the course, and sometimes into other MOOCs. These various interactions include collaborative tasks, as well as tasks which should be performed individually, such as assessments. This work illustrates the mismatch that can appear between prescribed and actual tasks, and the potential importance of interactions between users, to address the isolation that contributes to low retention rates for online learners.

Keywords: MOOC, interactions, social networks, lifelong learning, completion rates

Introduction

While Massive Open Online Courses (MOOCs) undoubtedly represent a form of distance education, they all share a common characteristic that makes them unique in the online learning ecosystem: registration is typically free (Daniel, 2012). This is in sharp contrast with traditional distance education, where peer interactions occur primarily between learners who have paid fees to an institution or a company. For a learner in a tuition-free course like a MOOC, it is easier to encourage relatives, friends, and colleagues to enroll in a course with them. It is then possible to either do the work collaboratively or simply discuss the content of the class. Such interactions between learners, which are likely to occur beyond course forums, has been discussed in MOOC literature (Veletsianos, Collier, & Schneider, 2015). These interactions can greatly impact learner retention and course satisfaction, as was documented in research on the interactionist paradigm (Tinto, 1975; Thomas, 2000; Rovai, 2002, 2003).

Several qualitative studies have revealed the existence of interactions in MOOCs, beyond those that occur on course forums (Milligan & Littlejohn, 2014; Veletsianos et al., 2015; Kellogg, Booth, & Oliver, 2014). Most quantitative analyses of such interactions date back to the pioneering connectivist MOOCs (cMOOCs) of the late 2000s (Fini, 2009; Kop, 2011), and as such, there is a great lack of data regarding non-connectivist MOOCs, often labelled xMOOCs (Daniel, 2012). Because of the relative absence of quantitative data on these interactions, it is difficult to discern whether those observations of interactions occurring outside of the forums are anecdotal or rather reveal a widespread phenomenon. In this paper, we aim to provide such quantitative data through the analysis of 7,000 survey responses retrieved from students registered in 12 MOOCs organized through French universities.

The first question of the survey tried to assess the extent of the phenomenon. How common is interaction between learners outside of course forum boundaries? In our opinion, a study focused on such a question would provide little information. Indeed, it is assumed that a brief online chat between two friends regarding a course they both engage in does not have the same significance or impact on retention than a face-to-face collaboration on assignments between colleagues or family members. This leads to a second set of questions. Which types of learners are the most likely to interact outside of discussion forums on MOOC-related topics? Do these interactions mostly take place face-to-face or online? What is their purpose?

To show the lineage of such questions, we will first discuss the historical and theoretical aspects of the relationship between interactions and course retention (Tinto, 1975), and then present a selection of publications on interactions in MOOCs. The research presented here was inspired by the work of renowned researchers like Tinto (1975, 1982) who have pinpointed the influence of parameters, such as *social integration*, on retention. Social integration depends upon daily interactions, particularly with other students. Decades later, many authors still underpin its importance, in particular within the context of distance education (Fulford & Zhang, 1993; Thomas, 2000; Rovai, 2002, 2003). This line of reasoning inspired our research questions. A few articles have aimed to identify the channels used by participants to interact with one another in the first generation of MOOCs, often labelled as connectivist (Fini, 2009; Kop, 2011; Koutropoulos et al., 2014), using a quantitative perspective. Due to the small number of registrants, surveys generally gathered only a few dozen answers and are no longer relevant since the phenomenon has grown since then.

After 2012, publications shifted from interactions in cMOOCs to interactions in xMOOCs, with an important focus on course forums (Gillani & Eynon, 2014). Most work on interactions outside the

course forums is qualitative: for example, Milligan and Littlejohn (2014) studied a MOOC on clinical research through a qualitative approach and discussed the use of MOOCs within professional networks; Veletsianos et al. (2015) focused on the experience of learners on social networks, and mentioned the existence of interactions about the MOOC within the family circle; Bulger, Bright, and Cobo (2015) analyzed 4,000 face-to-face events organized in 140 countries through meetup applications; Chen & Chen (2015) focused on the interactions between students in a MOOC that was incorporated into course curriculum. While this qualitative research provides a glimpse into student interactions and a first basis for designing a survey, it is our opinion that a quantitative analysis should also be conducted to clarify how widely these interactions occur. In the following paragraphs, we explore the details of the design and methodology we followed to plan and implement the survey.

Material and Methods

Design of the Survey Items

Items used in this survey were designed based on a review of the literature on interactions in MOOCs. In addition to the usual questions on demographics and motivations to register (Appendix), we gathered three types of information:

1. The nature of the relationship among the learners, specifically distinguishing between the interactions that occurred among people who knew each other before the course, such as colleagues (Milligan & Littlejohn, 2014) or family members (Veletsianos et al., 2015), and the interactions that occurred among learners who met through the MOOC.

2. The distinction between face-to-face meetings and online interactions in the MOOC, primarily focusing on the purpose of these interactions.

3. The number of MOOCs users' reported to have registered for and/or completed. A subset of the questions were tailored to specific respondents. For the main example, items related to the nature and modality of interactions were addressed only to the respondents who had interacted with a fellow learner outside of forums in a previous MOOC. For this subset of questions, only a few hundreds of responses were collected. Only a translation from French of the exact wording of the questions, as well as the corresponding possible answers, will be provided. In the following paragraphs, we will delve further into the methodology used for the distribution of the survey.

Methodology of Delivery of the Survey

In a MOOC, the proportion of registrants who answer a survey tends to decrease sharply after the first week of the course (Lamb, Smilack, Ho, & Reich, 2015), which led us to ask the partners organizing the course to deliver the survey as early as possible. All of the surveys were therefore delivered during the first week of the course, which meant that the answers reflected either the participants' declared intentions to interact with others during the remaining weeks of the course, or on their past behaviors in previous courses. The debatable reliability of declared intentions drove us to focus on accounts of past interactions for a significant amount of items.

The survey was sent to 11 MOOCs organized on FUN (France Université Numérique), and one MOOC organized on *Canvas.net*, between September 2015 and November 2015 (Table 1). It is important to note that for all the courses we studied, both the registration and certification were free. Most teams from French institutions whose MOOCs were launched during this period of time were contacted. All of those that agreed to deliver the survey were included in the study. The fact that most were organized on FUN, and only one on Canvas, reflects the predominance of FUN in the French MOOC ecosystem. We believe that the technological differences between these two Learning Management Systems have little impact on the interactions occurring outside of the boundaries of course forums.

Table 1

A Description of the MOOCs Included in This Study

Course ID	Course name	Platform	# of answers	Launch date	End date
ASSO	Launching a Student Association	FUN	140	05/11/2015	02/12/2015
CB	Creative Box	Canvas	1392	28/09/2015	28/10/2015
CC	Climate Change: Mechanisms and Stakes	FUN	624	21/09/2015	23/11/2015
EDD	Sustainable Development	*FUN*	810	05/10/2015	23/11/2015
ER	Renewable Energies	FUN	1190	28/09/2015	23/11/2015
FLE	French as a Foreign Language	FUN	322	02/11/2015	18/12/2015
MOOCAZ	Designing a MOOC from A to Z	FUN	667	02/11/2015	16/12/2015
MSD	Deformable Solids	FUN	271	21/09/2015	23/11/2015
PDM	Mechanical Sizing	FUN	156	21/09/2015	22/11/2015
PU	The Weight of the Universe	FUN	561	14/09/2015	19/10/2015
RMOOC	Introduction to Statistics with R	FUN	499	14/09/2015	25/10/2015
VP	Physical Volcanology	FUN	982	05/10/2015	30/11/2015

**Note*. N=7614

A total of 7,614 answers were collected. The details of these courses and the number of answers per course are provided in Table 1. The analysis of sociodemographic data shows that in most courses, a majority of learners work full-time or part-time and have at least a Master's degree (Table 2) – a result consistent with published studies (Christensen et al., 2013; Seaton et al., 2014). We observed that 81% of respondents declared that they live in France.

The survey was accessible as a *Google Form* embedded in a page on the first section of the course in an attempt to increase response rates. It is likely that the self-selection bias inherent to this type of survey may have induced an overrepresentation of learners particularly engaged in the course, and therefore the most likely to interact. As well, it is important to note that the interactions between learners outside of discussion forums may be less common in the courses than they appear in the survey.

Table 2

Sociodemographic Data of Studied Courses

Course	No diploma of H.E.	Two- or three - year diploma	Master degree	PhD	Employed full time	Employed part time	Liberal professions	Student	Unemployed	Retired	Other
ASSO	24	46	26	4	19	4	4	61	10	0	1
CB	9	31	34	4	30	3	8	48	7	1	4
CC	8	31	51	10	43	8	5	12	12	17	4
ER	14	29	52	6	43	5	9	14	17	8	4
EDD	10	34	50	6	41	8	7	13	19	6	6
FLE	5	24	36	6	35	14	8	13	17	8	5
MOOCAZ	10	44	58	14	58	9	14	5	9	2	4
MSD	14	32	38	8	41	2	4	32	16	3	3
PDM	6	37	50	7	44	3	6	14	22	6	5
PU	3	18	44	10	48	6	7	8	7	22	3
RMOOC	11	31	58	22	50	3	5	16	12	3	10
VP	10	34	44	13	48	6	6	10	10	17	3

**Note*. N=7614; H.E. (Higher Education)

The substantial number of answers (n=7,614) regarding the context surrounding participants' registration in the MOOC enabled us to calculate an average and a standard error among the different variables that we surveyed (introduced by ± in the text, which accounts for the variability between the 12 courses). For the subset of questions where we collected only a few hundred answers, results were described using a different approach. Percentages provided here were computed from pooled responses, and as a result, no standard errors will be provided.

Results

Registering Alone or With Other People

The questions that were asked of all respondents focused on two topics: collective registration and intent to complete the course. We first addressed the frequency of what we called "joint registrations," which corresponded to the fact that a learner registered for a course with another learner they already knew: "Have people you know (friends, colleagues, etc.) registered in this MOOC?" Three mutually exclusive answers were possible:

- 82% (±13) answered "Not to my knowledge."

- 7% (±4) selected “Yes, but we do not intend to interact.”

- 11% (±6) chose the answer, “Yes, we intend to interact, whether it is to exchange information about the course, to motivate one another, or to perform activities together.”

Most respondents appeared to follow the course on their own. Nevertheless, they may have unknowingly prompted some people to register in the course. If they did, it might generate interactions over the course later. We asked the question, “Have you recommended registering to the course to people you know?” Three non-mutually exclusive answers were possible:

- 56% (±10) answered “No.”

- 20% (±7) answered “Yes, I have advised some friends or some family members to follow the course.”

- 19% (±7) responded “Yes, I recommended it to some colleagues (or classmates, in the case of students).”

- 4% (±2) responded “Yes, I recommended it to both: some colleagues (or classmates, in the case of students), or friends and family members.”

The proportion of learners who recommended the course was significantly higher than the proportion who registered with people they knew. We were also interested in assessing the extent to which respondents were encouraged to register in the course. We therefore asked the question, “Were you encouraged to register in the course?” Three mutually exclusive possibilities were proposed, one outlining the existence of a hierarchical relationship with the person who recommended the course:

- 85 % (±9) chose “Nobody encouraged me to register in the course.”

- 7 % (±3) answered “A friend, a colleague (but not a superior), or an acquaintance encouraged me to register.”

- 8 % (±9) answered “A superior, a teacher, or equivalent, encouraged me to register in the context of my work or my studies.”

We found that only a small minority of learners were convinced to register to the course, which strengthens the argument that interactions are more likely to occur among users in the course forums, a hypothesis we will explore through the analysis of users’ behaviors in past courses. To perform such an analysis, it is important to assess to what extent respondents had registered to courses prior to answering the survey. This allows us to target learners who could provide insights regarding past interactions that actually occurred, or interactions that could have potentially occurred.

We made a distinction between three non-mutually exclusive situations: a learner may have started a MOOC, completed a MOOC, or may be in the process of completing another MOOC. We added the requirement that respondents needed to have invested at least one hour into the course in order to claim they had started another MOOC. Similarly, a respondent claiming to have completed the course, whether it was free or not, as defined as having obtained a certificate of completion.

- 27 % (±18) of respondents declared “I have never started a MOOC.”

- Up to 20 % (±5) of them declared "I have started more than four MOOCs."
- Interestingly, only 50 % (±13) of respondents declared "I have never completed a MOOC."

As typically less than 10% of registrants obtain a MOOC completion certificate (Ho et al., 2014), it suggests that the respondents of the survey may not be representative of most registrants. We focused on this group of respondents who were new to MOOCs – which we will later call neophytes – in order to see whether there was a connection between registration and the pattern of interactions. The results suggest that even though most respondents had registered of their own initiative, they were much more likely to have been encouraged to register by a hierarchical superior/a teacher (28% of neophytes), or by friends, colleagues, or acquaintances (10% of neophytes; Figure 1). This situation was in stark contrast with non-neophytes; only 7% of them had been encouraged to register to the course. Similarly, 26% of neophytes declared they wanted to interact with other learners, while only 6% of non-neophytes stated the same (Figure 1). Chi tests showed that these differences were highly significant (for incentive to register: chi = 1220.5, df = 2, p-value < 2.10^{-16}; for intention to interact: chi = 526.19, df = 2, p-value < 2.10^{-16}). These data suggest that word of mouth and top-down prompting play an important role in registration dynamics, and likely influence users' behaviors.

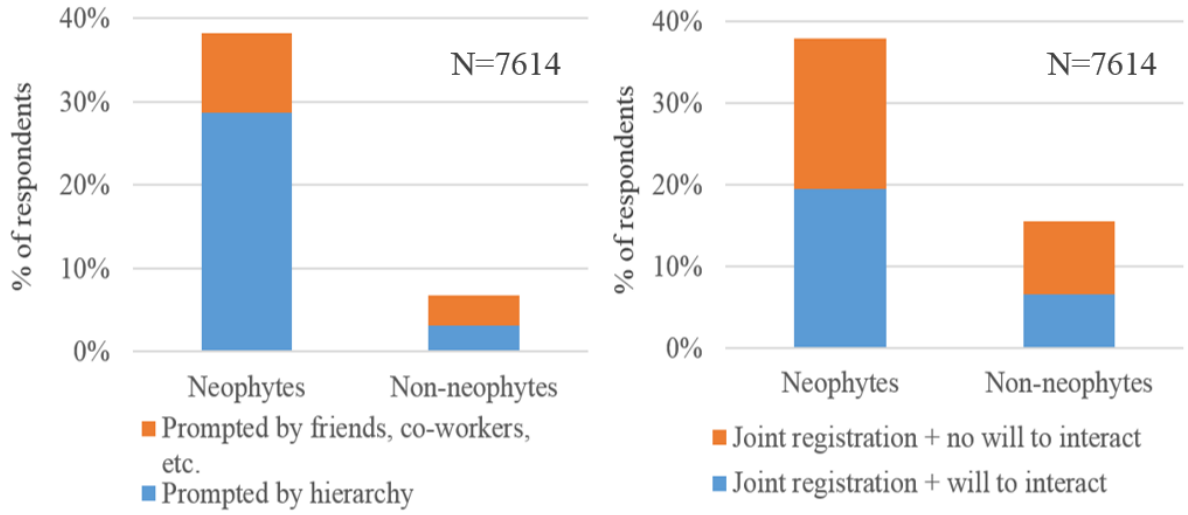

Figure 1. Differences in the interaction pattern between neophytes (who register to a MOOC for the first time) and non-neophytes. *Left*. Experience in MOOCs and incentives to register. *Right*. Experience in MOOCs and intention to interact. The exact wording of the questions and answers is provided in the text above.

Nevertheless, such data should be interpreted cautiously since it only represents declared intentions. To apprehend actual behavior, we focused on learners who already had registered to another MOOC before answering the survey (N=3350), beginning with the following question: "Have you interacted with a learner you knew ahead of the course in a previous MOOC?" The following answers were provided:

- 85% (±6) answered "No, I never registered in a MOOC with anybody."
- 7% (±5) chose "Someone I knew had registered in the course, but we did not interact."

- 8% (±3) picked “Someone I knew had registered in the course, and we did interact (discussions on the content of the course, collaboration over assignments, encouragements, etc.).”

An additional item was added to the survey in order to assess whether interactions outside of the boundaries of the course forums had occurred, and whether these interactions had gone on after the end of the course: “Have you interacted with a fellow learner outside of the boundaries of the course forums?” (N=3640). We specified that “fellow learners” did not include family members, friends, acquaintances, or colleagues. The analysis of the answers suggests that interactions beyond forums are uncommon, and that they do not last for long once the course is ended:

- 82% (±5) answered “No, never.”
- 13% (±5) chose “Yes, but only during the course.”
- 6% (±2) replied “Yes, and we have kept interacting after the course.”

In the following results, we intend to characterize these interactions. The corresponding questions were asked only to the respondents who had claimed they had interacted with a fellow learner. The various questions we have presented so far enable us to provide a quantitative perspective on the interactions among learners outside of the boundaries of the course forums. Even if they seem to concern only a minority of learners, they are far from being anecdotal and we need, at this point, to explore further the nature and purposes of such interactions.

Nature of Relationships, Object, and Channel of Past Interactions

In order to assess the nature of learner relationships with people they already knew in a course, we presented a question to gauge their level of prior interaction (Table 3). We proposed the following question: “If you followed a MOOC with someone you knew before the course, what was the nature of your relationship?” Choices were not mutually exclusive, since a learner could have interacted with different people, yet among the people who did identify a previous interaction, those people were primarily a “friend or acquaintance” (36%), “family” member (41%), or “colleague or classmate (for students)” (33%). Only 3% answered that they had interacted with “a person (they) met in a previous MOOC.” Family and friends seem to account for most of the interactions, while the proportion of people who met in previous MOOCs was negligible. The following questions aimed to identify the topic and the means of these interactions: “How did you interact?” and “Which communication means did you use?” (Table 3).

Unsurprisingly, face-to-face interactions seemed to prevail among learners who already knew each other ahead of the course, and virtual means of communication prevailed for learners who met during the course. Face-to-face gatherings with three or more participants appear to be uncommon without being negligible, since up to 17% of them declare they met up with people that they had pre-existing relationships with. This situation might be overrepresented among colleagues or classmates. We observed that 33% of learners who met in previous MOOCs engage together in activities, either individual or collective. This was slightly more frequent for friends, colleagues, or family.

Table 3

Object and Channels Used for the Interactions Occurring Outside of the Boundaries of the Discussion Forum for MOOCs Followed Before Answering the Survey

	People they knew ahead of the course	People they met during the course
If you followed a MOOC with someone you met ahead of the course, what was the nature of your relationship?	N=339	
▪ Friend or acquaintance	36%	
▪ Family	41%	
▪ Colleague or classmate	33%	
▪ Someone met in a previous MOOC	3%	
How did you interact?	N=339	N=238
▪ We watched some videos together (simultaneously).	27%	0%
▪ We helped each other in activities that were not supposed to be collective (quizzes, assignments, etc.).	26%	21%
▪ We did collective activities together.	17%	15%
▪ We encouraged each other to persist in the course.	56%	31%
▪ We discussed the content of the MOOC.	70%	62%
Which channel did you use?	N=339	N=234
▪ Virtual channels (social networks, email, etc.).	36%	52%
▪ We saw each other face-to-face.	69%	11%
▪ We saw each other face-to-face, in a group of 3 or more people.	17%	3%

These data suggest that two networks of interactions emerge during the MOOC, beyond the course forums. The first one corresponds to the immediate social circles of the learner. It is composed of friends, acquaintances, family, and colleagues, and is mostly made of one-on-one, face-to-face interactions. The other is virtual, composed of learners who meet for the first time in the MOOC, and is likely to originate in the course forums or the social networks associated with the course – Twitter threads, Facebook groups, etc. Those relationships might last a bit longer than the duration of the course, and for some learners, doing assignments together and becoming MOOC buddies. However, in the case of the French MOOCs, this rarely happens: less than 20 respondents developed such long-term relationships, out of the thousands that had completed a MOOC ahead of the survey.

Discussion

One of the main objectives of this paper was to provide a quantitative analysis of interactions in xMOOCs that had been almost exclusively subjected to qualitative research in previous studies (Milligan & Littlejohn, 2014; Chen & Chen, 2015; Veletsianos et al., 2015). In comparison to existing research, we were able to show that for most of the interactions, classmates or colleagues were not as much of a concern as family and friends or acquaintances. It was only in rare instances that previous MOOC interactions continued into another MOOC. Hence, it is unlikely that a large, hidden community of

MOOC learners, formed within course forums, exists (in France at least). Though it is rare, it is not uncommon to create interactions during a class, yet it has been found that these have a short lifespan. Face-to-face, one-on-one interactions focus on exchanges on the course and on motivational prompts to complete it. Collaboration on activities or synchronous visualization of course content, which was the focus of Chen and Chen's (2015) work, seem to be marginal, even though non-negligible. The purpose of an important proportion of the interactions we studied was to complete course activities that were required to be carried out individually. Many certificates were obtained thanks to such interactions, a phenomenon that could possibly undermine the value of these free statements of successful completion.

In the following paragraphs, we will propose a hypothesis as to why people tend to interact with users they already know rather than new acquaintances from the course forums. The first element to factor in is the relative absence of obstacles to joint registrations. As mentioned in the introduction, the fact that those courses are free fosters the development of interactions with relatives, relations, or the workplace. Self-regulated learning readiness may also contribute to this phenomenon. Kizilcec, Pérez-Sanagustín, and Maldonado (2017) have shown through large survey data and self-regulated learning scales that self-regulated learners were the most likely to complete the course. Moreover, numerous studies in distance education (Thomas, 2000; Rovai, 2002, 2003) have shown that the social integration of the learners is critical to their persistence in the course.

The association of these two ideas suggests that many learners could be self-regulated enough to understand that the absence of interactions in the course is likely to decrease their motivation to finish the MOOC. Some of them may therefore be trying to increase their social integration deliberately by enrolling colleagues or family members. The fact that one of the goals of the interactions was to encourage each other to persist in the course, corroborates this idea. Interacting with peers could be a strategy to compensate for the difficulty in interacting with faculty, but is made more difficult by the absence of dedicated features. In most xMOOCs, neither the discussion forums nor the design of the MOOCs are studied to foster collaborative learning (Margaryan, Bianco, & Littlejohn, 2015; Toven-Lindsay, Rhoads, & Lozano, 2015). It may therefore appear easier for learners to rely on already existing relationships rather than creating new ones.

This may explain why most learners try to enlist relatives, colleagues, friends, or acquaintances in the course, even if it rarely proves successful. The person that the learner encourages to join is likely dependent on their motivation to register for the course. We suggest that a learner will probably turn to colleagues when the MOOC is work-related, and to relatives, friends, or acquaintances in other cases. However, it is not possible to corroborate this trend based on the results of this survey, and further analyses are required to substantiate this statement.

Interestingly, it is common for learners to work as a group on tasks that are supposed to be carried out individually. We interpret this result to mean that many learners are disinterested in the certificate to demonstrate their own abilities, but instead view it as a means to increase their motivation to stay in the course. This observation corresponds to the *Goal Commitment* component of Tinto's (1975) retention model. Therefore, for these learners, collaboratively performing tasks that ought to be performed individually may not be considered as a form of cheating, since they may undermine the value to the certificate.

Since interactions outside the boundaries of the course appear to be uncommon, it is unlikely that they can provide enough social integration to make up for the lack of exchanges in the discussion forums.

This hypothesis is strengthened by the fact that the respondents of the survey were significantly more engaged in the completion of MOOCs than most registrants, and were therefore more likely to have interacted with a fellow learner. Following an interactionist approach, which has survived to this day in the literature on attrition in distance education (Thomas, 2000; Rovai, 2002, 2003), we can surmise that the lack of interactions among learners, notably outside of the discussion forums, represents one of the main explanations for MOOCs' low completion rates.

Conclusion

One of the limitations of our research is that it provides little knowledge about what triggered the interactions we described, and what enabled some of them to persist after the end of the course. Instructional design and course topic are likely to have had a strong influence on such interactions, but the survey approach we followed could not provide that information. A content analysis of the interactions that commence in discussion forums and continue afterwards, following Gillani and Eynon's (2014) work, could prove an interesting approach to deepen our understanding of this issue. One other limitation of our work is that we had to extensively rely on behavior in past MOOCs because launching a survey at the end of a MOOC would have elicited too few responses. Nevertheless, there is no simple way to avoid this methodological issue, given low completion rates.

Compared to traditional fee-based distance education, MOOCs have at least two characteristics that foster the implementation of interactions outside of the course forums. Firstly, registration is free. Secondly, the level of prerequisites for the course is generally low, since course designers often downgrade the difficulty level of the courses given to on-campus students so as to meet the expected MOOC audience's requirements (Najafi, Rolheiser, Harrison, & Håklev, 2015). Therefore, the certificates or statements of completion are usually designed to be within the reach of neophytes and are often not worthy of credentials in the eyes of the designers (Kolowich, 2013). The conjunction of these characteristics provides an interesting opportunity to foster collaborations within a learner's social circles, and therefore to fulfill one of the promises the pioneering MOOCs of the late 2000s held so high (Bell, 2011; Kop, Fournier, & Mak, 2011), increasing the quality and the quantity of interactions among learners. This dimension of learners' experience needs to be improved if MOOCs are to be more than a mere variation on free online videos with the addition of discussion forums – research surely has a role to play in such an endeavor.

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Appendix

Questions of the Survey Used in This Study

What is your gender?

What is the highest diploma you have got?

What is your current professional status?

What is your nationality?

In which country do you leave?

How old are you?

What was your main motivation to register to the course?

To what extent are you interested in obtaining the course certificate?

Have people you know (friends, colleagues, etc.) registered in this MOOC?

Have you recommended registering to this course to people you know?

Were you encouraged to register in the course?

Have you ever started another MOOC aside of this one?

Have you interacted with a learner you knew ahead of the course in a previous MOOC?

Have you interacted with a fellow learner outside of the boundaries of the course forums?

If you followed a MOOC with someone you knew before the course, what was the nature of your relationship?

How did you interact?

Which communication means did you use?

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Sustainability of Open Education Through Collaboration

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Abstract

The definition of openness influenced the sustainability of business models of Open Education (OE). Yet, whether openness is defined as the free (re)usage of resources, or the free entry in courses, there always is a discussion on who pays for the resources used in these offerings. The free offering of courses or materials raises the question if OE can be maintained independent of large government subsidies. This article analyzes four cases that each have a different approach to OE and (financial) survival. The aim of this study is to determine the most efficient conditions for a sustainable OE business model.

Instead of using different earning models, this research concentrates on the different aspects of unbundling (costs, income, and financiers), arguing that an adjusted Business Model Canvas can be used to analyze the not-for-profit organizations in higher education institutions (HEIs). The cases are OpenupEd, FemTechNet, MERLOT, and Lumen Learning. Openness plays different roles in the business models of the different organizations. For OpenupEd and MERLOT, openness of the materials offered to students and teachers (MOOCs, OER) is essential. For FemTechNet, openness is part of the need to collaborate and share within their community. Commercial organizations, such as Lumen Learning, use free materials to teach educational organizations to use these materials for their own courses. All four organizations use different key activities and key resources (for example, management competencies, social skills, or design and teaching skills) for their continuity. Yet, despite the differences between the case-organizations, community building is important in all cases. Either because producers and users of Open Education become identical, because standardization does decrease costs and increases findability and quality, or because they can bridge the difference between supply and competences necessary for usage of Open Education.

Keywords: open education, MOOCs, DOCCs, business models, collaboration, OpenupEd, MERLOT, FemTechNet, Lumen Learning, sustainability

Introduction

Higher educational institutions have offered classes, public lectures, summer schools, and alike, for free. Marshall (2012) states that "it could [be]… argued that public libraries were a form of open education with freely available content" (p. 112). It was the combination of the technical possibilities of the internet and a new social attitude towards openness that an open movement in education emerged. Open Education (OE) seems to take on two distinguished forms, Open Educational Resources (OER; UNESCO, 2002, 2012) and Massive Open Online Courses (MOOCs; Cormier, 2008).

MOOCs became so popular that *The New York Times* labelled 2012 "The Year of the MOOC" (Pappano, 2012). Hollands and Tirthali (2014) stated that due to these trends, education is changing towards education for more at lower costs and a change from knowledge accumulation towards skills and competences (p. 7). Although the authors are optimistic, they conclude that MOOCs do not lower educational costs (p. 168), or replace traditional education.

MOOCs are criticized for different reasons (Online Course Report, 2016; Czerniewicz, Deacon, Glover, & Walji, 2017). Despite all of the critique on the effectiveness of MOOCs, the production of MOOCs is still increasing. Especially in Europe, new initiatives continue to emerge (Jansen & Goes-Daniels, 2016). European initiatives are the *European Multiple MOOC Aggregator* (financed by the EU), *Futurelearn.com*, which offers a hosting site for MOOCs, and an EU-website as *OpenEducationEuropa*, which distributes news and tries to organize communities around several topics within OE. Slowly MOOCs are changing. Different authors (Salisbury, 2014; Burd, Smith, & Reisman, 2015; de Langen, 2008, 2011) concentrate on the possible earning model and see different possibilities to generate an income in combination with a free MOOC. Some providers ask a fee, sell packages, or request money for the assessments and certificate; others earn an income using data on students to inform potential employers about talented job seekers. Other courses are transformed into so-called small private online course (SPOCs) offering paid in-company training. Several of these developments move the free online courses into the domain of traditional online learning.

Open Educational Resources (OER) are defined as: "The open provision of educational resources….for consultation, use and adaptation by a community of users for non-commercial purposes" (UNESCO, 2002, p. 24). They are offered in different areas and with different motives. In China and Russia, the OER play a role in standardization of the quality of education, making educational materials available for remote parts of the country (Sigalov & Skuratov, 2012; Wang & Zhao, 2011). In Africa, organizations work together in OER Africa, to improve education by offering OER and stimulating others to develop more materials (http://www.oerafrica.org/about-us/who-we-are). Expectations were that OER would lower the costs of education (Wiley, Green & Soares, 2012; McGreal, Miao, & Mishra, 2016) because they could replace textbooks for students and support teachers in making their own materials. Cengage Learning (2016) interviewed several experts and OER-users. They started out with: "Clearly, OER holds promise… (for) institutions seeking to offer some financial relief…(to) teaching and learning" (p. 2); however, they concluded that the usage of OER is not simple and can be costly, depending on the amount of work necessary to integrate the materials in the curriculum.

Despite expectations, MOOCs didn't disrupt the international educational sector and OER didn't replace textbooks. Both are still developing and have not reached a stable steady state. In this research, the long term financial survival (sustainability) is analyzed, studying different models, which take a different road towards sustainability. The main purpose is to see what mechanisms can be applied so

OE can fulfill its promises, in a structural way, independent of onetime subsidies and gifts. Although OE (especially OER) can be used in all levels of education, the focus of this research is on higher education.

One such mechanisms seems to be unbundling, which is discussed in the next paragraph. Paragraph three presents four cases: 1) a European MOOC-platform (OpenupEd), 2) a United States-based OER-platform (MERLOT), 3) an alternative for MOOCs (DOCCs), and 4) a commercial initiative between OER and HEIs (Lumen Learning). In the first three cases, interviews are held, while the last case is based on the canvas model as provided by the organization. The article is concluded by analyzing the similarities and differences between the case studies and drawing some conclusions on the general sustainability of Open Education systems.

Analyzing Existing Open Educational Models: Unbundling and Methodology

Unbundling Education and Research: A Costs Approach

Christensen, Johnson, & Horn, (2010) distinguishes three kinds of business models: the solution shops (experts, research); the value-adding process businesses (transformation, teaching); and facilitated user networks (communities, communication). Typical modern-day universities have "three fundamentally different and incompatible business models all housed within the same organization" (Christensen, Horn, Caldera, & Soares, 2011, p. 35). They argue that the combination of these models will lead to transaction costs. Education could be offered at lower costs when not combined within one organization with research and communities. Unbundling the processes reduces the overhead costs. As Christensen et al. (2011) point out, this development will require a different kind of accreditation, which is seen as a barrier supporting the old structure, hindering educational innovation. This is supported by Mazoué (2014) and Kelly and Hess (2013), who both describe accreditation as a barrier to new forms of education and innovation, guarding the old structures. Sheets and Crawford (2012) support the idea of unbundled models: "Especially promising are open, multi-sided, and unbundled models that involve facilitated networks" (p. 48).

Unbundling in the Educational Process: An Income Approach

Mulder and Janssen (2013) used unbundling to develop a sustainable model for Open Education. They unbundle the different activities into three components on the supply side and two on the demand side. On the supply side they distinguish OER (freely accessible, free of pay), open learning services (freely accessible, part free and part paid, including assessments and exams), and open teaching efforts (supporting activities, generally not free). On the demand side, they distinguish a demand of learners, which should be accessible and affordable, and a demand of society, as result of employability and capabilities development; education should be open towards new and changing demands from society and the labor market. Sustainability is reached through a combination of paid activities with the supply of free resources. Central to the sustainability of this model is the notion that HEI's have skills, competences, or services to offer for which students or others are prepared to pay.

Unbundling the Business Model: Financial Unbundling and an Integrated Approach

Christensen et al. (2011) did analyze educational institutes without paying attention to the special role of open education. Likewise, Mulder and Janssen (2013) studied educational institutions that offered both traditional and open education. In this study, cases are analyzed in which open education is their main activity. Sanderse (2014) studies the organizational models of nongovernmental organizations (NGOs), where she extends the business model canvas of Osterwalder and Pigneur (2010) into a two-layer business canvas (Figure 1). The customers of the original Osterwalder and Pigneur (2010) model are replaced by stakeholders and beneficiaries. The model unbundles the financial and operational sphere. In the operational layer, all is aimed at providing services towards the beneficiaries (for example in Sanderse [2014], wildlife and patients). The second layer describes how the organizations (WWF, Médecins sans Frontières) finance their operational activities through the attraction of financial stakeholders (governments, private organizations, individuals).

Using this model to describe education, the operational level describes how teachers deliver education and educational services—as in Mulder and Janssen (2013)—towards students, financed through subsidies, gifts, grants, and alike (as described in the second layer).

In a fully OE system, education is offered for free. The financial layer describes the motives of the subsidizer, and the activities necessary to obtain and hold the required funds. In different educational systems—free, (un)bundled, or traditional—other motives will play a role and the education will take on different forms (MOOCs, OER, SPOCs).

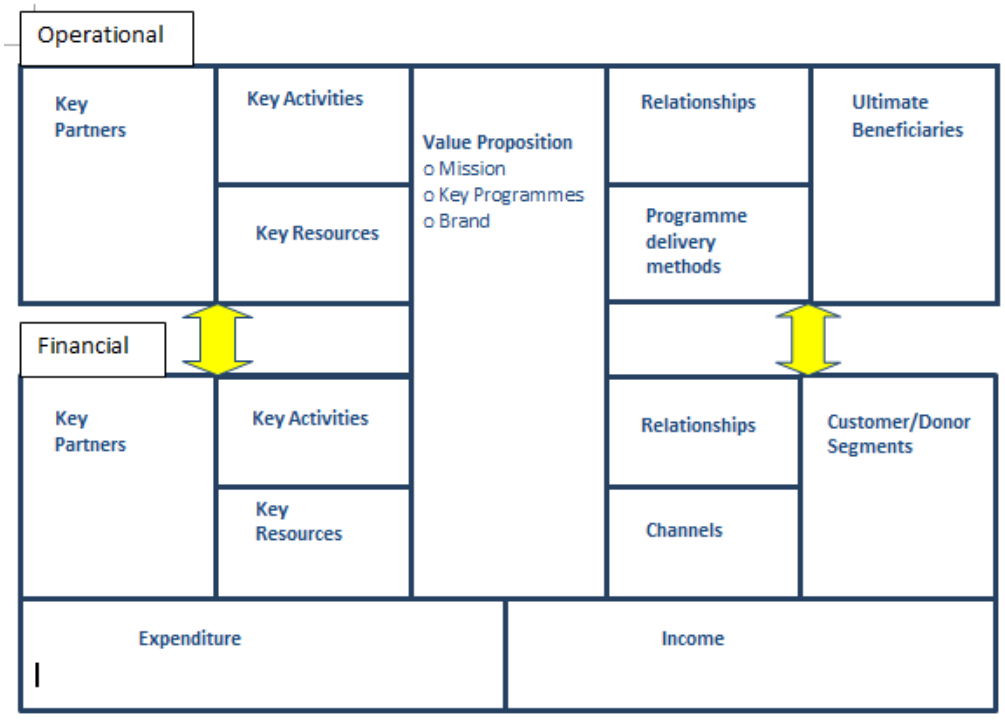

Figure 1. Business model canvas for NGO's. Adapted from *The Business Model Canvas of NGOs* (p. 47), by J. Sanderse, 2014, Open Universiteit. Adapted with permission.

The major purpose of this study is to explore the success factors for sustainability in OE in four different kinds of "business" models, to see if there are similarities and/or differences between the cases. In other words, how they balance the operational and financial levels. In-depth interviews are used because of

the explorative character of this study. In an earlier (unpublished) study, the questionnaires in Sanderse (2014) were used. During these interviews it became clear that the level of details was too high for the interviewees given the length of the interviews. The questionnaires were then summarized into two major categories:

1. **Operational Level**: Who are the primary stakeholders and what is the primary operational model? What is the reason for people/organizations to partake in your organization (what is the value you create for the stakeholders)? Given the value-offering, what activities and resources are necessary to realize this offering? With whom do you form partnerships and why?

2. **Financial Level**: Who are your financers? What is the value they derive from your organization? What do they expect of you in return or as a basis for the funds? How do you create this value, what are the required activities, resources, and partnerships?

3.

Business Models for Open Education in Higher Education: Four Case Studies

As stated above, four cases were selected, based on the different ways they try to sustain diverse forms of OE. What the organizations have in common is that they don't receive structural government subsidies. At least one representative of each organization was interviewed, and a synopsis of the interview was sent to the interviewees, who then commented on, returned, and approved it. Lumen Learning was added as an additional case based on its own business model description. One of the founders, David Wiley, was asked for comments on the description of Lumen Learning and agreed with the description by mail (April 20th, 2017).The resulting interpretations are, of course, our responsibility; the case descriptions and details are provided in Table 1.

Table 1

A Summary of the Organizations Analyzed, the People Interviewed, and the Documents Retrieved

Organization	People interviewed (type, role, and date)	Information retrieved (Documents and websites used)
FemTechNet	Dr. Sharon Irish, Video-skype, 11-23-2016 Dr. Elizabeth Losh, face-to-face interview, Leiden (Netherlands), 05-19-2017 Both initiators and early participants in FemTechNet.	Website: http://FemTechNet.org/ Documents Strategic plan: http://FemTechNet.org/publications/manifesto/ DOCCs: http://FemTechNet.org/docc/
Lumen Learning	Based on the business model available on: https://docs.google.com/drawings/d/1l-kSBcCCupbBGOvxZkRy3hQkcnqZuLTmeFuMmlC3zwo/edit	Website: http://lumenlearning.com/ Documents Mission statement: https://lumenlearning.com/about/mission/

MERLOT	Dr. Gerry Hanley, Executive Director, MERLOT / Assistant Vice Chancellor California State University, Video-skype, 10-01-2015	Website: http://www.MERLOT .org/ Documents Strategic plan: http://info.MERLOT .org/MERLOT help/index.htm#who_we_are.htm Website for students: http://www.MERLOT x.org/
OpenupEd	Drs. Darco Janssen, face-to-face interview, Heerlen (Netherlands), 06-01-2015, coordinator OpenupEd	Website: http://www.OpenupEd.eu/ Documents Mission statement: http://www.OpenupEd.eu/95-evolution-of-OpenupEd

FemTechNet

FemTechNet is a network founded in 2012 by Anne Balsamo and Alexandra Juhasz consisting of feminists in academics and arts. Juhasz and Balsamo (2012) state that they built FemTechNet on long-standing feminist principles and processes as sharing power, respecting diversity, creating safe spaces for collaborating, and technologically-enabled interaction.

According to the interviews (with dr. Losh and dr. Irish, see Table 1), the initial goal of FemTechNet was twofold, (1) to work on the legacy of feminist history, art, and teaching; and (2) to use technology to develop alternatives for MOOCs, based on co-construction and two-way communication. The need for a safe environment was mentioned several times. In general, when discussing gender and sexual related subjects, the students need their privacy. This raised the question of when and how to use social media, or more private means of media, what can be shared publicly, and which should not.

FemTechNet is organized through committees, with a steering committee as the main committee. The steering committee has no members. Decisions with regard to future developments are made at the steering meetings by those who (electronically) show up at the meeting. These decisions are posted on an electronic board and if there are not objections, they become part of the program of FemTechNet. The other committees have special objectives: race and ethnic studies, operations, and pedagogy projects. The working committees produce educational materials (podcasts, modules, videos, etc.), but individuals also are sometimes engaged in social activities, with or without support of the group as a whole. Stakeholders are mostly feminist academics, teaching or doing research, who take an interest in the activities of the organization. This group has connected since its inception to other groups that tackle issues of oppression because of race, ethnicities, sexualities, or gender. An example of this is the *Center for Solutions to Online Violence,* and organization that helps people safely navigate digital experiences and understand the impacts of, and responses to, online violence.

Although FemTechNet participants are primarily from the U.S. network, there are also individual participants from other countries as well, including Canada. Again, such a development depends on the labor invested by (potential) new participants. One collaboration, with a community in Bangalore, India, was not fruitful due to of the distances in time and space.

Central to the operational layer are the Distributed Open Collaborative Courses (DOCCs). A DOCC is described as “an innovative experiment in the use of networked technologies that engage multiple

communities and will yield important lessons for many stakeholders" (FemTechNet, 2013, p. 9). The website lists four DOCCs on *Collaborations in Feminism & Technology*, with the producers of the DOCCs in FemTechNet also acting as the users. In this sense, the network deviates from other platforms of learning objects and courses (i.e., MOOCs), where producers and users often are different individuals or organizations. The white paper on FemTechNet states that: "MOOC efforts often represent a step backwards, by promulgating a standardization of format rather than a focus on processes that support global access to learning and the reciprocity of teaching and learning" (FemTechNet, 2013, p. 5). Another critique on MOOCs is that universities would rather spend resources in MOOCs than on investing in real innovations in teaching and learning.

The participants in FemTechNet work together on so-called Key Learning Projects (http://FemTechNet.org/get-involved/self-directed-learners/key-learning-project/), developing learning objects that can be used in the DOCCs or in other courses. These projects are developed by teachers, but students can, and do, also contribute. Professor Irish indicated that the network also develops tools with respect to privacy and security, especially relating to feminist approaches and individual affirmations or choices that come under attack (S. Irish, personal communication, November 23, 2016). Yet, central to all these projects is what is called feminist pedagogy, "a pedagogical framework built on the analysis and exploration of visible and invisible modes of learning" (FemTechNet, 2013, p. 4). Because of the shared feminist ideology, and also the shared belief in the inadequacy of present pedagogical methods, the participants of the network decided to work together to develop the DOCC, and later to work on other emerging initiatives. An important aspect of the network are the personal relations.

Subsidies and grants are the second source of financing the network. The members of the network often work at institutions involved in gender and ethnic studies. They try to align their projects with the objectives of FemTechNet, hiring members without permanent situations to carry out some of the work. Institutes support the network by supplying licenses or help with the conferences. Others help with web hosting and server space. These contributions are important as much of the organizational efforts are done through groupware; the conferences (femtechnet.org/amc2017/) act as meeting places, which facilitates later electronic communication.

The DOCCs are part of the open educational resources offered by the network and the operational level is aimed at the participants (students, teachers, and researchers). The value offering consists of the alternative pedagogical feminist approach of materials on different subjects, related to gender, race, and sexuality, but also safety and digital participation. The key resources on the operational level are the voluntary members of the network; although working with a lot of freeware, the key resources (communication, meetings, and research facilities) are financed through the second level. As stated during the interviews: "This is a really minimal amount of money; FemTechNet hasn't been paid for research, but rather finds ways to leverage our work as research to benefit members of the collective—more use value than exchange value." (E. Losh, personal communication, May 19, 2017). The acquired competences make participants in FemTechNet, desired participants in other research and educational projects. On the other hand, the ideological value-offer attracts new participants and generates income through grants from institutions with the same public objective.

OpenupEd

OpenupEd provides a portal, through which educational institutions can offer their MOOCs. As described on their website, OpenupEd is an open, non-profit organization that forms partnerships in

an effort to “open up” education for all through the creation of MOOCs. For institutions that want to participate in OpenupEd, there are some severe restrictions. For example, they have to be an HE-institute, recognized by the national educational administration, obtain the OpenupEd quality label (the E-xcellence label), evaluate and monitor their MOOCs, and pay an annual fee of €2.500. According to the interviewee, openness is defined as the removal of barriers for learners and stimulating social inclusion (see http://www.OpenupEd.eu/mooc-features/42-openness-to-learners for the characteristics of openness).

OpenupEd has made a stakeholder analyses, with the primary stakeholders as the paying partners who use the portal. Although OpenupEd sees learners as stakeholders, they have no direct relationship with them. OpenupEd does not receive structural subsidies from national governments or the EU. Yet, the platform and its partners participate in national and international projects aimed at the (open) education policies, receiving project subsidies, so these governments and the EU are seen as important stakeholders.

Given the importance of the HEI’s as stakeholders, the activities of OpenupEd are directed at providing different services as a hosting (portal function), a searchable database of MOOCs, shared marketing, quality label, and additional services. Acknowledging the importance to offer value to the stakeholders, there are plans to expand their services, offering new research (for example, in the field of learning analytics and big data), sharing MOOC-knowledge, offering credit transfer, and ICT-services.

The actual staff of OpenupEd is very small. Activities are organized in collaboration with the partners, projects with the European Association of Distance Teaching Universities (EADTU), or hiring external experts. By sharing competencies and resources, the partners of OpenupEd are capable to apply for subsidies on national and supranational level. OpenupEd calls the participants in its portal “partners,” whereas a label as “customers” could also be appropriate, as services are provided based on a fee. Essential for OpenupEd is the process of co-creation; the services they offer are dependent on the participation of their customers, whereas the value for their customers is the result or the services. Critical to this process is a large network of both similar and complementary partners.

While portals do not encourage openness in education, they can play an important role as they offer learners the possibility to find and compare courses, acting as a kind of “Educational Google.” Additionally, they can offer the learners a guarantee of quality, by setting a system of standards for the MOOC-providers.

On the operational level, OpenupEd offers free MOOCs of good quality for learners. On the financial level, they offer services towards their members, partners, or customers, one of the services being the hosting. For these services OpenupEd is paid, with the free services reserved for beneficiaries (the learners), which are financed through a membership model and based on the desire of the members for a high-quality course environment.

Quality, credit transfer and standardization can only be realized by making your participants work together. One of the key competences of OpenupEd is the organizational quality and their relationship with HEI-non-members and subsidizers. However, part of their value-offer is the amount of traffic and learners they attract, which depends on the amount of courses, the quality, and the reputation of the partners. So, the quality and amount of courses determines the attraction for learners, whereas the amount of learners determines the earning potential of OpenupEd.

MERLOT

In the period 1995-1996, California State University (CSU) decided that they wanted to create an educational library for its 23 campuses. The main purpose of this library was to share educational instruments, resources, and teaching experiences. MERLOT was, and still is, financed by CSU (with support of Apple and the government). From the beginning on, the question asked was how to make the "library" attractive to the people contributing and using the resources. This was achieved by letting the communities be structured by the staff and faculty and not by the librarians and technological staff. Instead of allowing the producer to guess what is usable, they chose to let the user decide, in an aim to involve the users more over the producers (Hanley, 2013).

Of the total registered members, there are over 50,000 faculty, over 43,000 students, and over 11,000 staff. Diversity is guaranteed since anyone may contribute and review contributions. MERLOT is used by the California Open Online Library (www.cool4ed.org), which makes it easy to find free and open resources, as well as open access journal articles (http://coolfored.org/findjournalsandarticles.html).

From 1998 on, other institutions were interested in programs for faculty development and ICT-applications, which were developed as part of MERLOT. Several partners of MERLOT pay to use applications and for the advice of the MERLOT staff. In turn, this raises the effectivity and efficiency of MERLOT for CSU. About 50% of the MERLOT budget are subsidies, and the remaining 50% is earned offering different services. . Similarly, there are institutions that pay for the development of learning environments. MERLOT offers customized services, websites, and specific materials to build affordable learning systems.

New is the website aimed at students, which offers a self-assessment that is used by different universities. It also offers courses based on the materials of MERLOT.org, information on courses offered by the participating HEIs, information on open access journals, etc. (see MERLOTX.org). The purposes of MERLOT are stated as strategic missions:

- Openness for everyone.
- Provide an efficient and effective repository of OER.
- Open up educational resources for teachers and faculty.
- Open up resources for academic research.
- Contribute to learning and teaching in general.
- Contribute to affordable learning environments.

Producers, users, reviewers, and learners are combined in professional groups. To support the competences of different producers and users, MERLOT provides a community in ICT literacy on all kinds of ICT related skills (http://teachingcommons.cdl.edu/ictliteracy/). MERLOT stimulates quality and reviews of offered materials.

Community leaders were not assigned, but emerged from within the groups. MERLOT tries to identify these people and facilitates them in stimulating the community. These "key-producers" are involved in strategic decisions, the organization of the face-to-face conferences, and are given toll-free conference

lines and other communication facilities. MERLOT rewards individuals by offering free access to conferences, by giving out awards, and naming best practices and contributors (http://grapevine.MERLOT.org/#news1. An indication of MERLOT's success is the fact that the majority of the original communities are still together.

Key competences in MERLOT are the ability to keep up to date on technological developments, to stimulate further community development, to stimulate the individual participation, and to communicate with individual members and groups. The original purpose of embedding open resources in the CSU system of 23 HEI's requires further managerial and social skills.

MERLOT developed several business models. Firstly, it defined openness as free sharing: teachers were seen as both producers and consumers of OER, creating a connection between supply and demand for OER. On an operational level, MERLOT makes communities the central focus; on the funding level, CSU and others continue to finance these communities.

The second business model builds on the competences that were developed through the first model: paying activities as developing programs for employers, developing new learning environments, and lastly introducing the OER materials in third party educational programs and making them available for students.

Lumen Learning

Aim of Lumen Learning is to increase openness by replacing costly textbooks of publishers with the help of OER. By helping HEIs to replace expensive textbooks by internally developed materials, based on free materials, Lumen Learning claims to improve students' success, pedagogical flexibility, and –at the same time- lower costs for students and the institutions.

Lumen Learning trains staff to customize available open resources. They feel that the usage of open resources is important because: "Education is a matter of sharing, and the open educational resources approach is designed specifically to enable extremely efficient and affordable sharing" (Wiley & Green, n.d.).

Their customers are diverse and interrelated (Lumen Learning, 2015). Firstly, Lumen Learning is hired and paid by HEIs for their activities; secondly, they train staff to adopt OER, replacing commercial books; and lastly, the students, or the end users, will be personally using these adopted materials.

The key activities of Lumen Learning are to provide instructions during the course development process, assist by the search for relevant materials, help with intellectual property rights issues, and with problems with respect to hosting, integration, and alike. Lumen Learning lists key resources as the (open) educational resources they have accumulated, their hosting platforms, their knowledge on open software, and their expertise with respect to several educational and managerial topics.

As for partnerships, Lumen Learning lists several open communities, institutional partners, funding partners, and research communities. Since the start of this research, Lumen Learning started a partnership with Follett, an organization with similar goals.

Organizations as Lumen Learning bridge the gap between the supply of (open) educational resources and the demand, by offering the necessary capabilities for applying these resources in different educational programs. Since this research began, more of these initiatives were brought to our

attention. There is a Spanish organization, Humuork.lab, which aims to translate MOOCs into SPOCs for internal education of firms and e-learning experiences for companies and universities (http://www.homuorklab.com/en). In Texas, there are for-profit-organizations that help traditional universities to transform their face-to-face education into distance learning (Newbold & Angrove, 2017). Yet there seems to be a commercial market for reusing and redesigning open courses and resources for special groups.

Results: Cross-Case Analysis

Openness and the Value Offering

The concept of openness seems to be dependent on the actual educational system and specific conditions. For OpenupEd, openness is viewed as an access to education for all learners, as European educational fees are relatively low. In the American context, fees are high and prohibitive, and textbooks are expensive. In this context, openness is defined as cost effective. Merlot and Lumen Learning offer materials as OER and MOOCs as alternatives to expensive books and materials. In the case of FemTechNet, openness in itself is not the goal. Openness is the result of the perceived need to collaborate in order to share information and resources through a community.

Another difference is the approach towards the users of OE; MOOCs are organized top-down. Their attractiveness for learners is determined by quality, certification, and diversity in subjects, which are determined by the producers of OE (OpenupEd, MERLOT). In the case of Lumen Learning, the paying customers (HEIs) determine what they want, while the end-users (beneficiaries, students) are part of the value-offering (without students, the materials would be meaningless), but they have no direct influence on the value-offering.

OpenupEd is comparable to Lumen Learning in the sense that their expenses are covered through participant contributions. These participants pay for the opening up of their MOOCs. The end-users (the learners) are not customers in themselves, but part of the value offering towards the participants.

MERLOT is a mixture of different models. The organization can be split into an OER part (MERLOT I) and a service provider (MERLOT II), aimed at offering paid services towards third parties. The financial base of MERLOT I is the structural collaboration with CSU. In the interview with Gerry Hanley (G. Hanley, personal communication, October 01, 2015), he talked about the large commitment towards the suppliers and users of the collections. These make up the organizational level of Merlot I. MERLOTs value offering towards them is the supporting networks and peer review mechanisms.

MERLOT is expanding its activities (the value-offering and its earning-potential of Merlot II) by offering skills training, LMS-design and student support adding another traditional single layer business model, in which the financer and the beneficiary are the same.

FemTechNet is a network based within a community. The way it is organized guarantees the influence of both users and producers; the value offering equals the demand of the participants. These determine, not only the courses and resources developed, but also control which to share and which not to. Again, the organizational level is ordered around different motives than the financial level.

Key Resources and Activities

Both OpenupEd and MERLOT put a lot of importance on the capability to develop networks, mobilizing the skills of the participants to realize the value offer. Both organizations offer quality and ICT support, so the key resources are ICT skills, the capability to build and support the development of educational materials (OER or MOOCs), and LMS and portal environments. Lumen Learning, OpenupEd, and MERLOT (II) require commercial skills to convince institutions to use their services, while FemTechNet strongly depends on their existing network of people and materials for the development and utilization of the DOCCs. Overall, the most important resource is the willingness to cooperate.

Partnerships

OpenupEd and MERLOT both share some semantic confusion as both organizations describe their paying members as partners. If an explicit distinction is made between those who pay for services and those who have a non-monetary relationship with the focus organization, then their stakeholders could be divided in "clients" or "users" (paying) and "partners" (non-paying). For OpenupEd, the members are clients, whereas EADTU and governments could also be viewed as partners. MERLOT identifies individuals and communities as partners, building its earning model on the relationships with paying HEIs (clients).

In the case of Lumen Learning, several partners are listed that compose the value scheme of this organization, with the most important being the individuals and communities who offer OER materials. In addition, they name several institutions, which finance studies into the effects of OER. One could discuss if this is a partnership, or an additional earning model, competing with several other research institutes studying the practices of OE. Through the individual members of FemTechNet, the network has several partners, including institutions that donated the subscription fees for BlueJeans, grants for research, and offer support for congresses and alike.

A Framework for Opening Up

Based on these cases, it is not possible to formulate *the* business model for opening up, but some conclusions can be drawn. Table 2 gives a concise description of the role of unbundling in the four cases

Table 2

Results of the Case-Study

Unbundling case	Costs approach	Income approach	Financial unbundling
FemTechNet	Sharing costs through collaboration.	Offering free resources, within a traditional curriculum; offering services as research, etc.	Community oriented (teachers and researchers): users become producers and producers become users.
OpenupEd	Divide traditional education (within the own organization) and MOOCs (OpenupEd).	Deriving income through offering shared services as hosting, offering of courses, quality control, and authoring tools.	Operational: learners Financial: HEIs.
MERLOT I: Database of OER	Sharing costs through collaboration.	Offering free resources, within a traditional curriculum; offering services as research, etc.	Community oriented (teachers): users become producers and producers become users.
MERLOT II: Service provider	Helps organizations to integrate open	Resources are offered free for individuals, but are	A mix of learners, teachers (as users), and

	materials (OER) in their traditional programs, replacing textbooks and other paid materials.	used to offer services for HEIs.	organizations as financiers.
Lumen Learning	Helps organizations to integrate open materials (MOOCs) in their traditional programs, replacing textbooks and other paid materials.	Service oriented: deriving income by transforming open resources into customized education within traditional programs.	A mix of learners, teachers (as users) and organizations as financiers.

A problem with open education seems to be the demand for it. There are a lot of organizations offering either MOOCs or OER. Their success, as measured by sustainability, is dependent on the fit between value offerings and the objectives of the stakeholders. This can be done by the building of, or building on, a community. A community can consist of beneficiaries at the operational level, such as the teachers of MERLOT or the feminist teachers and learners of FemTechNet, yet can also be the financial stakeholders as in the OpenupEd MOOC approach. In the cases of Lumen Learning and Merlot II, open materials are used as an input in the services provided by the organizations, whereas the customers pay for the services (not for the materials). In this situation, the two-level business canvas reduces into the traditional business model canvas.

Based on these case studies, building a successful community would require a separate study, since it is important to have a shared strategic vision and a strong understanding of the target group. In contrast to traditional education, there are no formal requirements to offering OER or MOOCs, so participants have to voluntarily comply with different quality and entry requirements; there has to be a shared belief in the value of the collaboration.

To offer free materials, courses, or services requires key resources and activities. These resources and activities have to be financed, so these organizations must find ways to recruit financial stakeholders. To acquire the necessary funding, organizations have to help the financers to obtain their targets, for example, education for all, educating the workforce, or other targets. This will result in integrating the financier's goals into the value offering of the financial layer. Alternatively, the OE-organization can acquire funds by offering paid services based on the free resources, to finance the production of these resources.

Whether open education is a success should be measured on the satisfaction of both beneficiaries and financers. Whether OE will be sustainable in the future depends mainly on the satisfaction of the financing organizations.

Suggestions for Further Research

The framework in the former paragraph is based on a small selection of cases. More cases could be analyzed, for example the American MOOC platforms or collaborating platforms such as OERu. The geographical scope of the study was restricted; cases of organizations in Africa (OER Africa, African Virtual University) and Asia (OER Asia, see for example Dhanarajan & Abeywardena, 2013) should be compared to the cases here. It is very well possible that other models could be distinguished.

Further to this, the question exists whether commercial firms, such as Lumen Learning and Homuork.lab, will improve the usage of open materials and the integration into traditional programs,

or whether educational organizations will chose not-for-profit platforms such as OpenupEd or MERLOT to educate their teachers in the use of open materials. McGreal (2018) summarizes 13 case studies (teachonline.ca/tools-trends/open-education-resources-oer-applications-around-world/taxonomy-term), in terms of opportunities, benefits, challenges, and potential. These kinds of studies enlarge our working understanding of OE systems.

Another addition to this research should be an inquiry into the partners/customers of the three providers—MERLOT, OpenupEd, and Lumen Learning— to see if their strategic choices are in line with the desires and needs of users.

Lastly, another major research question is the role communities play in the sustainability of OE. It seems that OE created within a community increases the possibility of the long term sustainability. As MERLOT has already exists for 20 years, its top-down organization of communities should be described in more detail. Contrasting, FemTechNet is also based in a community, but has a bottom-up approach. Communities emerge organically around new topics and interests of the members. It will be interesting to see how both kind of approaches could be used to improve the effectiveness of open education in the future.

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Looking Beyond Institutional Boundaries: Examining Adults' Experience of Choosing Online as Part of Their Post-Secondary Studies

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Abstract

This research focused beyond the student, course, program, or institution by examining the conceptions of adults at the moment in time that they evaluated their choice to engage in furthering their post-secondary education by examining the possibilities provided through online learning. To capture their experience, not as students but as members of society, a practice of care framework, adapted from Tronto's (1993) work, was utilized as a theoretical framework. The use of this framework acknowledges that the practice of care is present in the lives of every human being and that each human being has received and/or provided care as part of their lived experience. A phenomenographical qualitative approach was the basis for the design of this project which allowed for the identification of the commonalities and variations of the described experience. All described experiences illustrated the balancing of needs, wants, and responsibilities, these descriptions included recognition of care of one's self, one's family, and one's community. The variation could be described as an expansion of the recognition of care, that is the focus of care expanded from self to family and then from family to community. This expansion occurred only in those described experiences that showed a strong conception of themselves within the previous category. The findings show that the choice to access online courses and/or programs provides possibilities for many adults that wish to continue their education but only if the educational environment can move away from its institutional centric perspective.

Keywords: online, elearning, higher education, phenomenography, qualitative, ethic of care, practice of care

Introduction and Background

Online learning has continued to experience substantive growth (del Valle & Duffy, 2009; Li & Akins, 2004; Roy & Suman, 2011) and has outpaced overall higher education enrollments (Allen, Seaman, Poulin, & Straut, 2016). Online programs are designed and delivered in multiple ways to individuals, and these delivery mechanisms take advantage of the technological and pedagogical innovations that are now available to educational programs. These innovations include, but are not limited to, the utilization of the internet to provide online (distance learning), learning management systems to create virtual learning environments, the use of videos and images to support textual data, augmented and virtual reality, and the use of online communication tools to support both asynchronous and synchronous dialogue.

For several decades educators and researchers have noted the potential of changing our education system through the use of online education (Cercone, 2008; Garrison, 2011; Moore & Kearsley, 1996; Oliver, 2002). In 1996, Moore and Kearsley noted that distance education (separating students in space and potentially in time from their instructors) "portends significant changes in education and how it is organized" (p. 15) primarily as a result of providing access to those who could not have attended the traditional system due to their location, life circumstance, work schedule, etc. There are those who have gone further and envision a complete revolution in the educational system, such as Curtis Bonk (2009) who states that "Earth will become a learning plant" through the use of web technology. More recently the increased attention, both negative and positive, to massive open online courses (MOOCs; as cited in de Freitas, Morgan, & Gibson, 2015) have changed the focus of academic rhetoric to this new delivery approach that purports to deliver online courses, certifications, and programs at little to no cost to a global population.

At the surface these innovations seem to illustrate the increase of access to adult learners around the world, and indeed for those who are engaged in continuing their education the increase in choice is obvious. One would assume, with this evolution of the educational landscape, that research on who the online learner is and the impact of their ability to access education would have been undertaken and published within the academic literature, however, upon review of the literature, little has been done in this regard. This observation was the result of several years of research in online education where I looked to the literature to help build an online learner profile, realizing that no current or complete description existed; "[t]his situation carries considerable pedagogical implications for the design of online learning environments" (Dabbagh, 2007, p. 217).

Who is the Online Learner?

Although little research has been done to examine who online learners are, or could potentially be, there is a wealth of research that examines the student experience *once they enter a program* (Chen, Lambert, & Guidry, 2010; Kauffman, 2015; Poelhuber & Anderson, 2011; Zimmerman, 2012). Within these research studies, students are superficially identified simply as online students, listed as a category (e.g., certificate students, undergraduate students, graduate students; Allen, Seaman, Poulin, & Straut, 2016; EduConsillium, 2015), described generically as non-traditional students, or are described through descriptive statistics (e.g., gender, age, work status, geographic location; Dabbagh, 2007; del Valle & Duff, 2009).

The consequence of a research focus that examines *a course, a program, an educational innovation, or intervention* is that the focus is removed from what I believe was the initial focus of online learning – that of creating educational opportunities and enabling people who have yet to engage in higher educational studies. If we do not focus on how the design of an educational environment can enable adults to engage and be successful in post-secondary education then we will continue to mimic what we have always done, and instead of being innovative and perhaps revolutionary in our educational initiatives, we will simply duplicate our historic methods into a new modality. Although a clear profile of an online learner may not be a guarantee of success it would

> significantly help administrators, teachers, and instructional designers understand (a) who is likely to participate in online leaning, (b) what factors or motivators contribute to a successful online learning experience, and (c) the potential barriers deterring some students from participating in or successfully completing an online course (Dabbagh, 2007, p. 217).

By not shifting at least part of the focus of online learning from within our courses, programs, or institutions to those adults who wish to engage in post-secondary educational activities, our research will never reflect the true demand for further post-secondary education and will continue to measure and evaluate only the demand for this that is currently being met (Association of Universities and Colleges of Canada, 2011).

This focus on the current students within the learning environment does not provide an environment that facilitates the envisioning of changes to our educational system that would provide education for those who wish to learn, and instead continues to perpetuate a system for those already found within. This perpetuation prevents the recognition of those individuals that by context of their circumstance, gender, culture, or place within society, do not fit within the historical perspective that analytics and statistical descriptions provide.

Looking Beyond Institutional Boundaries

Although online learning provides an enabling and accessible medium of education for adults across our globe, the focus of the institutions providing formal education seems to be firmly rooted within their perceived boundaries. "Universities … find distance education attractive since they can increase enrolments without increasing their physical plan requirements and they can reach out to audiences that would not otherwise be able to attend post-secondary education or who would not normally attend that particular institution" (del Valle & Duffy, 2009, p.129). Institutions are looking at efficiency and extending their market and the creation of new markets (del Valle & Duffy, 2009; Oliver, 2002), meaning that their focus is on their institution's financial health and not on the societal implications of providing education to our world's population. Oliver notes that this impacts not only their decision of what to place online but that "the bulk of online units tend to be based around very narrow instructional design models and tend to be a testament to the economic efficiency and marketing imperatives on which they are based" (2002, p. 35).

When an adult chooses to further their education, their perspective goes well beyond the boundaries of a course, program, institution, and can, given the advances of online offerings globally, expand to a global evaluation of what fits within their responsibilities and expectations as a member of their family, work, community, and society as a whole. When we examine and evaluate education, researchers and

practitioners see the adults within their class, course, program, or institution only within their role as a student. This is not reflective of any adult's experience, which is composed of every decision we make as a member of our society, based on the myriad of responsibilities and choices we must make every day. To truly look beyond our conceptualized boundaries of student, instructor, and institution, researchers need to be able to recognize and capture those involved as more than students and certainly more than their statistical descriptions of demographics, courses, and grades.

Nature of the Research

The identified lack of understanding of the potential online learner and the implications to the design of online programming heavily influenced the design of this research project, by focusing on adults contemplating accessing online education as part or all of their education journey. This research was done within a specific geographic region – the province of Alberta, Canada-- and captured their experience of deciding to engage in online learning. By capturing what adults consider before deciding to take online courses, we (instructors, instructional designers, program administrators, researchers, strategic planners, etc.) can begin to address the needs of these potential learners leading to the changes to our educational landscape that these technological advances can create.

Canadian Context

The existence of online learning and potential students encompasses our planet; however, to respect the history, culture, and needs of each area, a study needs to clearly describe the participants that will represent the findings. This study examines adults from across the province

of Alberta, Canada and reflects the county, the province, and the environment and culture Albertans live within.

Canada is the second largest nation in the world with a total area of 9,984,670 square km (Statistics Canada, 2005) and a large sparsely populated northern region, as the vast majority of Canada's population resides in the more habitable southern portion of the country. Canada is comprised of 10 provinces and three territories, and according to the Statistics Canada 2016 Census, Canada has a population of just over 35 million (Statistics Canada, 2017). It is a diverse, multi-cultural nation with over 200 languages identified in the 2011 Census (Statistics Canada, 2012) with a strong aboriginal population consisting of First Nations, Inuit, and Métis, each with their own culture and language. According to Statistics Canada's 2011 census, 64.7% of the non-Aboriginal population (25 to 64 years) had some level of postsecondary qualification compared to 48.4% of the Aboriginal population (25 to 64 years). Within this group 26.5% of the non-Aboriginal population had a university degree compared to 9.8% of the Aboriginal population. (Statistics Canada, 2016).

It is difficult to look at a national perspective on education (past the generalized type of statistics provided by Statistics Canada) as Canada is the "only industrialized country without a federal office or department of education… [and] there is no clear mechanism for national policy development" (Shanahan & Jones, 2007, p. 32). As part of the Canadian constitution, each province (and territory) is given ownership of their

educational systems (Government of Canada, 2017) and as such the federal government has no direct role in directing or shaping our education systems. In an attempt to create a national perspective, the federal government created the Canadian Learning Council in 2004, however, this is no longer locatable through electronic media. A second council (which may have been an offshoot of the 2004 council), the Canadian Council on Learning, dissolved in April 11, 2012 (voices-voix, 2012) and its website and resources have since disappeared. The final result is that there is no national organization that represents a national perspective on education. This has made research from a national perspective very difficult if not impossible to do.

To provide a Canadian context, I have pulled from two resources: EduConsillium's report on *Online and Distance Education Capacity of Canadian Universities: Analysis and Review* that was produced for Global Affairs Canada in 2015, as well as material found on the Canadian Virtual University (CVU-UVC) website (CVU-UVC, 2016a), both which offer a limited view of our post-secondary online learning environment. EduConsillium's work was focused primarily on attracting international students (Bates, 2016; EduConsillium, 2015) but did capture data analyzing Canada universities online and distance learning. CVU-UVC was founded in 2000 with two universities and initial funding from Industry Canada, with a mandate of increasing access to university education (CVU-UVC, 2016b). CVU-UVC has grown to include 11 Canadian universities and has reported that registrations are doubling each year since its inception (CVU-UVC, 2017) yet this organization represents only a fraction of Canada's post-secondary institutions. Recognizing these limitations, they do provide some data in regards to the current online environment in Canada.

Over the last few decades, online/distance education has grown; in Canada 93.15% of Canadian universities offered over 809 online programs and over 12,728 courses (EduConsillium, 2015). In fact, over 29% of the Canadian university student population took online courses during the 2014-2015 academic year (EduConsillium, 2015). Yet we "cannot be considered a leader in this field, as more than 20 countries invest about twice as much each year in their accredited online learning offerings" (EduConsillium, 2015, p. 3). CVU-UVC has noted that registrations in the online degree courses within their 11 members have exceeded 246,000 with 117,000 students within its 2000 courses (CVU-UVC, 2017). Although Canada has not focused efforts towards online learning there has been shown a strong and increasing demand for such offerings across the nation.

With the continuous advancements in technology and the expansion of utilization of technology enhanced learning within our educational programs, online learning has been made ubiquitous within our higher education institutions' long-term strategies. The primary strategic goals of these institutions is to use online courses to increase registration without increasing infrastructure costs (68.49 % of the institutions), to attract students from other regions or provinces in Canada (76.71% of the institutions), and to attract international students (53.42% of the institutions; EduConsillium, 2015). This institutional focus on financial issues reflects the overall findings of research in this area as noted previously (del Valle & Duffy, 2009; Oliver, 2002).

These two resources, although providing more than was available historically in regards to Canadian online learning, still do not focus on the learner themselves. Additionally, given that each province legislates and maintains their own education portfolio, there is no distinct Canadian education strategy as each province creates their own system based on its needs and circumstances.

Provincial Context

Alberta has a population of just over 4 million people (Statistics Canada, 2017) and has a total area of 661,848 square kilometers (Statistics Canada, 2005). Alberta's economy has historically been highly resource based with a heavy emphasis on the oil and gas industry (Alberta Canada, n.d.). The educational system within Alberta is directed through two ministries with our post-secondary system under the Ministry of Innovation and Advanced Education and our K-12 system under the Ministry of Education. Alberta has 26 public post-secondary institutions located across the province including six universities, 11 colleges, two polytechnic institutions, two arts and culture institutions, and five independent institutions (Alberta Advanced Education, n.d.). Total enrolment in post-secondary institutions is 268,828 with 139,558 being full-time and 129,270 attending part-time (Advanced Education, 2016).

Until recently, the province of Alberta had a provincially funded consortium, eCampusAlberta (n.d.), which grew to represent all 26 of the provinces post-secondary institutions. Its vision was to "create a technology supported, lifelong learning environment that increases access to high quality online learning opportunities throughout Alberta" (para. 1), and its mission was to serve as a "province-wide advocate for increasing access to high quality learning opportunities… [t]ogether with its members, eCampusAlberta will facilitate the adoption of best practices in online learning to improve institutional resource effectiveness and serve as a catalyst for innovation and eLearning" (para. 2). Its mandate was "to research, develop and share best practices in online learning in order to assist member institutions, improve resource effectiveness and foster innovation and excellence in online learning in Alberta" (eCampusAlberta, n.d., para 3). After 14 years of continued growth in programming and registrations, eCampusAlberta ended on March 31, 2017 due to lack of continued funding. As a result, a growing and collaborative environment that did extend beyond a single institution ended with the closure of the consortium. The study on which this paper is based was made possible by eCampusAlberta, as they provided the conduit that allowed contact with the provincial population of adult learners.

With little research being undertaken focusing on Alberta's online learning environment and with no other body to access for data at a provincial level we can utilize historical data from a report based on a student survey undertaken by eCampusAlberta in the spring of 2013. This unpublished report noted that there was a positive response to eCampusAlberta and to online learning, as well as a desire for more online courses (Marles, 2013). This report focused primarily on demographics to describe the online student. Out of 900 responses 71% were female, 61% were over 25, 82% had taken courses or received certification within the post-secondary environment, and 44% worked full time. The validity of the study however is unknown, as nothing was reported on the process followed for this study.

Research Purpose

The intent of this research was to begin to create a profile of the potential online student by moving beyond the limited role of student to that of any adult interested in online learning as a way to engage, either fully or in part, as part of their post-secondary studies. The choice to investigate adults within Alberta was motivated by a number of factors including, but not limited to, the lack of academic research done within this context; the acknowledgement that Alberta maintained its own education system; the characteristics of Alberta which are bounded by its history, location, and peoples; and the need to set a geographic boundary that the research could clearly describe and that could be set in a specific time and place.

Additionally, I have been involved in the post-secondary environment for several decades and have heard many descriptions of an online learner, yet these descriptions are often based on the perspective of the individual and are rarely based on any evidence or supported by data or research.

This research engaged with adult learners across the province through the support of eCampusAlberta. At the time of the request for participation, eCampusAlberta had 16 of Alberta's 26 public institutions within the consortium (this grew to include all 26 institutions before it was dissolved in 2017; eCampusAlberta, 2014). To be able to plan, design, and deliver any online programming, the needs of the learners that will engage with these learning opportunities should be acknowledged (Cercone, 2008). According to Dick, Carey, and Carey (2001), design of learning needs to include a clear assessment of their attitudes, preferences, and skills. However, most post-secondary institutions create a program with a set of predetermined skills, expectations, and requirements which results in the identification of a student based on a set of prerequisite courses and grade levels. This creates a system where only those that fit within the predetermined institutional expectations are allowed to access the educational system. As Ken Robinson (2013) has noted, education is now focused on conformity and not on diversity and although speaking of the American's education system it does seem to reflect the educational environment across levels and location.

As a result of the current research focus in higher education this research project went beyond the institutional boundaries and contacted adults from across the province of Alberta who had shown interest in online education by engaging with eCampusAlberta and providing their information for further contact. The intention of this research was to capture the conceptions of these adults and present these conceptions regarding their decision to engage in online learning for part of their studies. The presentation of this data should inform all levels of post-secondary, from instructors and instructional designers to those engaged in strategic planning and research.

The research question that guided this project was "what are the commonalities and variations of the personal experience of adult learners (located in Alberta, Canada), focusing on their responsibilities of care, that led them to select online learning as part of their post-secondary coursework?" (Rasmussen, 2015, p. 23).

Theoretical Framework

An adult must continually balance the multiple competing demands they have within their daily lives – from caring for themselves and their family to the responsibilities they have in their studies, work, home and their community (Rasmussen, 2013). Care, as defined by Tronto (1993) in her work with Fisher (*Toward a Feminist Theory of Care),* is "[o]n the most general level, we suggest that caring be viewed as a *species activity that includes everything that we do to maintain, continue, and repair our 'world' so that we can live in it as well as possible"* (p. 103).

The vastness of experiences that could be captured as a result of this research was seen as problematic, as a result a theoretical framework was selected to help provide a perspective that would still capture and help to elucidate the participants' conceptions in a meaningful way. By recognizing that "any decision to increase one's responsibilities by adding the responsibility of engaging in further education would be observable as

part of one's practice of care" (Rasmussen, 2015). Given this recognition, the research utilized a practice of care framework based on Tronto's (1993) work on an ethic of care and adapted to provide a structure on which to base the research process. Figure 1 illustrates this framework.

To acknowledge care	**To observe and measure care**
1. Recognizing that care is needed	1. Observe the recognition of care within a person's experience
2. Taking responsibility and determining a response based on the recognition of care	2. Observe and measure conflict of competing needs, responsibilities and of resource constraints
3. Providing the care	3. Observe the provision and receipt of care while remaining cognizant of cultural implications
By acknowledging this section the researcher may then focus the research process.	
By observing and measuring care as noted the researcher may then contain the scope of the research by a focus on the practice of care.	

Figure 1. Practice of care framework. From *The Ability to Access Post-Secondary Education: Adult Learners' Conceptions of Choosing Online Learning* (p. 20), by K. Rasmussen, 2015, Lancaster University, UK. Copyright 2015 by Kari Rasmussen.

By utilizing this framework, the research had a lens through which it could perceive the study, allowing the research to focus on the lives of the adults as they choose to become learners while still capturing their other roles as a member of society. It provides a way to view the data during the analysis phase that again allows the research to embrace the multiple competing demands on an adult without a predetermined order of priority or importance. Finally, although this framework could be utilized to measure the care being provided, the measurement of the participants in the role of care-giver was out of the scope and intention of the project and therefore there was no evaluation on the care provided. However, this framework could be utilized to examine the experience within the boundaries of the institution to again recognize the practice of care and the provision of care, something that may be of interest to those looking at the overall health and wellness of the individuals involved within these boundaries.

Method

This project utilizes a qualitative, phenomenographical approach to the design, data collection, analysis, and presentation of the results. Phenomenography "is a research methodology that aims to actually investigate the conceptions people have in relation to a particular phenomenon that give rise to their behaviours" (Pherali, 2011, p.7). Furthermore, phenomenography takes a second-order position that gives the voice to the participants, as it focuses on the variation of experience as described by the participants. "The world is only one world, a really existing world, which is experienced and understood in different ways by human beings… an experience is a relationship between object and subject, encompassing both"

(Marton, 2000, p. 105). This approach allows the research to identify the variations of experience and provides the ability to investigate the participants' conceptualization of an event that could not be as clearly communicated by making statements about the event (Marton & Booth, 1997).

Research Design

This design of this study is the integration of a qualitative, phenomenographical approach utilizing a practice of care framework. The design of this study is provided graphically in Figure 2.

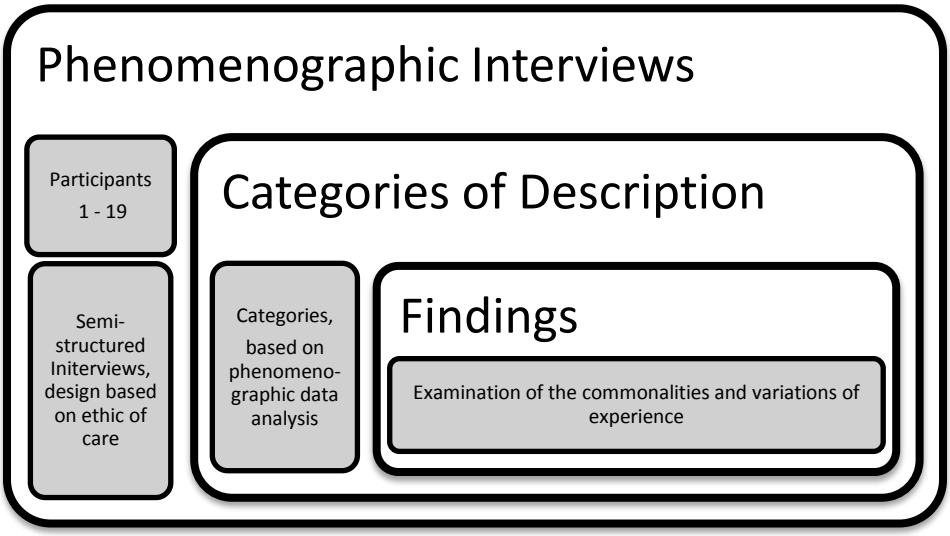

Figure 2. Research design for project. From *The Ability to Access Post-Secondary Education: Adult Learners' Conceptions of Choosing Online Learning* (p. 73), by K. Rasmussen, 2015, Lancaster University, UK. Copyright 2015 by Kari Rasmussen.

Phenomenographic Interviews

The interviews were designed based on the work of Bowden (2000); semi-structured interviews, focusing on open-ended questions were designed as the single source of data. A pilot interview was performed "both to provide an opportunity to develop the required skills but also to refine the planned questions" (Akerlind, Bowden & Green, 2005, p. 80-81). This pilot did alter the approach to the interview, creating a more conversational approach to the process, but did not impact the questions themselves. The results of the pilot interview were not included in the subsequent analysis.

Participants

Participants were selected through a purposeful sampling of learners (Suri, 2011) who showed interest, through eCampusAlberta, in engaging in online post-secondary studies. Participants had to be adults (18 years or older) and living in Alberta. Invitations to participate were emailed and subsequently 20 individuals were selected; one individual did not attend their interview which resulted in 19 total participants from across the province. Figure 3 shows the geographic disbursement of the participants

Figure 3. Participant distribution across the province of Alberta. From *The Ability to Access Post-Secondary Education: Adult Learners' Conceptions of Choosing Online Learning* (p. 84), by K. Rasmussen, 2015, Lancaster University, UK. Copyright 2015 by Kari Rasmussen.

Data Analysis

All interviews were fully transcribed to capture both the message and context of the conversation by documenting not only the words but all aspects of the conversation (pauses, sighs, laughter, etc.). Categories of description (phenomenographical approach to the result of data analysis) were derived by coding the transcripts and involved an iterative process of moving from the participants as a whole, to a specific transcript, to a specific category, in order to ensure context was captured (Bowden, 2000; Prosser, 2000).

As the study utilized a theoretical framework (practice of care), this framework did have an effect on the coding process and the findings. This influence allowed for the coding process to address the personal conflicts experienced by the participants more explicitly then otherwise. As care is an emotion or set of thoughts they have to be acknowledged before they can be perceived.

After the categories of description were finalized further analysis between the final outcome space and the framework was performed to determine if there was alignment and to provide more depth in each category. This consistent focus provided grounding for the analysis and the ability to create a set of categories that would not have been perceptible without the framework.

Research Findings

Phenomenographic studies result in an outcome space that shows the categories of description (commonalities) and their interrelationship (variation). Three categories of description were identified within the 19 participants' descriptions of their experience: the choice reflected my responsibilities to self, the choice reflected my responsibilities to my family, or the choice reflected my responsibilities to my community. The dimensions and interrelationship of these categories is shown in Figure 4.

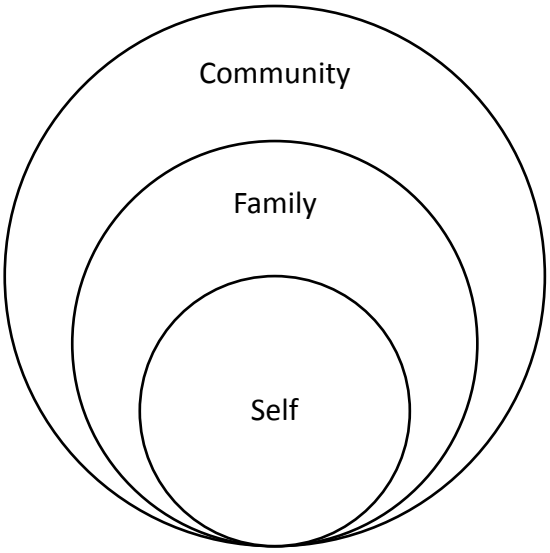

Figure 4. The outcome space – a visual representation of categories of description and their interrelationship. From *The Ability to Access Post-Secondary Education: Adult Learners' Conceptions of Choosing Online Learning* (p. 116), by K. Rasmussen, 2015, Lancaster University, UK. Copyright 2015 by Kari Rasmusen.

Categories of Description

Responsibilities to self: these included learning needs, learning environment, financial security, independence, continuing to work, starting a career, maintaining a life/work balance, reaching their potential, not wanting to locate, and career needs.

Responsibilities to family: these included being a spouse, being a single mom, parents, meeting family expectations, grandparents, being a grandparent, family unit, and being a mom.

Responsibilities to community: these included making a difference, social work, geriatric care, focus of career, personal struggles, taking on an advocacy role, consideration of next steps, and striving to improve themselves.

All participants showed a consideration of responsibilities to self, some expanded their consideration to family, and of those who did consider their family, some then considered their impact on their community. This expansion of consideration aligned with the strength in which they articulated their identity in the previous or inner category of description; that is, those who had a strong sense of themselves would expand their consideration to family and those that strongly articulated a practice of care within their family showed

consideration of their community. These results do not show a priority or linear approach to their decision to engage in further studies, for the practice of care is a continuous balancing act where all demands and responsibilities we have constantly impact our decisions (Tronto, 1993).

The foundation of this experience was the tie of these decisions to specific career aspirations; no participant within the study engaged in learning without a specific goal they wished to attain. These goals "showed a determination to better themselves or improve their life circumstance in some way" (Rasmussen, 2015, p. 147). No one spoke to taking online for exploration or general interest. Furthermore, each participant spoke about the responsibilities they had as an adult as main considerations for their choice to engage in online learning; their gender, their age, and their place in society were not within these descriptions unless they supported a role as a care-giver (spouse, grandparent, parent, etc.), yet it is these demographics that the literature focuses upon when analyzing learner populations. What impact would be possible if we expanded this description of a learner to a member of the society in which they live?

Conclusion

With the current emphasis on analytics and statistical information regarding our educational environment, our understanding and description of this environment is very narrow. If we expand our perspective to include a practice of care, in which we describe people as care-givers and care-receivers, we can move beyond the statistical description of our interaction with the world and as a result also recognize the complex and interwoven experience we have daily as members of our society. "The WORLD WILL LOOK DIFFERENT if we move care from its current peripheral location to a place near the center of human life" (Tronto, 1993, p. 101), and we can, by the nature of the framework utilized for this project, focus on the practice of care and its cultural implications if we so choose.

Online learning has continued to be an opportunity for transformation (Cercone, 2008; Garrison, 2011; Moore & Kearsley, 1996; Oliver, 2002), but it hasn't yet created the new environment we have been envisioning and discussing for years. In more recent years, MOOCs (de Freitas, Morgan, & Gibson, 2015) have gained a place in the academic literature and, given the number of individuals signing up for courses within the multiple MOOC platforms, the data analytics now available has pushed the focus of educational research in this area even more to the statistical description of the learning environment, learner, and the experience of the learner as they move through these online courses (Qu & Chen, 2015). To balance this focus on analytics we also need to continue examining the possibilities of online learning and the ability to transform our current systems. To do this it will be essential to move beyond our numerical descriptions of events. By examining those experiencing these environments through a practice of care lens with an approach that enables us to understand the mental constructs of these individuals through the use of research approaches like phenomenography, we can begin, perhaps again, to effectively "engage in discourse around opportunities and human potential" (Rasmussen, 2015, p. 161) while recognizing and respecting peoples' history, culture, and place within our world.

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Purpose, Pedagogy and Philosophy: "Being" an Online Lecturer

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Abstract

Instructing online has become an increasingly common aspect of a university lecturer's role. While research has developed an understanding of the student learning experience, less attention has been paid to the role of the lecturer. This study observed the practice of university lecturers teaching in a range of undergraduate degree programmes in the United Kingdom. The lecturers' purpose, pedagogy, and philosophy emerged in the dialogic patterns of the online space. Practice was shaped by the lecturers' epistemological positioning and their cultural values and beliefs. The practice, which was observed across different modules, reflected the different positions lecturers took when they approached online teaching. The research highlights the way in which a lecturers' purpose, pedagogy, and philosophy are reflected in their online facilitation.

Keywords: online teaching, online lecturers, e-learning, online pedagogy, e-pedagogy

Introduction – What is the problem?

As universities develop more online and blended programmes, working online is becoming an increasingly common occurrence for lecturers in higher education. Research has highlighted the key role that lecturers play in supporting student proficiency and participation in the online setting (Park, 2015; Stott, 2016). Effective facilitation of online modules supports student engagement (Arbaugh, 2014) and scaffolds student interactions (Cho & Cho, 2014). Online students' value teaching presence and lecturer-student interaction (Kyei-Blankson, Ntuli, & Donnelly, 2016). The current research explored the role of lecturers within a range of online undergraduate degree programmes.

Research, focusing on online learning in educational settings, has largely focused on the student rather than the lecturer (Arbaugh, 2014). Studies have explored students' loss of social and emotional cues in the online space (Guillaume et al., 2016; Slagter van Tyron & Bishop, 2006), the challenges of creating social presence for learners (Kehrwald, 2008; Laffey, Lin, & Lin, 2006), communities of inquiry (Akyol & Garrison, 2011; Garrison, Anderson, & Archer, 2000; Garrison, 2012; Joksimovic, Gasevic, Kovanovic, Adescope, & Hatala, 2014; Pozzi, Ceregini, Ferlino, & Persico, 2016), and the influence of motivation and self-efficacy (Kim, Glassman, & Williams, 2015; Stott, 2016). These factors also influence the lecturer experience, posing new challenges due to online delivery, particularly when facilitating collaborative activities (Palloff & Pratt, 2004). Lecturers are positioned differently to students as they are responsible for the learning of students within the module space. Unlike being in a classroom, online lecturers are often in different physical and temporal spaces to the students they are teaching. Many of the cues that lecturers use in face-to-face settings are lost, posing potential challenges for the online lecturer.

Lecturers working in university settings use a range of pedagogic approaches (Åkerlind, 2004); the approach taken influencing the learning of students in their classes (Karagiannopoulou & Entwistle, 2013). Pedagogic and discipline beliefs, epistemology, and technological ability may also influence a lecturers' approach to facilitating online modules (Lameras, Levy, Paraskakis, & Webber, 2012; Owens, 2012). Studies of e-learning in university settings have found similar pedagogic variation to the face-to-face environment; transmission of information and dialogic or collaborative pedagogies being observed in both settings (González, 2010). This would suggest that not all lecturers approach online teaching with the same pedagogic underpinning, or the same technological know-how.

In institutions quick to take up online delivery, there are now a generation of experienced lecturers who have developed teaching approaches appropriate to the online setting. These lecturers work in a range of disciplines and are likely to hold a variety of pedagogic beliefs. The current study explored the teaching approaches of lecturers, when facilitating online collaborative activities. Lecturers taught on a range of modules within four undergraduate degree programmes at the same university. Focusing on the ways in which lecturers facilitated collaborative activities as part of the teaching process, this study observed practice as it was enacted in the online setting.

Research Methodology and Methods

Taking an ethnographic approach (Hammersley & Atkinson, 2007), lecturers' online participation was observed as they taught online undergraduate modules. The observations focused particularly on the collaborative aspects of practice: the ways in which lecturers worked with students, or facilitated students to work with each other. The observation was iterative using data from the online space,

interviews, and a focus group (Figure 1). The study observed the ways in which lecturers participated online, observing what they did through data drawn from online modules and gaining their perceptions of the experience through interviews and a focus group. The iterative approach created a rich observation of the lecturers' online practice. In keeping with the ethnographic stance, data gathered from the university learning management system was observed qualitatively (Cohen, Manion, & Morrison, 2013) and a hybrid inductive-deductive approach (Fereday & Muir-Cochrane, 2006) was taken when analysing interview and focus group data.

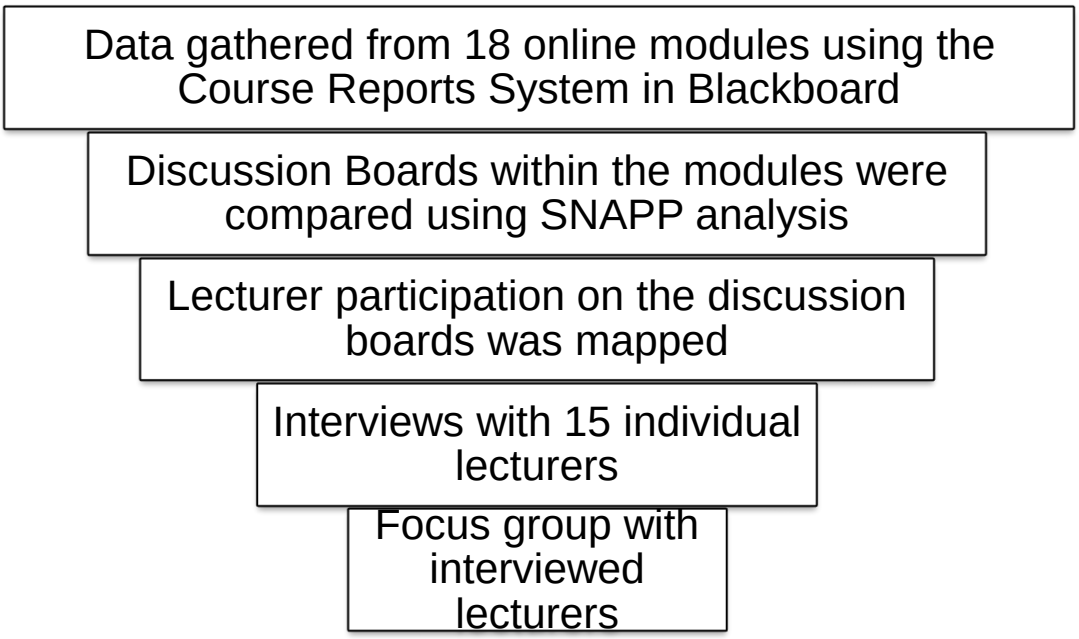


Figure 1. Layers of data collection for research study.

The lecturers the study observed worked at a distributed university in the United Kingdom, teaching on a range of online undergraduate degrees. Data from the university learning management system (LMS) was gathered, which presented the participation patterns of lecturers as they engaged within the online setting. Data was extracted from the LMS through running "course reports" and exported in the form of excel spreadsheets. To access the data, lecturers were approached and asked to take part in the study. Eighteen lecturers enrolled the researcher onto their module space, inviting the researcher to observe the practice and enabling her to run course reports to collect data. Data from the module space of each lecturer was shared with them at the interview stage. Fifteen lecturers were interviewed.

Socio-grams of discussion boards were drawn using SNAPP software, which presented visual representations of the discussion board dialogue (Dawson, 2010). Although social media such as Facebook, Twitter, and Linkedin has become increasingly popular (Lambert & Fisher, 2013), observations of discussion boards enabled the research to focus on the university's online setting. Some lecturers discussed the use of social media but all lecturers used discussion boards. Socio-grams were generated from 135 discussion boards, situated in 11 of the 18 modules observed (Technical issues with the software prevented the creation of Socio-grams from the remaining seven modules). Dialogue mapping identified posts in relation to whether students or lecturers posted, and visualised strings of dialogue. These were coded to analyse differences in the types of posts lecturers used.

The data was analysed taking an ethnographic stance – it was used to observe patterns of online participation (Wolpers, Najjar, Verbert, & Duval, 2007). GPS data has been used in a similar way when observing movements around physical spaces (Christensen, Kraftl, Horton, & Hadfield-Hill, 2014) and social networks have been observed by visualising online discussions (Dawson, 2010; Gottardo & Noronha, 2012). Approaching the data qualitatively, the aim was not to quantify or predict action, but instead participation within the online space was observed while identifying qualitative differences. The data allowed, to an extent, immersion in the online world and observation of its rituals (Hammersley & Atkinson, 2007). While it was not possible to travel to the online setting, the data enabled observation of the participation within that setting, in line with an ethnographic stance (Maneen, 1988). Engaging with the challenge of interpreting and translating these observations adequately, observations drawn from the data were collated and presented to lecturers during the subsequent interviews (Table 1).

Interviews and a focus group were carried out following the analysis of the online data. Interview questions were developed in response to the data analysis and informed by a pilot interview, carried out with a lecturer who also took part in the focus group. Interviews lasted between 35 minutes to one hour. Thirteen face-to-face interviews were conducted, while two used the university video conferencing (VC) system. The interviews were conceived as a process of co-constructing meaning between the interviewer and the interviewee (Gubrium, 2012). Interviewees were asked seven questions (Table 1) and then shown, and asked to respond to, the data relating to the modules on which they taught.

Table 1

Questions Used in Interviews With Online Lecturers

Number	Interview questions
1	How would you describe teaching and learning? What is involved?
2	What discipline would you describe the modules you teach (relating to this research) as belonging to? What is the nature of knowledge in that discipline?
3	I'm looking at collaboration in online environments. How would you describe the nature of collaboration in an online module?
4	How would you describe your approach to teaching modules (here insert the relevant modules the research had observed)?
5	What do you think is the nature of the student experience on an online module?
6	What collaborative tools do you use on your modules and why?
7	What do you think is the nature of the student experience on an online module?

The subsequent focus group used video conferencing to bring together seven lecturers, in geographically disparate locations. Three lecturers, unable to attend the focus group, commented on a summary of proceedings. The focus group began by the researcher sharing a summary of the interview analysis. Five questions were then posed (Table 2):

Table 2

Focus Group Questions That Structured the Discussion

Number	Focus group questions
1	In regards to your own experience does that make sense?
2	Are there any aspects which you didn't agree with?
3	Do you approach discussion boards with a clear rationale? Would you describe your main aim as being to check or validate understanding, support students to post or develop dialogue?
4	How would you describe your role as an online tutor in regards to your presence on a module? Should you be central to delivering structuring content, part of weekly discussions or simply available if students have questions? How does an online tutor enable student learning?
5	Do you think these findings have any implications for practice? Do they highlight any key issues in relation to online practice?

The focus group enabled a dialogic negotiation of meaning (Lambert & Loiselle, 2008), as lecturers discussed their experiences as a group. Sharing the summary of the interview analysis enabled the focus group to act as a second member checking layer. Following the identification of patterns of participation within the online data, the interviews and focus group were analysed narratively, using an iterative approach that identified themes within the data.

Before proceeding with the research, ethical clearance was granted by the university ethics committee. Data collected from the online space was kept secure; it was not shared in its raw form and all data were made anonymous before being presented in publications or to lecturers. During the interviews, lecturers were only shown data from modules that they had taught and data that they had access to through their own module space. Participants' perspectives were respected and the researchers own positioning within the field was acknowledged. Any evidence used in analysis was made anonymous before being included in any written or verbal presentations.

Results

The observation drawn presented a rich and varied picture of online practice. Within this, qualitatively different approaches to online teaching, and to facilitating discussion boards, were observed. Presented below are three vignettes that highlight the qualitatively different ways in which lecturers approached online practice. The vignettes are presented in narrative form to highlight the different experiences of the lecturers involved, demonstrating the situated nature of online practice. They do not suggest that any one approach is better than another; rather, they show how epistemological and philosophical differences influence the practice of online lecturers.

The three lecturers were all experienced online practitioners, physically situated in different locations. They each taught predominantly on one of three different undergraduate degree programmes (this

research looked at modules from four undergraduate degree programmes). Data were collected from two modules; one at Scottish Credit and Qualifications Framework (SCQF) level seven and one at SCQF level nine (first year and third year of undergraduate degrees), for two of the lecturers. For the third lecturer, data were collected on three modules; one at SCQF level seven and two at SCQF level nine. In the vignettes below, the lecturers have been given pseudonyms and all identifiers have been removed for anonymity.

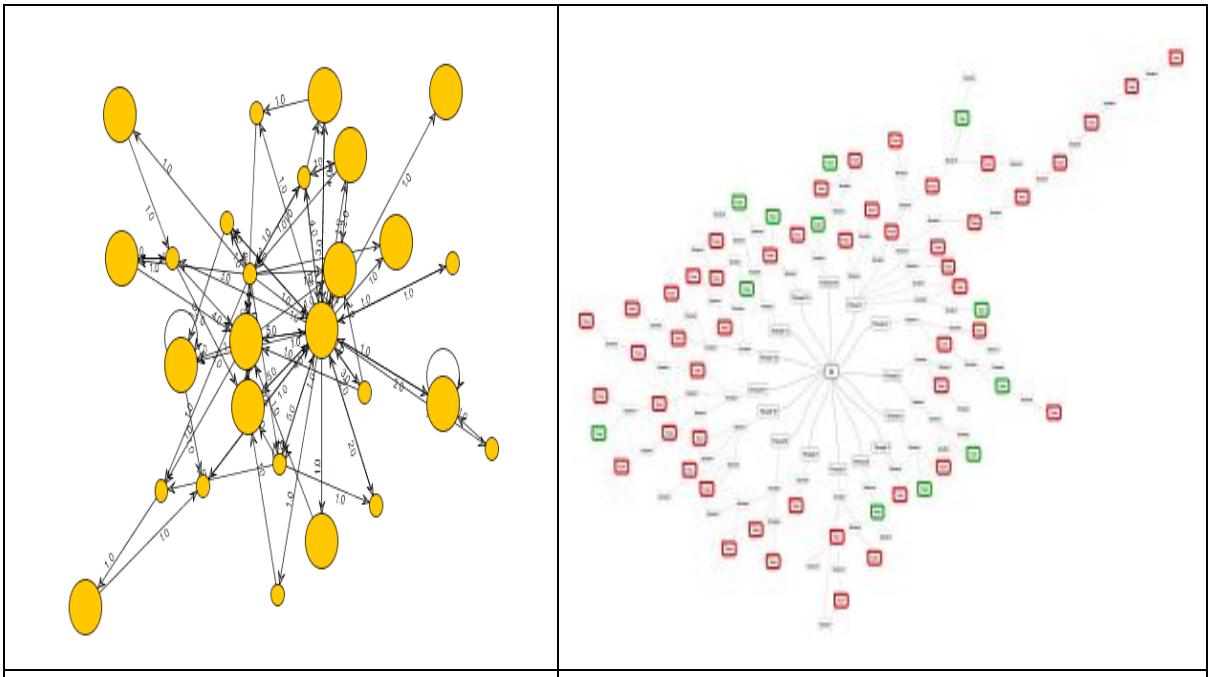
Vignette One – Jenny

Jenny viewed education as a holistic practice. She spoke about the social and emotional aspects of the learning process and was concerned with the holistic development and well-being of students. When asked about learning and teaching she said:

> To me education, learning, and teaching, is much more about these softer outcomes … it's to do with helping people realise their worth, their capacity in terms of who they are… my role as an educator has to be, I think, about helping students to recognise their potential… the capacity they have to be the best that they can.

The degree in which Jenny taught related directly to a professional community. Students were employed and completing qualifications directly related to their day jobs. The degree attracted a wide range of students, predominantly female, with a mix between mature and "traditional" students. The routes into the degree were varied; many of the students accessed the programme through college-based vocational courses, while others had experienced a large gap of time since engaging with academic study.

The discussion boards on Jenny's modules presented socio-grams with multiple connections between participants:



Socio-gram of Jenny's discussion board.	Dialogue mapping showing lecturer comments in bold red (Jenny) and green (Second Module Tutor).

Figure 2. Visualisations of a discussion board: Jenny.

Jenny took a nurturing approach and responded to students individually, encouraging them, and supporting their participation on the discussion boards. Observations of participatory positioning reflected this. Jenny responded to the majority of student posts (Figure 2) and was recorded with the highest number of posts out of all the lecturers observed. When discussing her facilitation of the discussion boards, and in response to the diagram showing her dialogic participation, Jenny commented: "This is me (identifying the boldly outlined red boxes in Figure 2). I would purposefully go out to interact to this level." Reflecting on this Jenny added: "Presence, social presence is really important … they're (students) looking for that level of reassurance (response from tutor)."

Although Jenny was an experienced online lecturer, she still found the online context challenging:

> In the face-to-face classroom, it's easier (facilitating discussion) because of the immediacy … you're not getting that level of facilitation that you can immediately in face-to-face …maybe as a tutor I'm trying to compensate for that, and that's why you're seeing me as present as much as I am.

The online space mediated Jenny's practice through its lack of non-verbal and para-verbal feedback. The lack of feedback led to interactions feeling constrained. Jenny was always available for her students and worked hard to project her presence into the online space. As well as frequent discussion board communications, Jenny responded quickly to e-mails and was "available 24/7" (Focus Group), supporting her students as they progressed through the modules. The use of collaborative activities in Jenny's teaching was motivated by the holistic needs of students:

> I think collaboration is the key in terms of helping students to feel engaged with the learning process … I think as a tutor my role is to try to get them to recognise that there's this wider community that they can engage with and if they reach out to engage with the wider community that makes them feel more part of the bigger picture, part of something that's going on rather than I'm sitting at home on my own.

Collaborative activities, for Jenny, provided an opportunity to engage students in a learning community. The social and emotional aspects of the learning process were important.

Vignette Two – David

David worked on a degree in a scientific discipline and was passionate about his subject. The degree on which he taught had the same wide ranging student demographic as Jenny's. In contrast to Jenny's programme, David's was more subject-orientated. It related to future professions, but was not firmly connected to one particular professional community. David described the progression of teaching as it developed over the three years of the degree:

> In first year it's just science and it's just factual … we don't try to explore why that is, the reasons behind it, debate about it …there's a heavy dose of science in all of the (modules), however by third year I'm trying to teach them that they need to broaden their horizons beyond just the science … there's implications in everything we do … in politics … computing, we're using computer models … socio-economic aspects… it's multi-disciplinary.

David's passion for his subject shone through in the interview discussion: "Everyone on this earth should know for example … it's a fundamental fact." The language was emotive, the knowledge which the degree taught was important.

Sociograms drawn from David's discussion boards and the related dialogue maps (Figure 3) showed David to be centrally located in the dialogue, reflecting the traditional classroom dialogic pattern of question, answer, and comment (Nuthall, 2007).

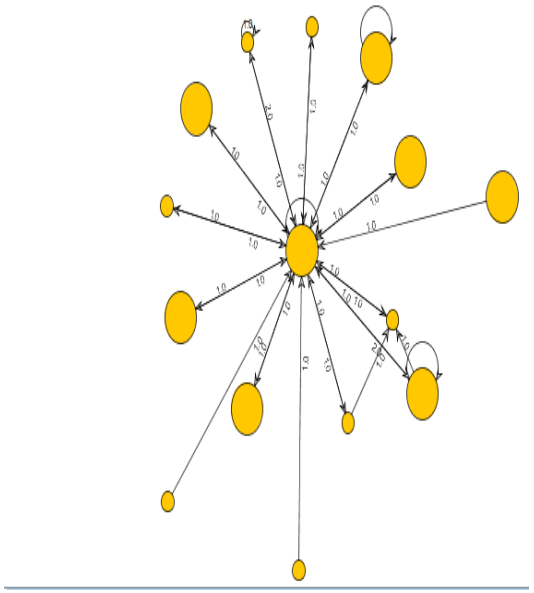
	
Socio-gram of David's discussion board.	Dialogue mapping showing lecturer comments in red.

Figure 3. Visualisations of a discussion board: David.

David positioned himself in the centre of the dialogue, setting questions and responding to the answers posted by students. David shared Jenny's perception of online collaboration being a challenge: "(Collaboration) it's quite iffy … personally I prefer VC (video-conferencing) much more because they see me and they put a name to my face."

Jenny had compared online interactions with her previous face-to-face teaching; David compared them to his teaching using video-conferencing. In both examples, the humanness of the other medium, the immediacy of the face-to-face, and seeing people's faces on VC, emphasised what was lacking in the text-based communications of the online context. David's response to this, though, was quite different to Jenny's:

> I make it obligatory for them to contribute to the discussion board each week because 40% of their grade depends on a reflection of contributions to the discussion board, however, I pick four weeks for them to talk about, reflect on … but I don't tell them until the end of term which four weeks … they must contribute to all of the weeks even though I'm only going to pick four of them at the end for them to reflect on, this works really well.

David was responsive to the feelings of his students; he spoke of how they were often scared to post on discussion boards. He enjoyed the rapport he built with classes through VC sessions and he felt the online context constrained this: "In the online environment it's a lot more difficult … there's not as strong a rapport."

Although both David and Jenny identified similar constraints to the use of collaborative activities when teaching online, their responses were quite different.

Vignette Three – Laura

Laura described teaching and learning as a relationship:

> Well it's a relationship, I think that's absolutely critical, it's the nature of that relationship that will make it, not entirely but certainly have a strong lean on how effective it is … the students respond to the relationship and to the personality of the person who's doing the teaching … Now that's not, that's not across the board, there are some very well-motivated students that never want to talk to you but in the main I would suggest it's about relationships.

Laura's modules were based in a different degree to Jenny's or David's, although first year modules from Jenny's degree were optional in Laura's and vice-versa. As with all three of the tutors presented in these vignettes, Laura was experienced in relation to teaching online. When asked about the nature of online collaboration, Laura highlighted its pedagogic potential:

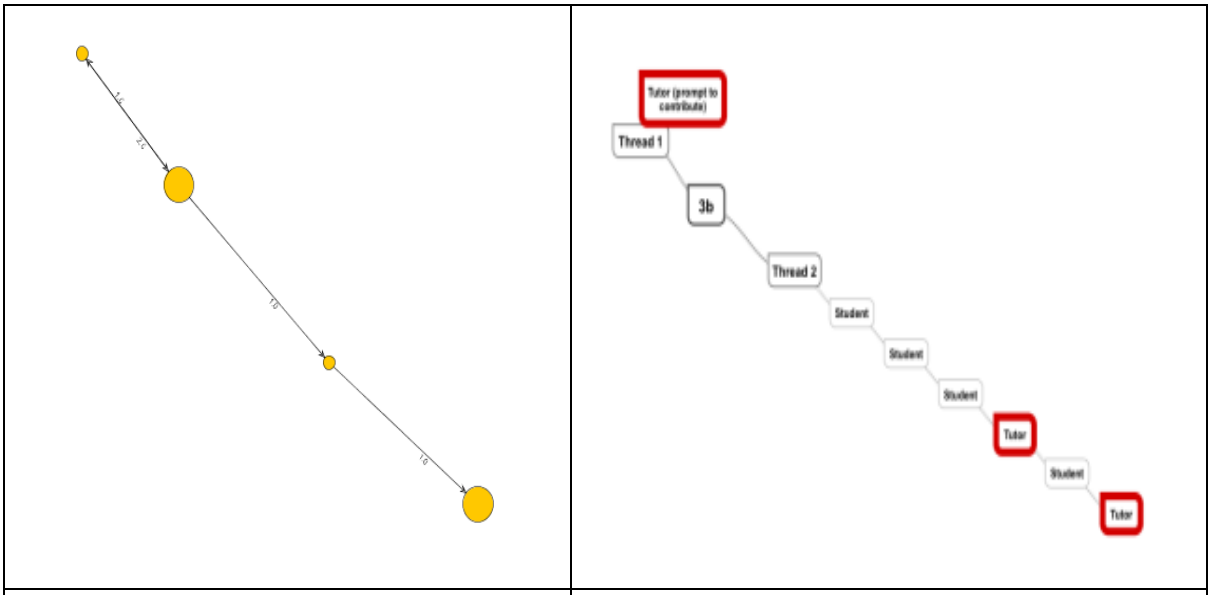
> The nature of collaboration, I think I'd start by saying it's not instinctive and therefore it has to be contrived. The importance of collaboration, if we start from the point that collaboration is a part of this relationship of learning and teaching then to collaborate is about developing knowledge, learning, and constructing knowledge in a group.

Laura presented a pedagogic approach which reflected a social view of learning (Bruner, 1996; Wenger, 1998), in which collaborative activities developed and constructed knowledge. In describing collaboration within the online environment as contrived, she highlighted the mediating role of the online space. In discussion she suggested that face-to-face collaboration was more natural: "When you sit in a classroom next to somebody and there's a kind of instinctive chatting."

Facilitating discussion boards Laura was informed by a clear philosophy; as well as actively engaging with her own online teaching, Laura had taken part in research, related to student's use of discussion boards;

> If the lecturer stays out in the early stages the conversation reaches consensus and stops, the job of the lecturer in an online discussion is to take it outwards, to bring in a new idea, to ask a question and in some cases to share opinions, disclosure is really important in there as well … it's also being responsive to what's going around, what the students are interested in.

This was reflected in the data drawn from discussion boards on Laura's modules (Figure 4). She positioned herself within the dialogue, and directed the students to reply to a single thread, rather than starting new ones.



Socio-gram of Laura's discussion board.	Dialogue mapping showing lecturer comments in red.

Figure 4. Visualisations of a discussion board: Laura.

Sociograms from all of Laura's modules displayed single lines of dialogue (Figure 4). Laura took a directive approach and positioned herself within the discussion, acting to stimulate and generate student's continued dialogue.

Laura's posts were the longest of the three lecturers presented here. Being positioned within the dialogue, Laura drew together the discussion, added new thoughts, or introduced a new concept and invited responses. Laura reflected that not all students wanted to join in on the discussion boards; some were quite happy to work alone. However, she felt that the lecturer's role should be active. She discussed the use of chat rooms (synchronous text-based online discussions) and the success of these, when students engaged. Chat rooms were a regular occurrence on the modules which Laura led. She felt that the role of the lecturer, as in a face-to-face class, was to engage students with the module content, to "teach": "The tools are the same, it's the personality, it's the materials, it's the engagement but you're doing it in a different setting'."

Discussion

Frameworks such as the Community of Inquiry (Garrison et al., 2000), enable understanding of online learning and support the development of collaborative constructivist approaches (Garrison, 2012). However, the focus on the learner overlooks the diversity of experience that lecturers bring to their teaching. Instructor presence; "the intersection of social and teaching presence" (Richardson et al., 2015, p. 250) has been defined as the pedagogic and social positioning of the tutor. This research highlights the ways in which instructor presence influences dialogic activity in online settings, as lecturers enact qualitatively different approaches to online facilitation. Online discussion boards provide spaces for knowledge construction (Bruner, 1996; Garrison et al., 2000; Redmond, Devine, & Basson, 2014) and the negotiation of meaning (Wenger, 1998; Akyol & Garrison, 2011). These

experiences are shaped by the philosophy of the facilitating lecturer, reflecting their pedagogy and purpose.

The dialogic patterns of discussion board interactions can be seen to reflect the cultural and social situation of the facilitating lecturer. In Vignette One, the lecturer is observed to respond to each student comment, reflecting her philosophy. Describing her role, the lecturer focused on the affective aspects of the learning experience and the importance of students' feelings about their own ability. The positioning she takes within the dialogue reflects this philosophy as each student is supported with a response that focuses on encouraging and valuing their participation. This dialogic pattern can be seen to reflect the philosophy of the lecturer and the values and beliefs of the professional community in which she was working; a community which was "nurturing," valuing the holistic and emotional experience of learners. Comparing this with the positioning of the lecturer in Vignette Two, a qualitatively different approach to facilitation is observed. In the dialogic patterns observed here, the lecturer positions himself in relation to knowledge, confirming, challenging, or consolidating the students' answers. This reflects the values and beliefs of the professional community in which the lecturer is situated; a community which is informed by a scientific epistemology and a focus on knowledge. The lecturer in Vignette Two was aware of the feelings of students and the ways these might influence their interactions on discussion boards. However, the dialogic structure reflected the values, beliefs, and epistemology of his practice, as he positioned himself in a traditional teaching role in relation to his students.

The vignettes present a simplified picture in their presentation of the variance of lecturers' approaches to online facilitation, highlighting the situated nature of online practice. Previous research has highlighted the influence of lecturers on the student experience in both face-to-face (Karagiannopoulou & Entwistle, 2013), and online settings (Lameras, 2012; Owens, 2012). The findings here suggest that the positions lecturers take in online dialogue influence the student experience. Lecturers' philosophy, their values, and beliefs are reflected in the ways they facilitate online dialogue.

Pedagogic approach can also be seen to position lecturers. In Vignette Three, the lecturer focused on creating dialogue, actively shaping the dialogue to create social interactions, reflective of a social constructivist pedagogy. In all three examples lecturers' facilitation of the discussion boards created a dialogic pattern reflective of the professional community in which lecturers engaged. This enabled the negotiation of meaning (Wenger, 1998) and the construction of understanding (Bruner, 1996), within a social context. The online dialogue lacked the utterances of face-to-face interactions (Beth, Jordan, Schallert, Reed, & Kim, 2015) but the underlying structure reflected the genre of the discipline (Bakhtin, 2010) and the "voices" of the professional community (Wertsch, 1991).

Observations of the complete data set showed variations of these approaches. Lecturers were observed to facilitate discussion boards in similar ways throughout the duration of a module, rather than to move between these qualitatively different approaches. This suggested that facilitation was informed, as presented above, by philosophy, purpose, and pedagogy. Future research could further explore the varying competencies of online lecturers, in relation to these differing approaches to facilitation. Garrison (2012) argued that the Community of Inquiry framework (CoI) (Garrison et al., 2000) was designed for online learning informed by a collaborative constructivist pedagogy. In relation to the CoI presences, all of the lecturers interviewed in the wider research were acutely aware of social presence (Annand, 2011). Jenny, David, and Laura used inclusive pronouns in discussion board comments and highlighted the importance of students being aware of other online participants as people. Their

awareness of teaching presence and cognitive presence, however, differed as it reflected differing pedagogies and philosophical positioning.

Laura (Vignette Three) reflected the collaborative constructivist approach of the CoI (Garrison, 2012) in her focus on dialogue and relationships. David focused on knowledge when teaching, this was potentially not a reflection of a transmissive pedagogy (Gonzalez, 2010), but of his scientific epistemology. For Jenny, the focus on affect reflected extensions of the CoI, which have added emotional presence (Stenborn, Jansson, & Hulkko, 2016) and an online pedagogy that considered the emotional experience of students. Drawing these approaches together with research from the wider study three foci were identified, which related to lecturers' approaches to discussion board communications: knowledge, affect, and dialogue (Figure 5).

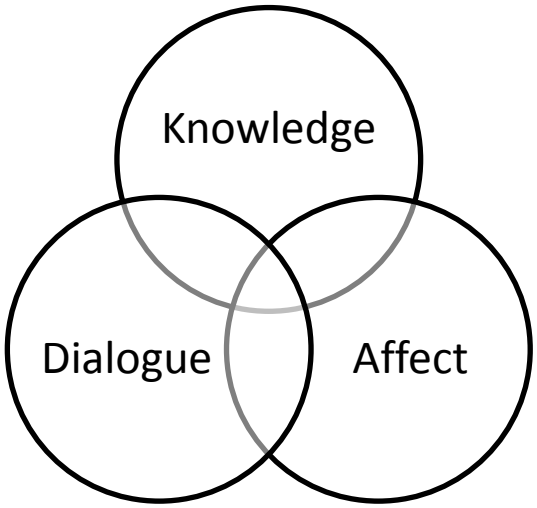


Figure 5. Knowledge, affect, and dialogue: Foci of online practice.

These three foci were observed to be mutually constituting (Rogoff, 2008); one could be brought into focus but the rest were still there, and influenced by any action taken. Although lecturers might foreground a particular foci (as in the three vignettes presented above), they were still aware of the other two. In contrast to the CoI (Garrison et al., 2000), this framework does not reflect a particular pedagogic approach (Garrison, 2012), rather it describes the experience of online teaching.

For online lecturers, consideration of their positioning within the frame of reference of the three foci (Figure 5) has the potential to develop their awareness of the purpose, philosophy, and pedagogy they enact. This, in turn has the potential to develop the student experience in epistemologically relevant and culturally appropriate ways. Further research could explore the social and cultural nature of online spaces, and develop lecturers' awareness of the factors that influence their online facilitation.

Conclusion

Lecturers' facilitation of online modules reflects their philosophy, pedagogy, and purpose. Students are positioned in relation to the pedagogic focus of the lecturer, through the dialogic structure of online discussions. Online dialogue reflects the cultural values and beliefs of the professional community, or discipline of the lecturer, thus implicitly enabling students to negotiate meaning in culturally relevant

ways. Online practice, like face-to-face instruction, is situated by the cultural spaces in which lecturers' act. The cultural values and beliefs of professional communities and the informing epistemologies are enacted through the interactions between participants as they engage in, and through, online spaces. The online setting mediates practice in ways which are fundamentally different to face-to-face settings, challenging physical and temporal boundaries. To develop online practice and ensure that the learning which takes place is high-quality and comparable to the face-to-face setting, it is important to consider the philosophy, purpose, and pedagogy of the online lecturer.

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Characterization of the Reasons Why Brazilian Science Teachers Drop Out of Online Professional Development Courses




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Abstract

Teachers face different challenges and opportunities through distance education. We used a combination of quantitative and qualitative approaches to investigate the factors leading in-service science teachers to quit online courses. No differences were found between persistent and drop-out teachers based on their sociodemographic data and their technological skills. The dropout rates were unrelated to courses' contents or duration. A follow-up procedure revealed that a heavy workload and technological issues accounted for most of the reasons teachers left courses. We conclude that financial incentives and reduced workload are key factors that could minimize attrition and increase persistence among Brazilian teachers.

Keywords: online courses, dropout, teacher education, lifelong learning

Introduction

The models used to explain why learners drop out of face-to-face or online courses are constantly changing. New models usually rely on their predecessors to incorporate the features of new educational settings or of different learner profiles. Because dropout rates are influenced by factors related to learner profile (e.g., traditional or non-traditional) and educational settings (e.g., face-to-face or distance education), most models share common characteristics, but also differ on important features.

Dropout Models: From Traditional Students in College to Non-Traditional Learners in Distance Education

Early frameworks designed to explain dropout processes were developed for traditional learners in traditional settings, that is, for young students attending face-to-face college courses. Among those, Tinto's (1993) model has long been considered the most influential (Bean & Metzner, 1985; Kember, 1989; Rovai, 2003). The model describes the dropout process as a longitudinal series of interactions between an individual and other students, as well as college faculty and staff (Tinto, 1993). Individual integration into the college community continually modifies, either positively or negatively, the students' intentions and commitments, which in turn influences their decision to leave or to stay at the institution. Tinto's (1993) model predicts that students' involvement with the college community and their positive interactions with their peers and college faculty are key factors behind their decision to remain a student, while the failure to establish such interactions and to fit in their educational environment is likely to increase dropout rates (Rovai, 2003). Tinto's (1993) model was developed for explaining attrition among traditional college students (young resident students) for whom academic and social integration within college or university are very influential. In the last few decades, however, the number of non-traditional learners has grown exponentially (Bean & Metzner, 1985). Non-traditional learners were initially considered somewhat synonymous with commuting students (Tinto, 1993). Bean and Metzner (1985) admitted that it was difficult to profile such students as they were very heterogeneous in terms of ethnicity, gender, and origin, among several other factors. The authors opted for a definition of non-traditional learners that contrasted some of their key features with those of traditional students; specifically, they categorized students that were mature, had enrolled in part-time courses, usually did not live in a college dorm, commuted to classes, and were more likely to have jobs as the non-traditional students (Bean & Metzner, 1985). Due to their maturity and less frequent interactions with the other members of the college community, non-traditional learners were considered unlikely to be as susceptible to the socialization and integration issues that more traditional learners face (Bean & Metzner, 1985). Although Tinto's (1993) model was recognized as a powerful tool, it has been suggested that it has several limitations when it comes to explaining non-traditional student dropout processes (Bean & Metzner, 1985; Kember, 1989; Rovai, 2003). Because prior models to explain dropout relied heavily on social processes to explain attrition, Bean and Metzner (1985) suggested another model to explain non-traditional learners' reasons to drop out. In general terms, Bean and Metzner's (1985) model comprises academic, background, and environmental variables, as well as student academic and psychological outcomes. Environmental variables are thought to have more impact on dropout rates for non-traditional students than academic variables, primarily due to the fact that supportive environments (e.g., healthy finances or good child care management) might help non-traditional students to continue their education even when academic performance or support is weak (Bean & Metzner, 1985). As such, the

rise of distance education has posed new challenges to the study of student attrition. Distance education courses are increasingly common for both traditional and non-traditional learners. Those courses are typically non-traditional processes of education in the sense that they seldom involve face-to-face interactions or the presence of learning groups (Kember, 1989). Models used to explain dropout processes that proved applicable to either type of students in face-to-face settings needed to be reformulated in order to address issues related to the new educational environments.

Non-traditional learners face different challenges and opportunities through distance education, such as an asynchronous learning environment and adaptive study schedules. An early study suggested that factors influencing dropout rates could be generally recognized as what the author called "characteristics" or "circumstances" (Kennedy & Powell, 1976). The former were hard or slow to change, as they had an intrinsic value (e.g., educational background), while the latter could change more readily because they comprised items such as the learner's finances and family relationships. More recently, new frameworks were suggested for dealing with the dropout process from online courses. Rovai's (2003) composite persistence model aimed to explain the factors that affect a learners' decision to drop out from online courses and included two prior-to-admission variables, namely students' skills (e.g., computer literacy and information literacy) and students' characteristics (e.g., age, ethnicity, and gender). The framework also included two after-admission variables, the so-called external factors (e.g., finances, hours of employment) and internal factors (e.g., social integration, goal commitment, and course utility).

Based on Rovai's (2003) earlier work, Park (2007) suggested a new revised framework for understanding the factors affecting non-traditional and non-degree online program learners' decision to drop out. In this new theoretical framework, some variables were relocated while new relations between variables were proposed. For instance, learner skills were set apart on the basis of the lack of sufficient empirical studies to support their relevance (Park, 2007). Moreover, the author suggested that external factors affect learners' decisions not only during, but also before, the courses, and thus could influence learners' decision to drop out at the two stages.

Online Professional Development Programs for Teachers

In the last decade, the number of opportunities for adult learners has increased at both graduate and undergraduate levels, as well as in professional development courses (Allen & Seaman, 2016; Bersin, 2005; Ministério da Educação, 2010). Almost three million students (roughly 14% of all higher education students) were attending higher education online courses in 2014 in the U.S.A. (Allen & Seaman, 2016). In this context, several authors have suggested the urgency of developing online development programs specifically aimed at teachers in order to enable them to use information and communications technology (ICT) effectively and to improve the quality of their teaching (Kenski, 2009; National Research Council, 2007; UNESCO, 2008; Villani, Almeida-Pacca, & Freitas, 2009). More often than not, however, online courses have suffered with high levels of attrition (Favero & Franco, 2006; Frydenberg, 2007; Hart, 2012; Levy, 2007; Lykourentzou, Giannoukos, Nikolopoulos, Mpardis, & Loumos, 2009; Meister, 2002; Park & Choi, 2009; Yukselturk, 2010). Even if distance education is commonly accompanied by attrition and high dropout rates, the use of online courses may still be a useful alternative to face-to-face courses for teachers' ongoing education, specifically in countries with near-continental dimensions yet with limited resources to

invest in ongoing teacher development. Indeed, a recent study showed indistinguishable outcomes between face-to-face and online professional development courses for teachers (Fishman et al., 2016).

Teachers fit the definition of non-traditional adult learners but their profession is known to be characterized by high levels of attrition and dropout rates due to many factors, such as financial and geographical issues (Borman & Dowling, 2008; Ingersoll & Perda, 2009; Karsenti & Collin, 2013; Macdonald, 1999). Those are also major issues in Brazil, where an early report suggested that the number of teachers quitting their jobs in the past decade had increased up to 300% (Lapo & Bueno, 2003). That massive increase in resignation was caused mainly by low wages, poor working conditions, and lack of professional perspectives (Lapo & Bueno, 2003). Official Brazilian documents have also emphasized the need for a consistent teacher training policy (Conferência Nacional de Educação, 2010).

There are quite few studies on Online Professional Development Programs (OPDP) dropout rates among teachers. Most of those studies report dropout rates ranging from 30% to 40% (Russell, Carey, Kleiman, & Venable, 2009; Kubitskey et al., 2012, Stiller & Bachmayer, 2017). There is no consensus in the literature regarding a definition of a dropout. The fact that these studies deal with different educational settings adds to the difficulty of making generalizations. Little is known about the specific patterns of dropout or about the reasons why teachers decide to drop out of online courses. High dropout rates impose losses to educational systems in countries where resources are already scarce. The present study took advantage of an existing online development program aimed at science teachers being developed in Brazil to characterize the reasons for dropping out within a broad sample of teachers. We have used a combination of quantitative and qualitative data to address the main research question: What factors influence the dropout rates among Brazilian teachers enrolled in online professional development programs?"

Methods

The Online Courses

An online professional development program for science teachers comprising seven different non-degree courses was offered by CECIERJ throughout the three years of the present study (from 2010 to 2012). Courses are made available on Moodle free of charge and provided 30 hours of core work each. The courses were: Introductory Microbiology (MIC), Integrated Human Health (HHE), Introductory Botany (IBO), Understanding the Environment (ENV), Biodiversity (DIV), Sexuality and Education (SED), and Collaborative Technologies and Biology Education (TBE). Each pedagogical unit (course module) had the following components: lesson plans, main texts, additional texts, multimedia resources (animations, videos, simulators), and the distance activities (DAs). All courses comprised of: (i) discussion forums where members could take part in discussions about pedagogical issues and course contents, and supervised by tutors; and (ii) assignments (all teachers received formative feedback from tutors). Each course comprised six DAs to be handed in according to a previously agreed schedule and a final paper to be submitted after the completion of the DAs. Courses were offered in both 12 and 16-week terms, with the final paper submition as a mandatory requirement to receive a certification of completion. The certification has no

impact on the teachers' income or career development. All courses were coordinated by online tutors who were responsible for supporting learners in their assigned tasks and for motivating them to pursue their goals and complete their courses. The tutors were supervised by at least one faculty member with prior experience in teaching and research on the specific course subject.

Sample

The online courses were offered by the state government and were aimed preferentially at teachers from public schools (Salvador, Crapez, Rolando, Rolando, & Magarão, 2010). The original sample to be analyzed in the present study comprised the 3,026 teachers who enrolled in at least one course during three consecutive years.

Candidates filled online applications in which they should inform their educational background, teaching subjects, and professional affiliation. The applications always exceeded the number of spaces available. Criteria for admission were used and preference was given to qualified biology and science teachers working at public schools. All the applicants that fulfilled those two criteria were admitted.

Demographic information, as well as data on teachers' use of internet tools, were obtained by means of an online questionnaire (Rolando, Salvador, & Luz, 2013). Briefly, the questionnaire consisted of closed-ended questions on whether or not each tool from a set of 13 different internet tools was used by each respondent. This analysis was based on a sample of 2,491 teachers (82% of the original sample) that provided demographic data and filled the questionnaires.

Characterization of Dropout Patterns and Rates

The learning management system (LMS) Moodle available allowed for the identification of teachers that delivered each of the DAs within their respective deadline. Although it was not unusual for teachers to miss one or a couple DAs throughout the courses; however, those who missed two consecutive DAs did not continue doing the course (see below).

In the present study we were interested in characterizing the factors that determine dropout rates and patterns rather than in the effectiveness of the courses. What it means to be a dropout in an online course vary in the literature (Grau-Valldosera & Minguillón, 2014; Levy, 2007; Lee & Choi, 2011). Although a general definition would be desirable, we believe that it is unattainable due to the inevitable differences in the educational settings of each study. Nevertheless, a clear definition must be presented in each study to make the necessary comparisons feasible. In the present study, a dropout teacher was defined as one that did not submit their final paper; the final paper was the only mandatory activity of the courses analyzed. Failing to hand the final paper in was defined as equivalent to failing the course; therefore, a teacher was considered as a dropout if he/she failed to submit their final paper regardless of the number of DAs handed in during the course. On the other hand, a teacher was considered persistent if he/she handed in the final paper, regardless of passing or failing the course. It is noteworthy that all teachers who failed to submit their final paper had also failed to hand in one or more DAs prior to the final paper and did not return to the virtual classrooms after prolonged absences. Those findings support the assumption that they had effectively left the course prior to its closure and that the definition of dropout adopted in the present study was adequate.

Understanding the Reasons for Dropping Out

A follow-up procedure adapted Nistor and Neubauer (2010) was implemented and helped to promptly identify and contact dropouts. This procedure was adopted during two 16-week courses. The procedure was based on emails sent after an absence of seven consecutive days from the virtual classroom. The message included an invitation to rejoin the course as well as questions about the teachers' intention to return or not to the courses (Appendix A). All teachers that replied to the emails presented explanations for abandoning the courses and none of them returned to the virtual classroom or rejoined the course afterwards. Their replies were therefore included in the data sample used in the characterization of the reasons for dropping out. Teachers that did not reply to the email and missed two DAs after the email was sent were contacted by telephone for a short interview. The interview focused on the reasons for abandoning the course (Appendix B). This procedure was slightly adapted for the sixth DA (DA6) because the time interval between the deadline for handing in the DA6 and the deadline for submitting the mandatory final paper was shorter. The 21 teachers who failed the DA6 but submitted the final paper were not contacted by email or telephone, as they were not considered dropouts from the course. None of the teachers contacted by email or interviewed by phone throughout the whole process submitted the mandatory final paper. Those additional findings corroborate the previous assumption that they all had indeed opted to drop out from the courses. Replies to emails (n=45) and transcriptions of phone interviews (n=104) were pooled and used for further analysis. The categorization of replies to email messages and transcriptions of phone interviews followed a content analysis procedure (Fraenkel & Wallen, 2003). The categories (Table 1) were based on Rovai's (2003) and Park's (2007) theoretical frameworks. Teachers' answers were independently categorized by two coders with an agreement of 97% between them (disagreements were coded by consensus).

Table 1

Categories of Teachers' Answers to E-mail Messages or Phone Calls

Type	Category	Definition	Examples
Internal	Technology issues	Technical difficulties in using computers, accessing the internet, or using the course's platform.	"My home computer broke and I do not have access to the internet anywhere else."
			"My internet connection was too slow and I couldn't follow the courses effectively."
External	Schedule conflicts	Failing to cope with the course's activities due to lack of time and/or excessive workload.	"I am currently working in two different schools so I do not have time to follow the course."
	Family issues	Need to deal with family obligations.	"My daughter is going through a difficult pregnancy and needs my support."
	Personal issues	Reasons that do not fit any of the other categories.	"I am going to undergo a surgery and can no longer follow the course. "

Results

Dropout Patterns and Rates

A total of 3,026 teachers joined at least one of the 19 groups attending the seven different courses available during the present study (Table 2). Only 17.7% of the teachers did not join their courses at any time while the remaining 82.3% handed in at least the first DA. A total of 1,543 teachers (46.9%) completed their courses by submitting the final paper resulting in a global dropout rate of 53.1% (Table 2). Dropout rates ranged from 45% to 56% depending on the course. Statistical analysis weren't carried out to compare dropout rates in different courses because many of them were offered only once or twice. Differences of about 10% in dropout rates could be found between courses on different subjects as well as between a course that was offered twice (not shown). The heterogeneity in dropout rates seems thus unlikely to be related to course subjects. The percentage of teachers that remained in the courses by handing in the DAs according to the schedule, fell gradually and similarly along both the 12 and 16-week courses (Figure 1). A total of 182 teachers failed to hand in DA6 but submitted the final paper, perhaps because only the latter was mandatory. That explains the slight inflexion in the persistency curve after DA6 (Figure 1).The percentage of persistent teachers was significantly greater in 16-week courses considering the deadlines for DA2 and DA3 but no significant differences in persistence could be found after that (Figure 1). The total percentages of persistent teachers in 12 and 16-week courses were similar (46.5% and 47.3%, respectively) and no significant differences were found between the total dropout rates in the two contexts (p=1.0, Mann-Whitney test). The total percentage of persistent teachers was also very similar when the only two courses offered in both 14 and 16-week terms were considered (55.3% and 53.8%, respectively). The similarity in the dropout rates in courses on different subjects, as well as the similar final dropout rates regardless of course duration, suggested that the teachers' decision to dropout was unrelated to a courses' content or duration.

Table 2

Sample Composition and Dropout Rates in 12 and 16 Weeks' Courses

Term duration	Courses	Groups	Teachers (n)	Final dropout
12 weeks	4	9	1622	53.5%
16 weeks	5	10	1404	52,7%
Total	9	19	3026	53.1%

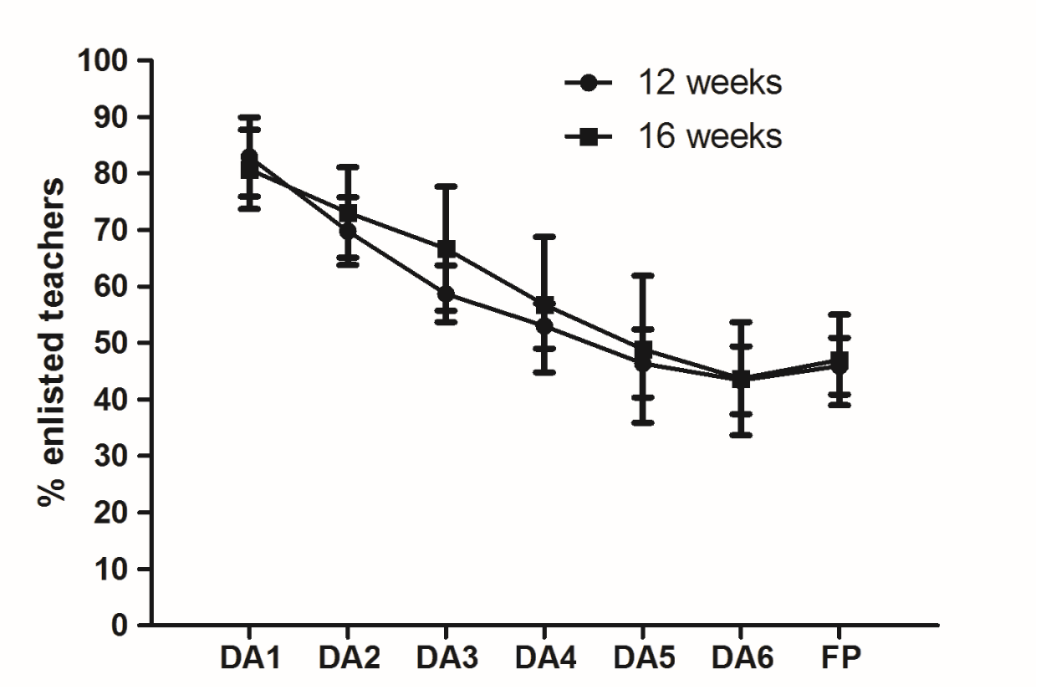

Figure 1. Persistence in online courses as indicated by the percentage of teachers that delivered each distance activity (DA) or the final paper (FP) on the corresponding deadlines.

Profiles of Persistent Teachers

We compared persistent teachers and dropouts concerning the sociodemographic data available (Table 3). No significant differences were found between them considering gender, age, frequency of internet use, and average number of internet tools used. Moreover, the percentages of teachers that used each of the internet tools surveyed were also indistinguishable (Figure 2).

Table 3

Participants' Self-Reported Demographic Data

		Persistents (n=1569)	**Dropouts (n=1386)**	***p* value**
Gender	Male Female	24.8% 75.2%	24.4% 75.6%	$p = 0.08^{***}$
Age		36.45 (±9.12)	35.75 (±8.29)	$p = 0.2294^{**}$
Frequency of Internet use*		6.04 (±1.58)	5.93 (±1.65)	$p = 0.1513^{**}$
Average number of Internet tools used		6.90 (±2.46)	6.67 (±2.42)	$p = 0.1513^{**}$

Note. *In days per week. **Mann-Whitney test ***Chi-squared test

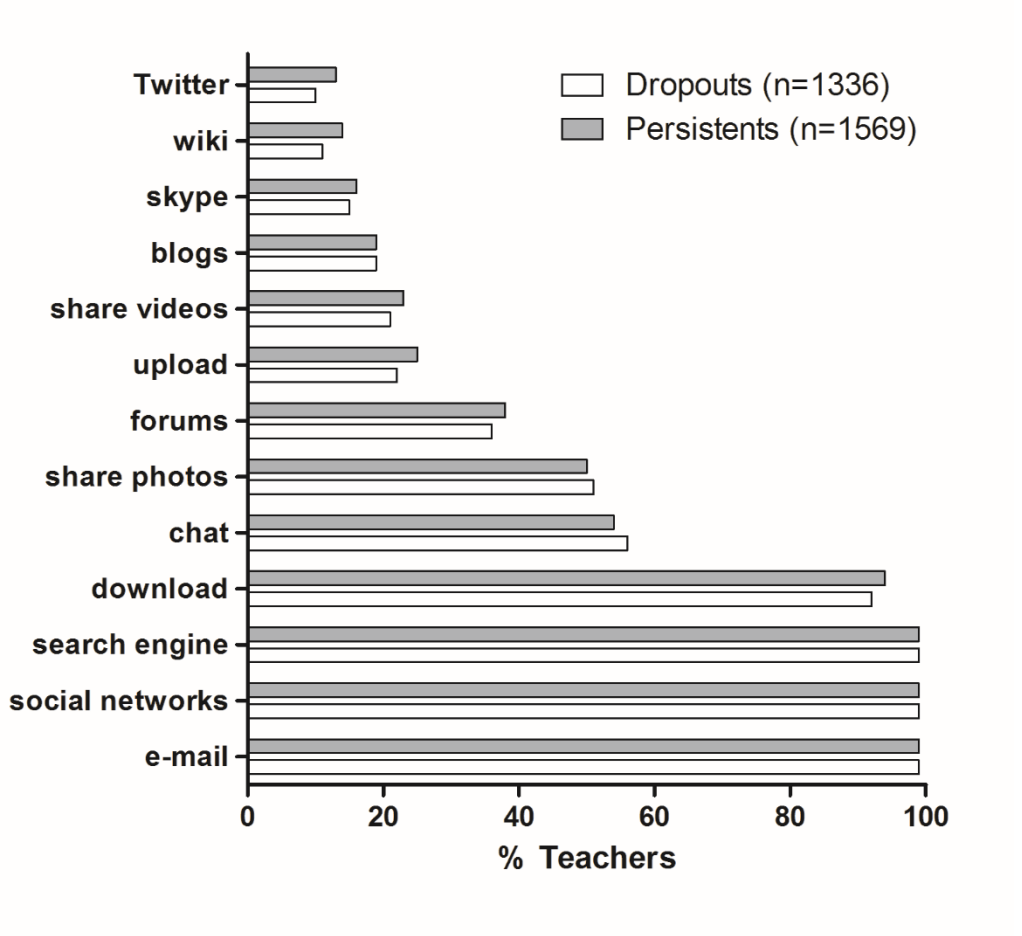

Figure 2. Use of 13 Internet tools by teachers.

Understanding the Reasons for Dropping Out

A follow-up procedure based on email messages and phone interviews was established to keep track of individual teachers during two courses. The procedure was aimed at trying to foster their participation and to identify possible reasons for dropping out of the courses. A total of 149 teachers out of the 188 that dropped out of those two courses were reached, either by e-mail (n=45) or telephone (n=104), resulting in a response rate of 79.3%. The answers to email messages and to interviews fell into similar categories and were analyzed together. Pooled results are shown in Figure 3.

As shown in Figure 3, the most frequent category (40.3%) that emerged from the answers comprised internal causes related to technological and technical issues (Park, 2007; Rovai, 2003). Technological problems were related mainly to difficulty in accessing the internet (16.9%) or to not owning computers (8.7%). Technical issues included difficulty in dealing with a courses' platform (12.1%) or other software issues (2.6%).

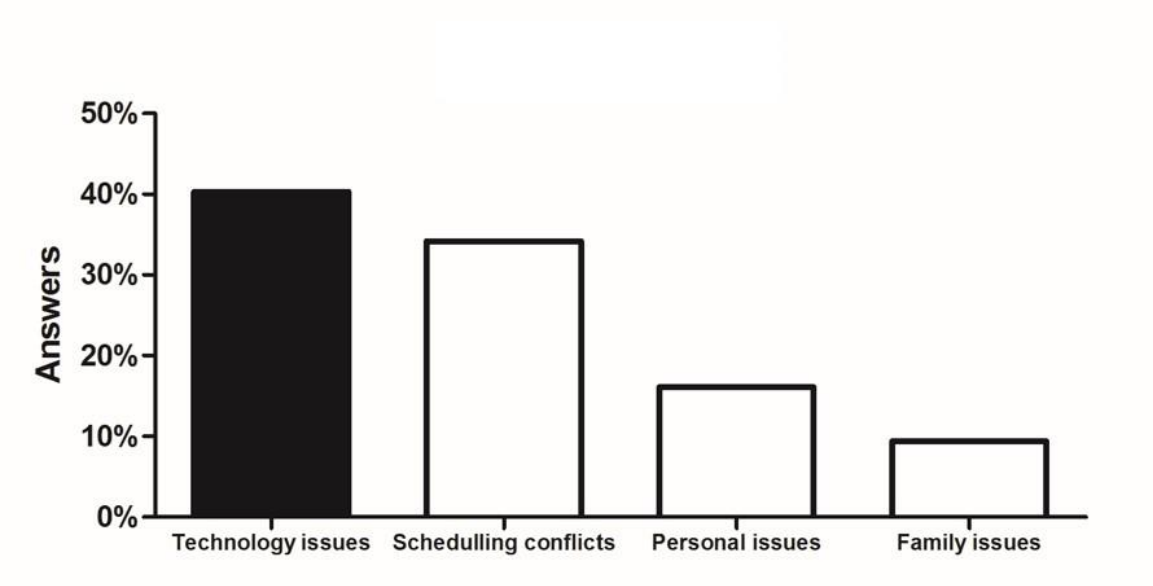

Figure 3. Teachers' (n=149) self-reported reasons for abandoning online courses. Internal (black bars) and external causes (white bars) are defined based on Park & Choi (2009) theoretical framework. Adapted from "Factors influencing adult learners' decision to drop out or persist in online learning," by J. Park and H. Choi, 2009, *Educational Technology & Society, 12*(4), 207–217. CC-BY-NC-NC 3.0.

However, the majority (59.7%) of the reasons reported by teachers for dropping out were external in nature (Figure 3, white bars). The scheduling conflicts mentioned as reasons for dropping out of the courses by 34.2% of the teachers were a consequence of the excessive workload related to the required number of lessons to be taught weekly in several different workplaces. According to the teachers, that overload made it difficult for them to cope with the DAs and to keep track of the activities, thus leading them to drop out. Answers provided in the personal issues category (16.1%) were mainly related to health problems (9.4%) that rendered it impossible for the teachers to do the courses. Family issues were also frequently reported (9.4%), which demanded substantial time from the teachers who needed to spend time with their children or caring for their relatives' health. The remaining teachers (6.7%) used general expressions such as "family problems" or "family complications" as reasons for dropping out.

Discussion

Comparing dropout rates of different online courses is a rather complicated task. The dropout rates depend on the educational settings studied. Lower dropout rates are more common among undergraduate students and may be as low as 18% when students face financial penalties for dropping out (Levy, 2007). A slightly higher dropout rate (23.9%) was reported for undergraduate students in regular online university courses not aimed at non-traditional learners (Nistor & Neubauer, 2010). However, Levy's (2007) study was based on a definition of a dropout student that excluded learners that left the course at early stages when they faced no financial penalty for leaving. A dropout rate of 39.2% would have been achieved even without

financial incentives if the teachers who never joined the courses were also excluded from our sample. The global dropout rate reported in the present work (53.1%) results from the combination of two different processes: a sort of no-show phenomena, in which teachers never effectively joined the courses nor handed in any of the scheduled activities and a complementary and more substantial gradual process of dropping out during the courses. That pattern is not uncommon. Grau-Valldosera and Minguillón (2014) reported that about 20% to 30% of the students drop out of their courses in the first semester while the other dropout students gradually leave their courses later. Massive online open courses (MOOCs) are known to suffer with high levels of attrition and high dropout rates that may reach 90%. Those high dropout rates are due to several, and sometimes controversial, causes. (Veletsianos & Shepherdson, 2016). Although MOOCs are remarkably different from most other OPDP, a recent study analyzing MOOCs for non-traditional adult learners also described a combination of a no-show process (only 5% of the learners joined the courses) followed by a gradual dropout process (Eriksson, Adawi, & Stohr, 2017).

A dropout rate of 53.1% is compatible with other reports for adult learners enrolled in online courses. Indeed, Park and Choi (2009) reported dropout rates ranging from 46% to 54.2% for non-traditional adult learners enrolled in job-related online courses. Similarly, Lykourentzou et al. (2009) reported a dropout rate (44%) for adults with different educational backgrounds in introductory e-learning courses. As mentioned previously, reports on dropout rates in OPDP for teachers are rare. Russel et al. (2009) reported a dropout rate of 47% among math teachers enrolled in online courses. Although that dropout rate was lower than those reported here, the teachers who completed those courses in Russel et al.'s (2009) study, did receive financial incentives. A study of a one year long professional teacher development program reported a dropout rate of 40% for both online and face-to-face strategies, but again the teachers who completed the program received financial incentives and the drop-rate rate excluded the teachers who never effectively joined the project (Kubitskey et al., 2012). More recently, Stiller and Bachmaller (2017) reported a dropout rate of 34.1% among 574 trainee teachers registered in an online training course comprising eight modules of up to 90 minutes each (resulting in 18 hours of total workload). In that study, teachers were considered dropouts only if they failed to complete at least one module. That definition makes it difficult to compare their results with those obtained here. The courses analyzed herein had total workloads of 30 hours and were offered during shorter periods. If only the teachers who completed the eight modules in Stiller and Bachmaller (2017) study were considered as persistent it would result in a dropout rate of 66.3%.

The dropout rates of online courses for teachers in developed or developing countries are likely to differ, as the educational conditions in the latter countries are also very distinctive. The strategies to reduce dropout rates that are effective in developed countries may prove unfruitful in other contexts. Although little is known about attrition in online professional development courses for teachers in developing countries, some inferences seem valid. Dropout rates are known to decrease as a consequence of financial penalties and certification (Levy, 2007; Rovai, 2003) However, the possibility of facing financial penalties when abandoning the courses would probably demotivate Brazilian teachers. Indeed, recent reports show that Brazilian teachers' wages are the second lowest among OECD countries, with little improvement in later stages of their career (OECD, 2014). It is thus unlikely that those teachers would risk facing such penalties.

The dropout rates reported here are unlikely to be related to course contents, as similar rates were reported for all courses analyzed. Grau-Valldosera and Minguillón (2014) also reported varying dropout rates

(ranging from 37.3% up 65.6%) in different programs offered by the Universitat Oberta de Catalunya. The dropout pattern is also unlikely to be related to course duration or intrinsic workload because both the total dropout rates and the pattern of dropping out that took place more gradually are quite similar in shorter (12-week) and longer (16-week) terms. That finding is somewhat contradictory with the high percentage of teachers (34.3%) that reported scheduling conflicts as their main reasons for dropping out. It can still be argued that the 16-week courses were still too demanding for Brazilian teachers that are known to be subjected to an excessive workload (Lapo & Bueno, 2003; Villani et al., 2009).

The persistent teachers were indistinguishable from those that left the courses regarding the available socio-demographic data (gender proportions and age). Similar results were obtained by Levy (2007). Hart's (2012) review also found that demographic factors were neither barriers nor facilitators to leaners' persistence in online courses. There were no differences between persistent teachers and dropouts regarding their technological skills. Rovai's (2003) framework included computer skills and the ability to deal with computer-based interactions among the skills relevant for persistency (Rovai, 2003). Park and Choi (2009), on the other hand, suggested that empirical evidence to support the impact of a learners' skills on the dropout rates in distance education was still unavailable. Although the data on teachers' technological skills analyzed in this study was far from exhaustive, we found no differences between persistent teachers and dropouts regarding several factors related to internet and computer use. Those findings may indicate that the teachers' internet-related skills did not play major roles in their decision to leave the courses. This conclusion is corroborated by a study that analyzed the influence of variables, such as teachers' computer attitudes and computer anxiety on dropout rates, and found no significant differences between persistent students and dropouts (Stiller & Bachmaller, 2017).

In the present work, teachers' answers to telephone interviews and email messages were used to investigate self-reported reasons for leaving courses. The decision to contact teachers during the courses as soon as a potential dropout was identified is likely to have allowed the teachers to be contacted near the time when they decided to leave the courses. Teachers were also contacted without prior notice. We believe that this approach may have led to more reliable answers as it neither demanded teachers to recall reasons for their past decisions nor left time for them to elaborate on answers aimed at pleasing the interviewer.

Several studies have reported factors that lead learners to dropping out of online courses. The number of relevant factors reported varies significantly, ranging from 14 (Packham, Jones, Miller & Thomas, 2004) to 69 (Lee & Choi, 2011). In general, those factors are grouped in categories that are either related to learner, environmental, or course factors. Park and Choi (2009) emphasized the importance of organizational support and course relevance to life in the case of non-traditional learners, reinforcing Levy's (2007) idea that relevance and student satisfaction are key factors for persistence. In the present study, certification had no impact whatsoever on the teachers' career, but no teacher mentioned the lack of relevance as a factor that contributed to their decision to leave the courses. The teachers' replies to email messages and phone calls fit the categories of Park's (2007) framework. The majority of the answers (59.7%) fell within categories grouped as external factors, mainly scheduling conflicts, personal, and family issues. The predominance of external factors among non-traditional adult learners is not uncommon. This finding agrees with the results of a recent study showing that physical constraint (a comprehensive external factor that comprises schedule conflicts, increased workload, child rearing, and personal disease) showed a strong

negative correlation with persistence among students from undergraduate courses (Choi & Park, 2018). The most commonly alleged external factor behind dropping out in the present study was related to scheduling conflicts (34.2%). Such conflicts were connected to a learners' workload, a finding that is in agreement with several reports on the causes of high dropout rates in the context of online courses (Packham et al., 2004; Park, 2007; Park & Choi, 2009; Rovai, 2003). Teachers' heavy workloads is a well-known phenomenon (Ballet & Kelchtermans, 2009; Klassen & Chiu, 2010) and has also been reported as a reason for dropping out in a study about online professional development programs (Kubitskey et al., 2012). Family issues, mostly the need to interrupt the courses to support sick family members, were also common as were issues related to the teachers' own health. Those findings are especially relevant in Brazil, where excessive work hours in multiple jobs can lead to burnout among teachers (Carlotto, 2011).

Internal factors accounted for a relevant proportion of the answers (40.3%) and could be grouped within the technology issues category (Park, 2007; Park & Choi, 2009). The teachers that enrolled in the courses analyzed in the present study are frequent internet users and use a broad variety of internet tools, a finding that is compatible with a previous study that characterized Brazilian teachers' use of internet tools (Rolando et al., 2013). Only 12.3% of the teachers mentioned the instructional design as a reason for abandoning the courses, suggesting that changes in the courses' general features would have little effect on the dropout rates. The low speed of their internet connections and the frequent connection failures accounted for a greater proportion of answers than issues related to the course platform. Although improvements on school-based internet access and computer availability have been documented in Brazil (Fidalgo-Neto et al., 2009) it is also unlikely that those improvements could have a relevant impact on dropout rates from the courses, because most teachers access the internet from their homes (CETIC, 2013) probably due to the constant commuting between their multiple jobs. On the other hand, it is reasonable to expect that improvements on the quality of internet connection that teachers have at home could substantially reduce dropout rates in online courses.

Conclusion

Public policies have recently been implemented in Brazil to promote teacher online development programs. We have shown that dropout rates in those courses are high and probably unrelated to the characteristics of the courses. The lack of time due to a heavy workload as well as technological issues associated with the quality of the internet connection that teachers have access to accounted for most of the reasons for dropping out. These results suggest that increasing the opportunities for teachers to enroll in online courses in Brazil will not suffice. Currently, professional development programs have little or no impact on the teachers' careers or wages in Brazil (Villani et al., 2009). Dropout rates in OPDP would likely fall if such programs had a positive impact on teachers' careers. It seems that the players involved in providing online courses for teachers (e.g., schools, universities, and government agencies) should develop partnerships to offer at least temporary financial incentives and reduced workload to reduce attrition and make it feasible for Brazilian teachers to complete courses. Further large-scale studies are needed to determine whether or not the reasons that lead Brazilian teachers to drop out of the courses studied here reflect a general pattern.

It is also necessary to investigate whether those findings apply to similar contexts in other developing countries.

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Appendix A

Text of the Email Message Sent to the Teachers

Dear teacher,

You have not accessed the virtual classroom of the course (name of the course) during the last weeks. Please, feel free to contact us in case you are experiencing difficulties in accessing the classroom or facing other issues that are preventing you from doing the course. We will be glad to assist you in any way so that you can continue attending the course.

Best regards,

Fundação Cecierj - Outreach Team

Appendix B

General Structure of the Phone Call Made to Teachers

Tutor: Greetings. I am (caller's fictional name) a tutor with the CECIERJ foundation. We are calling you to talk about the course (cites name of the course) you are enrolled in. We have noticed that you have not accessed the virtual classroom for quite a long time. Is there anything that I can do to help you? May I assist you with anything that might help you rejoin the course? (in case of a negative answer) Would you like to share the reasons that lead you leave the course?

Thank you, Fundação Cecierj - Outreach Team

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Interaction of Proctoring and Student Major on Online Test Performance

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Abstract

Traditional and online university courses share expectations for quality content and rigor. Student and faculty concerns about compromised academic integrity and actual instances of academic dishonesty in assessments, especially with online testing, are increasingly troublesome. Recent research suggests that in the absence of proctoring, the time taken to complete an exam increases significantly and online test results are inflated. This study uses a randomized design in seven sections of an online course to examine test scores from 97 students and time taken to complete online tests with and without proctoring software, controlling for exam difficulty, course design, instructor effects, and student majors. Results from fixed effects estimated from a fitted statistical model showed a significant advantage in quiz performance (7-9 points on a 100 point quiz) when students were not proctored, with all other variables statistically accounted for. Larger grade disparities and longer testing times were observed on the most difficult quizzes, and with factors that reflected the perception of high stakes of the quiz grades. Overall, use of proctoring software resulted in lower quiz scores, shorter quiz taking times, and less variation in quiz performance across exams, implying greater compliance with academic integrity compared with when quizzes were taken without proctoring software.

Keywords: online learning, online testing, academic integrity, academic honesty, proctoring, distance learning

Introduction

The dissemination of advanced technology in education, and in particular the growth of online and distance learning courses, have created countless opportunities for intellectual and professional growth. Prospects for continuing one's education without traditional constraints of in-class instruction schedules appeal to many learners, especially those who can learn without being under direct in-person supervision of an instructor. An unintended consequence, however, is an increased potential for academically dishonest behaviors due to opportunities for cheating that use unauthorized technological assistance and occur out of the sight of an instructor (Etter, Kramer, & Finn, 2006). This is a significant problem in higher education as academic integrity is critical to an institution's reputation, as well as the expectation of workplaces and society that college graduates actually master the content and skills assessed in their program of study. Despite efforts to encourage honesty in all types of course assessments, higher education institutions face the same types of scandals and deceit that occur in the workplace and society (Boehm, Justice, & Weeks, 2009).

Academic misconduct has many forms that include submitting work that is not one's own, plagiarizing other's words without acknowledgement, using unauthorized notes during an exam, receiving help from another person or from the internet during an exam, programming answers into electronic devices, texting answers, and having another person take an exam or write a paper in one's place. Newly established internet business sites sell or trade academic papers and answers to tests in specific courses at colleges and universities across the nation (Berkey & Halfond, 2015). The convenience and perceived anonymity associated with patronizing these sites can make it difficult to resist when students perceive that the stakes are high if they do not achieve a high grade. The numerous cheating methods, especially those that use the latest technology, make it difficult for even experienced instructors to detect.

Research on student perceptions about integrity indicates that student dishonesty is a significant concern, especially in online classrooms (Berkey & Halfond, 2015; D'Souza & Siegfeldt, 2017; Kitahara, Westfall, & Mankelwicz, 2011), and that steps taken to ensure a fair environment when it comes to assessment are supported by students as well as instructors. Faculty who teach online are encouraged to use various pedagogical strategies to develop a relationship of trust with their students (WCET, UT Telecampus, & Instructional Technology Council (WCET), 2009). Connecting with students in meaningful ways is important, but can still be challenging due to students who are geographically dispersed. Student-instructor relations can be further challenged when teaching and assessment roles become separated due to automation in popular modular teaching systems (Amigud, Arnedo-Moreno, Daradoumis, & Guerrero-Roldan, 2017). The sense of distance, weak personal ties to classmates and instructors, and perceived anonymity, may yield a detached feeling that enables a student to engage in dishonest behavior in an online assessment (Corrigan-Gibbs, Gupta, Northcutt, Cutrell, & Thies, 2015). Nevertheless, the success of distance learning requires careful attention to the design of the course as WCET (2009) describes, including establishing policy, incentives for honesty, and holding accountable students who demonstrate dishonesty.

Background

Academic Dishonesty in Online Classes

Cheating, while not new to academia, has become increasingly complex in online environments where asynchronous learning and assessment occur far from the instructor's explicit monitoring. Students may be tempted to cheat due to the perception that academic dishonesty will go unnoticed in a virtual classroom. Instructors are challenged with providing an environment and tools that prevent and detect occurrences of academic dishonesty. There is a growing body of literature supporting the notion that students are more likely to cheat in online courses than in face-to-face environments. This includes both indirect and direct measures of cheating in a wide variety of educational contexts.

Self-report survey research includes a study by King, Guyette, and Piotrowski (2009), who found that 73% of 121 undergraduate students reported that it was easier to cheat online compared to a traditional face-to-face classroom. Furthermore, Watson and Sottile (2010) reported that when asked if they were likely to cheat, 635 students surveyed indicated they were more than four times as likely to cheat in an online class than in a face-to-face class.

Direct assessment of cheating has also found it to be common in online courses. Corrigan-Gibbs and his colleagues (2015) directly measured cheating in online MOOCs and work assignments, using both content analysis of open-ended assignments and visits to a "honey pot," a website that promised solutions to problems; they found that between 13% and 34% of students cheated, despite honor codes and warnings of penalties. Fask, Englander, and Wang (2014) found evidence that students taking an online unproctored test cheated more than those taking the same test in a proctored face-to-face format. Despite a few studies that found no evidence of cheating (e.g., Beck, 2014), these results present an ominous picture of integrity in the online classroom that Rujoiu and Rujoiu (2014) reported is associated with integrity or lack thereof, in the workplace.

Factors That Affect Cheating

Understanding factors that influence student behaviors to cheat is complex as it includes personal factors and ethical principles, regardless whether cheating behavior occurs in a traditional classroom or in technologically-assisted ones such as online classes (Etter et al., 2006; McCabe, Trevino, & Butterfield, 2001). Personal factors can include individual situations and circumstances, including each student's prior experiences, level of competence, and beliefs, that guide their behaviors in the classroom (Schuhmann, Burrus, Barber, Graham, & Elikai, 2012). Ethical principles can be influenced by personality and peers, as well as the organizational climate, condition, and structure of the classroom.

The classroom environment that is created by the instructor is important in affecting student behaviors of all types: frequency and quality of participation in class, workgroup cooperation, sparking student curiosity, independent learning, and demonstrating academic integrity on assignments and assessments. Rubin and Fernandes (2013) summarized several reports on organizational climate and composition theory and found evidence that the psychological climate in online classes facilitates students' interpretation and affects the action they take, which in turn affects the environment, continuing in a reciprocal way.

D'Souza and Siegfeldt (2017) describe the academic dishonesty triangle of three factors that contribute to cheating: "Incentive to cheat, an opportunity to cheat, and rationalization to cheat" (p. 274). According to this framework, taking an unproctored online test provides an opportunity to cheat. Taking majors that lead to highly competitive graduate education, such as medical, law, or business schools, or that require high grades to maintain student status, would constitute an incentive to cheat. If this model is correct, such students would be more likely to cheat than would students in less competitive majors.

Another factor that may create an incentive to cheat is the perceived difficulty of a test (Christie, 2003). If students believe that they will not likely be successful without cheating, or that their academic success rests upon their performance on an exam such as occurs in high-stakes testing, it gives them a greater incentive to cheat. Students who have higher cumulative GPAs are less likely to cheat than are students with lower GPAs, indicating different levels of preparation (Schuhmann et al., 2012). Students taking courses within their major may be less likely to cheat due to greater interest or preparation.

Multiple studies have addressed ways of reducing the likelihood of cheating on online assessments. Strategies that emerged from studies by Beck (2014), D'Souza and Siegfeldt (2017) include various aspects of test and course design such as offering multiple versions of tests or even randomly selecting questions from a pool; providing a tight testing time-limit; randomizing questions and options; reducing closed-ended assessment to reduce the stakes of testing; blocking students from printing the exam questions; withholding answers until the exam is completed by all students; avoiding high-stakes tests; and developing a supportive and trusting community within the class (Beck, 2014; D'Souza & Siegfeldt, 2017; McCabe et al., 2001; Rogers, 2006; WCET, 2009). These techniques have been assessed in combination rather than separately in an experimental format, so it is not yet possible to know which approaches have been more effective (e.g., Beck, 2014; Cluskey, Ehlen & Raiborn, 2011; McGee, 2013),

Some researchers hold that appropriate instructional design of open courses can eliminate cheating, particularly when assessment relies upon application of concepts rather than memorization of facts (Cluskey et al., 2011; McGee, 2013). However, several studies belie this notion. Northcutt, Ho, and Chuang (2016) found that a significant number of students taking Massive Open Online Courses (MOOCs) cheat by means of using more than one user account: one to "harvest" questions and correct answers, and another to obtain a certificate. This large-scale study used multiple algorithms to identify such cheating, and found 657 individuals across 115 courses used at least one cheating strategy called Copying Answers Using Multiple Existences Online (CAMEO). Among those students who earned 20 or more MOOC certificates, 25% appeared to use the CAMEO method to cheat. In another study of large-scale open online courses (Corrigan-Gibbs et al., 2015), assessment involved the application of concepts and high levels of critical thinking in both closed and open-ended questions, whereby instructors created 15 versions of the test with randomized questions arbitrarily pulled from a question bank to each student in the course. Despite these aspects of assessment design, the researchers found that a large proportion of students (13% - 35%) cheated by sharing answers with other students, seeking correct answers online, or using the CAMEO method.

Prior Findings of Grade Disparities and Cheating in Online Classes

Previous research has used the finding of significant differences in scores between proctored and unproctored tests as a measure of cheating (Beck, 2014; D'Souza & Siegfeldt, 2017). An elegant study by

Fask et al. (2014) statistically controlled for the effects of online versus face-to-face examination processes, and found that students were more likely to cheat in unproctored online tests. A study by Alessio et al. (2017) attempted to determine if online quiz results were lower when proctored than when unproctored, which would imply, although not directly prove, that cheating occurred more often in online quizzes that were not proctored. In a natural design study of 147 students enrolled in nine sections of the same online course, student scores averaged 17 points higher when they were not proctored compared to when they were proctored. This result was consistent both within and between sections. Students who were not proctored also used significantly more time to complete their online quizzes compared to those who were proctored, a finding both within and between sections. This finding appears to support students' attitudes toward cheating in an online class as reported by Watson and Sottile (2010), but also suggests an intervention strategy likely to prevent cheating - the use of online proctoring software.

The study described in this manuscript uses a randomized design in multiple sections of an online course to examine quiz scores and time taken to complete online quizzes with and without proctoring software, controlling for exam difficulty, course design, instructor effects, and student majors, in an effort to explore some attributes that may affect academic dishonesty. The research questions of this randomized study are:

1. What is the significance of proctoring software on student's test scores and completion time in comparison to tests without proctoring?

2. What is the effect of exam difficulty on scores in online tests with and without the use of proctoring software?

3. What is the effect of student major on scores in online tests with and without the use of proctoring software?

Methods

Investigating Academic Integrity in an Online Course

The data were collected from college students attending a college in the Midwest region of the United States taking an accelerated format, three-week course titled *Medical Terminology for Health Professionals*. The bulletin description states that this course "provides the opportunity for students to comprehend basic terms related to anatomy, pathophysiology, diagnostics and treatment. Students will understand word parts necessary to build medical terms and acceptable medical abbreviations and symbols." The course is a common prerequisite for professional schools in many allied health fields, including medical, physical therapy, nursing, and occupational therapy schools. The class emphasizes the learning and application of medical vocabulary terms associated with anatomy, health, and disease. Following best practices for reducing cheating, the course includes multiple forms of assessment, including open-ended discussions (e.g., case studies that require accurate descriptions of medical conditions, problems that require use of commonly used and standard medical terms, and creation of subjective, objective, assessment, and plan [SOAP] notes for documenting and interpreting patient medical charts), as well as a series of four tests. The course also follows the recommended practice of tests that represented approximately half of the total course grade and varied assessments that include ongoing discussion, projects, case studies, and

applications. Quiz performance contributed to 40-50% of the overall grade across sections. The course had several sections taught completely online with different instructors administering the same curriculum. All six instructors agreed to use common exam formats that apply concepts from WCET's best practice for online education, including timed quizzes, random selection of questions from a common question pool, and responses that are in randomized order (WCET, 2009). In addition, students could not exit and restart an online quiz once they had begun, and could not view the exam after completing it.

All six instructors used the same proctoring software, Respondus Lockdown Browser™ + Respondus Monitor, a remote proctoring software that videotapes the student in their surroundings and also locks down their internet browser during the test so they cannot open other websites, nor can they take a screenshot, copy, or print exams to share them with others.

Participants and Responses Evaluated

Students enrolling in six sections of this class were analyzed. These students were from a variety of majors including the Kinesiology and Health (KNH) department, which were categorized under the following fields of study: Kinesiology (KNH-Kin), Health-Nutrition-Athletic Training (KNH-Health), Pre-Med, Business, Biological-Sciences (Bio-Sci) and others. For a full listing of majors within each category please see Appendix A.

Quiz scores and the time to complete each quiz from students were analyzed in this study. Each student completed four quizzes containing multiple choice questions pertaining to the four units in the course, with 60 minutes allowed to complete each quiz. The quizzes were administered through the online course management software, Canvas, and were uniquely generated for each student using questions randomly selected from question sets shared across all course sections. Questions were determined by the instructors to have similar difficulty levels.

Reasoning and Plan for Online Quizzes in Proctored and Non-Proctored Environments

A concern about integrity in distance learning is that due to the online administration of quizzes and tests, there is typically a heavy reliance on student honesty to refrain from using unauthorized reference materials during examinations. This especially applies in classes that have multiple sections, some of which may be offered online, while other sections are offered in a traditional format. The different ways of proctoring for online versus traditional tests may yield different results that do not accurately reflect student mastery of the content. This is particularly likely in closed-ended tests that measure recognition, understanding, and basic applications of information that can be easily looked up on the internet or in a textbook, rather than open-ended questions that involve more complex processing of information. There is a need in such cases to assure that the integrity of the course was upheld such that academic honesty of students was promoted to the best of the instructors' abilities.

Students were informed in writing about the following conditions and expectations that applied to all quizzes: students were to take these quizzes by themselves with no notes or other resources allowed during the exam. Students were not certain which of the quizzes would be proctored prior to the start of the exam. All quizzes covered similar material, and questions were randomly drawn from a shared question bank. Following the completion of proctored quizzes, thumbnails of the pre-quiz student photo, student ID, and

environment scan were generated, along with randomly timed thumbnails of the entire quiz video from Respondus Monitor. The thumbnails were available for review by the instructor of the course to detect rule violations or suspicious activity. The instructor could click on each thumbnail to view a brief timed interval of a portion of the video that recorded the student while taking the quiz in order to confirm whether or not a violation occurred during the exam.

Data Collection and Analyses

To explore the impact of proctoring software on student performance, the six course sections were assigned to a sequence of proctored/unproctored quiz progression. For shorthand reference to this sequence of proctored and unproctored exams, we will use a four character acronym of "P" and "U" in order of the quizzes (example: *UPUP* refers to a sequence with quizzes 1 and 3 being unproctored, and quizzes 2 and 4 being proctored) In designing the study, it was decided that the first two units contained easier materials than the last two units, so only the orders *PUUP, UPPU, UPUP,* and *PUPU* were considered to allow for one quiz of each proctor status in each half of the course.

Following the conclusion of the course, all students were contacted about the use of their data in class with all identifiers removed, and were provided an opportunity to have their data omitted from analyses. No student requested removal of their quiz scores or other information. The anonymized data from all students who consented and had completed all four quizzes were then used in a statistical analysis to assess the effect of proctoring on exam scores and the percentage of allotted time taken.

Statistical Modeling of Quiz Scores

The effects of proctoring while controlling for the section, quiz, and major of the students were modeled. It was hypothesized that the four quiz scores from the same student will be naturally related, and also that the scores from students of the same section may be correlated as well. To accommodate this covariance structure, a mixed effects regression model (McLean, Sanders & Stroup, 1991) was used, with nested random effects for students and students within sections, and fixed effects to estimate the effect of proctoring status while controlling for student major and quiz number. The model promotes the most viable interpretability to a broader population of students as it acknowledges that the results are specific to the student majors and the quizzes in this particular Medical Terminology course.

The model selection process revealed that scores were significantly affected by proctoring, quiz number, and student major, and additionally that proctoring effects varied significantly across quizzes and majors; thus these were included in the fixed effects of the model. The nested random effects for students and students within sections were also found to provide stronger model fit. The selected mixed random effects model is therefore defined as:

$$\text{Score}_{jklmn} = Intercept + Proctor_j + Quiz_k + Major_l + (Proctor \times Quiz)_{jk} \quad (1)$$
$$+ (Proctor \times Major)_{jl} + \gamma_m + \delta_{mn} + \epsilon_{jklmn}$$

where Score_{jklmn} is the score for proctor status j on quiz k with major l from section m and student n. Random effect $\gamma_m \sim Normal(0, \sigma_m)$, $\delta_{mn} \sim Normal(0, \sigma_{\text{mn}})$, and $\epsilon_{jklmn} \sim Normal(0, \sigma)$ are assumed to be

independently distributed and represent the effect for class sections, effect for students within sections, and error terms for each individual quiz score, respectively.

Statistical Modeling of Time Taken

A similar modeling process to that described for quiz scores in the section above was used to explore the effect of proctoring on time taken for quiz completion, while controlling for other important factors. Model selection yielded a model with main effects for proctoring, quiz number, and student major, and interactions between quiz number and proctoring is included for time taken. Note that for time taken, the interaction between student major and proctoring status was not found to aid the model fit. The model fitting also suggests the need for nested random effects for students and students within sections. The final model fitted for time taken is defined as:

$$\text{Time}_{jklmn} = Intercept + Proctor_j + Quiz_k + Major_l + (Proctor \times Quiz)_{jk} + \gamma_m + \delta_{mn} + \epsilon_{jklmn} \quad (2)$$

where Time_{jklmn} is the time taken for proctor status j on quiz k with major l from section m and student n. Random effect $\gamma_m \sim Normal(0, \sigma_m)$, $\delta_{mn} \sim Normal(0, \sigma_{\text{mn}})$, and $\epsilon_{jklmn} \sim Normal(0, \sigma)$ are assumed to be independently distributed and represent the effect for class sections, effect for students within sections, and error terms for each individual quiz time, respectively.

Results

Data Description

Proctoring is possible in the online setting if monitoring software is employed. In the plots in Figure 1 below, with proctor status (procStatus) indicated in red for unproctored and blue for proctored, we see that overall the proctored and unproctored quizzes start off with similarly high scores and short time taken on Quiz 1, but that a clear separation forms with unproctored quizzes scoring higher and taking longer on average. In Figure 2, with proctor status indicated as unproctored in red and proctored in blue, the bottom two graphs show that the overall trends of increasingly separated scores and time taken seem to hold for unproctored tests for most student majors; with the exception of the KNH-Health students outside of Kinesiology – including athletic training, nutrition, public health, and sports leadership and management. These KNH-health students had scores and times that were not easily separable by proctoring status. We can also note that all six of the Pre-Med students were in sections following the *PUUP* quiz progression and thus we will be careful with our interpretations for students of this group of majors. The top two plots in Figure 2 show that the unproctored quiz scores tended to be higher with longer time taken for most sections. Despite a miscommunication in administration of quizzes in a seventh section, the other sections (A-F) provide sufficient observations to allow the estimation of proctoring effects while controlling for quiz progression.

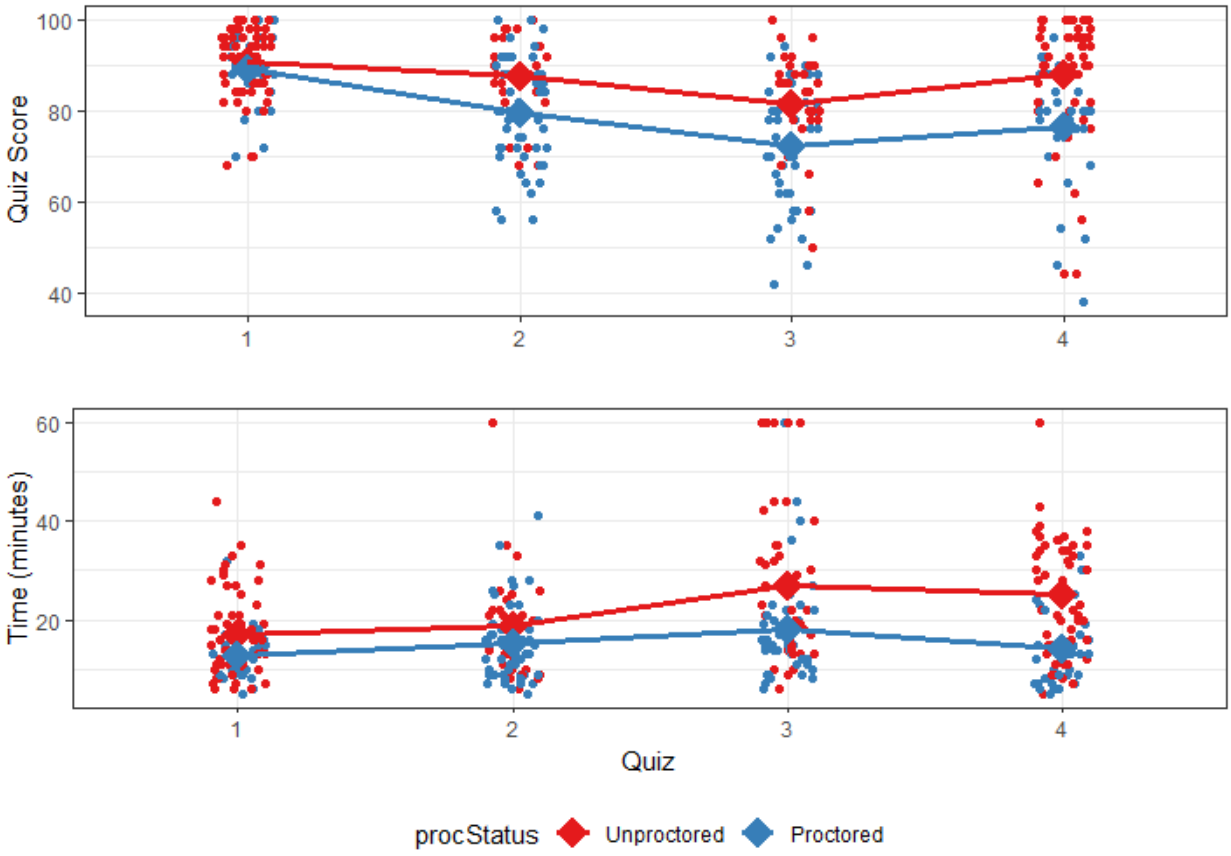

Figure 1. Quiz scores (top) and quiz times (bottom) – when unproctored and proctored.

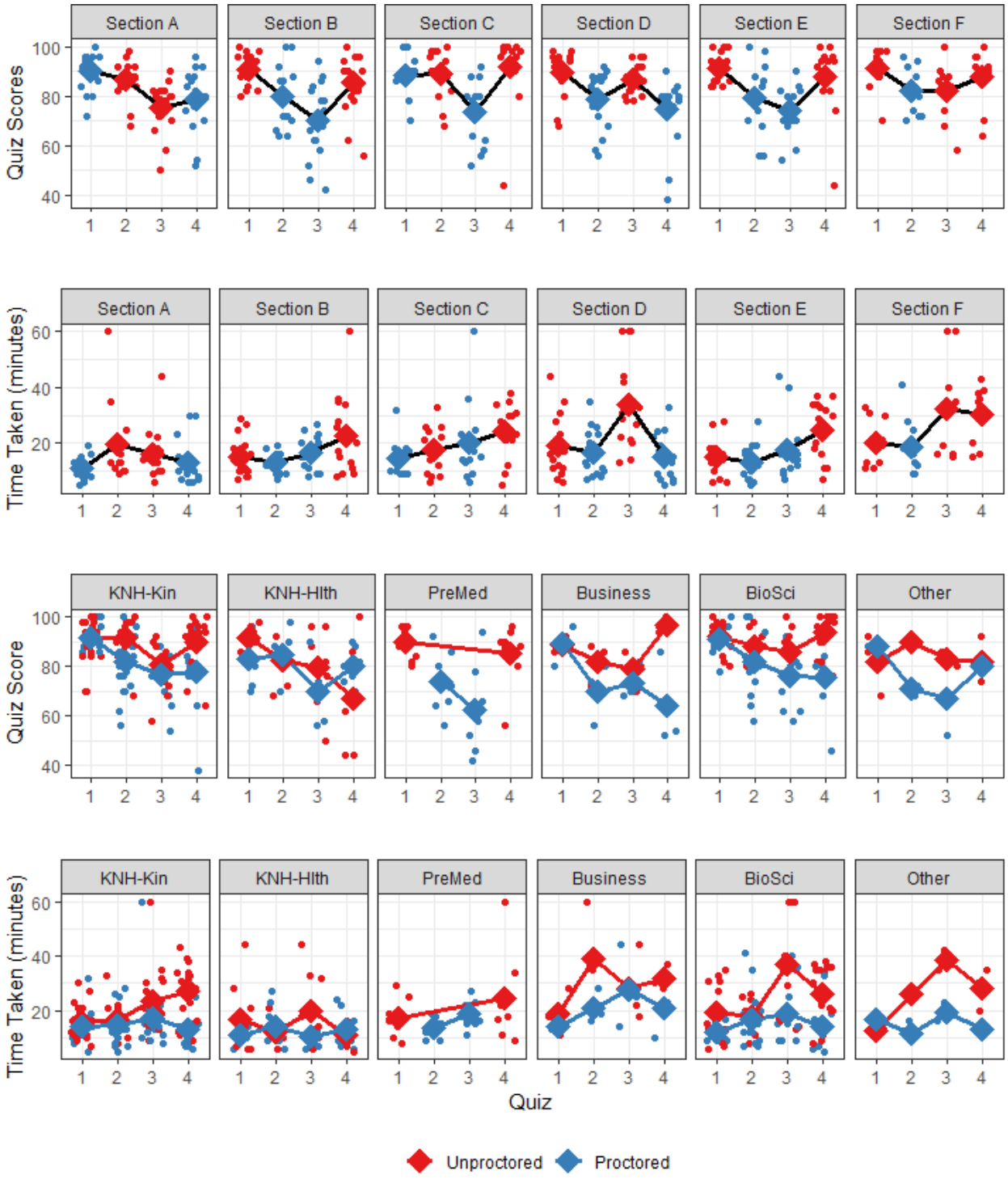

Figure 2. Four different quiz scores by section, quiz times taken by section A-F, quiz scores by major, and quiz times taken by major.

Modeling Quiz Scores

The fixed effects estimated from the fitted statistical model provide a few key insights about how proctoring, quiz progression, and student majors interact. Figure 3 displays the behaviors that are contained in the fixed effects structure of the fitted model for quiz scores. This plot shows predicted quiz scores for each student major and proctoring status with red lines representing unproctored and blue lines representing proctored status for each quiz. Model coefficients and associated inferential statistics are provided in Appendix B: please note that coefficients are interpreted relative to the intercept that represents a baseline of Kinesiology students (KNH-Kin major) unproctored on Quiz 1. We find that there is no statistically significant effect of proctoring for the baseline group on Quiz 1, however, through the interaction terms, we find that significant differences are manifested over the different quizzes and majors.

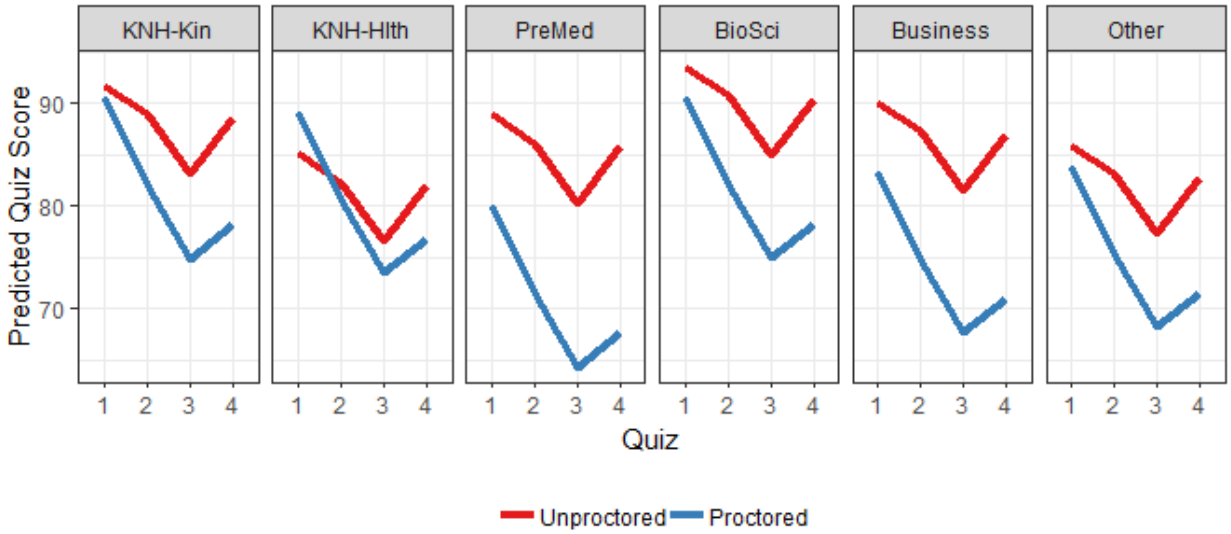

Figure 3. Plot of predicted quiz scores under each combination of student major, quiz number, and proctoring status based on fixed effects structure from fitted model.

Not all quizzes are equally difficult, with statistically significantly different average scores even while controlling for majors/proctoring. Quiz 3 appears to be the most difficult, with an estimated 15 point lower score than on Quiz 1. It is also is clear that in nearly all cases, the proctored scores are predicted to be lower than unproctored scores. On Quiz 1 and 2 the estimated scores for unproctored are not statistically significantly higher, but this difference grows to a statistically significant 7 point and 9 point higher score for unproctored students on Quizzes 3 and 4, respectively.

The interaction terms show some distinctly different results of proctoring within the student majors as well. Majors in Bio-Sci, Business, and Other displayed no statistically significant differences from the baseline KNH-Kinesiology cohort, each having notably lower scores when proctored on Quizzes 3 and 4. However, the KNH-Health showed significantly lower unproctored scores than the baseline, while having a positive adjustment when being proctored; the net effect overall is that they are the only cohort without a major change in scores when being proctored. Also apparent is the gap between proctored and unproctored quizzes, which is statistically significantly larger for pre-med students than the rest of the majors.

Modeling Time Taken

We now take a similar approach for interpreting the proctoring effects on the time taken per quiz, based on the model discussed in the Methods section. In Figure 4 below, we plot the predicted time for quiz completion under each major, with proctoring indicated by red lines for unproctored and blue for proctored, and quiz combination that represent the fixed effects portion of the model for time taken. The model of coefficients and associated inferential statistics relevant to this figure is provided in Appendix C.

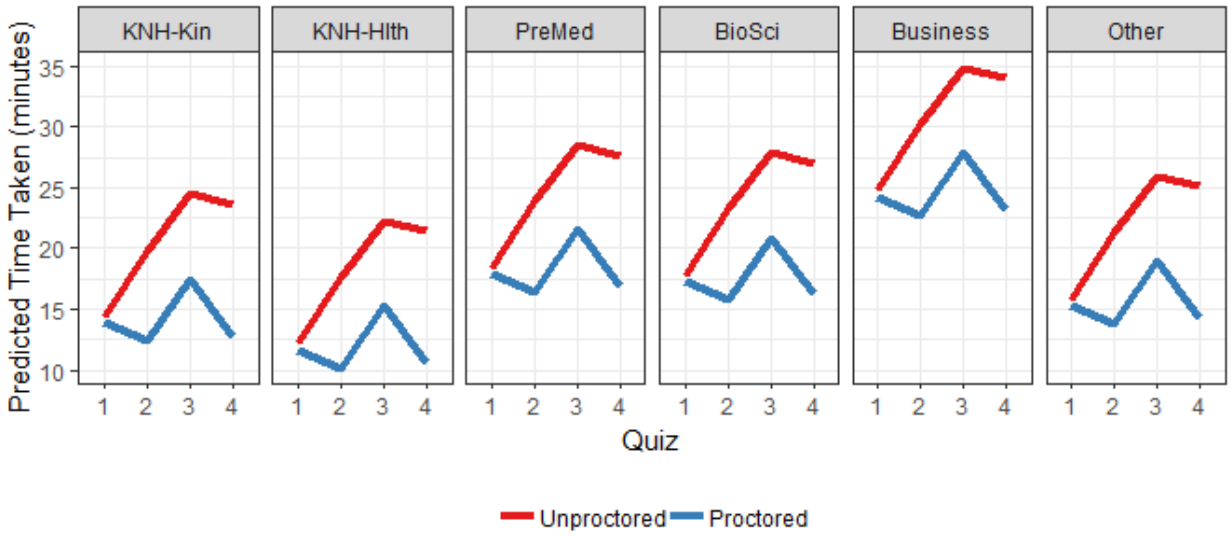

Figure 4. Plot of predicted time to complete test under each combination of student major, quiz number, and proctoring status based on fixed effects structure from fitted model.

From the model, it is shown that in Quiz 1 there is no statistically significant effect for proctoring on time taken; however, on all subsequent quizzes there was a statistically significant increase in the time taken when the quizzes were unproctored. It is additionally noted that only the business students had statistically significant difference in time taken from the baseline of KNH-kinesiology students, taking an estimated 10.4 minutes longer per quiz.

Discussion

This study was conceived and conducted as a structured randomized design that reported significantly different online quiz scores, as well as time taken to complete online quizzes when comparing students who were tested with and without proctoring software and audiovisual monitoring. The number of quizzes, length of quiz time, and number of quiz questions that were proctored and unproctored were similar for each section. Based on Beck's (2014) suggestion that multiple factors may influence academic dishonesty, including student major, this study compared test results and time taken among a variety of student majors. The first research question inquired about the effects of proctoring software on students' test scores and quiz completion time in comparison to quizzes without proctoring. Results showed that the unproctored quiz scores tended to be higher with longer time taken for most sections compared with proctored quiz scores. Since these results happened both across and within sections, together, these two findings suggest

that when not proctored, students may spend extra time looking up answers using resources that were not allowed during the test.

In our comparison of proctoring effects by student major, a few groups were identified to have significantly different behavior than the rest. Significant differences in grade disparity were found with students who were pre-med and business majors when comparing proctored vs. unproctored and time taken to complete the unproctored tests, respectively. It is noteworthy that the students in these major categories may feel higher academic pressures for high grade than peers in other majors; from medical schools admissions requiring a high GPA and the business college requiring a minimum GPA of 3.4/4.0 for acceptance. Based on results of this study, which controlled for exam difficulty, course design, instructor effects, and student majors, the main findings are that online quiz scores were significantly affected by a) proctoring, b) student major, and c) quiz progression or difficulty.

In addressing the effect of exam difficulty on scores in online tests, with and without the use of proctoring software, results showed that mean grades for the first quiz, across all sections and majors, were highest compared with all other quizzes, indicating a difference in level of difficulty. Grade discrepancy between proctored and unproctored for quiz 1 was the smallest, except for those who identified as "pre-med" students. The grade discrepancies increased with the level of difficulty in each subsequent quiz. The third and fourth quizzes appeared to be the most difficult, and also showed the largest grade disparities in all majors, especially those in pre-med. The overall proctoring effect on the more difficult quizzes approximated 7-9 points lower when students were not proctored compared with when they were proctored.

Time discrepancy between proctored and unproctored quizzes was greater for business students who used much more time to complete their tests compared to all other students. These were the two groups that arguably had the highest stakes for earning a high grade: admission into medical school and admission to, or continuation in, business school. This supports the triangle model of cheating used by D'Souza and Siegfeldt (2017), indicating that factors that increase the incentive to cheat, the opportunity to cheat, and provide rationalization for cheating, all will lead to dishonest behavior.

These findings contradict those of Beck (2014), who found that online unproctored exams were not different from face-to-face, proctored exams. However, Beck's study identified several limitations including a very small sample and possible instructor effects from a single professor. This study controlled for these problems, as well as others such as grade inflation, changes over time (year to year), a test design that does not reflect best practices for discouraging cheating, instructor behavior, and exam difficulty. The findings of the current study support those of other studies (e.g., Alessio et al., 2017; Kitahara et al., 2011) who recommended webcam proctoring in all online courses. The content of the course investigated in this study, Medical Terminology, aligns closely with content expected in nursing courses examined by Mirza and Staples (2010). Therefore it was not surprising that the current results of disparate grades on proctored and unproctored tests, and implications support those of Mirza and Staples (2010), who further reported that students said they were less likely to cheat when monitored with the webcam during online testing.

Conclusions

Academic dishonesty has occurred long before online learning and testing were introduced to academia. The difference in addressing cheating in online classes includes unique challenges that new technology presents that differ from face-to-face situations (Christie, 2003). Instructions and expectations for academic honesty are often written in similar language for both traditional and online courses. However, when students are separated from their instructors and do not experience personal communication, including tone, sense of presence, and facial expressions, they view cheating differently and less negatively than in traditional settings (Moten, Fitterer, Brazier, Leonard, & Brown, 2013). In an effort to get an advantage, some students in online courses turn to dubious businesses that sell academic papers, develop software that assists in cheating during online tests, and even arrange for third-party test takers. Students perceive that their risk of getting caught is low, consequences are light, and have reasons that include a desire to help others as well as themselves (Christie, 2003). Self-reporting of cheating is difficult to interpret due to different survey results ranging from online students reporting they cheated less than face-to-face students (Kidwell & Kent, 2008) to students who admit they were more than four times as likely to cheat when taking an online vs. face-to-face class (Watson & Sottile, 2010).

In a study that explored academic dishonesty beyond self-report data, Alessio et al. (2017) conducted a natural study design that compared online test results from proctored versus unproctored online tests in nine sections of the same course. When proctoring software that included audiovisual monitoring was used, the average test grade was 17 points lower compared with students who were not monitored. This grade disparity occurred both within the same class, when students were proctored on one test and not proctored on another. It also occurred between classes, comparing students who were proctored in one section with students who were not proctored in another section Alessio et al., 2017]; Kitahara et al., 2017).

The current study was conceived and conducted as a structured randomized design that provided a higher level of confidence in the findings. It found significantly different online quiz scores, as well as time taken to complete online quizzes when comparing students who were tested with and without proctoring software and audiovisual monitoring. Grade disparities were observed in the most difficult quizzes and were particularly large for students who identified as pre-medical studies. Compared with all other majors, students who identified as majoring in business used the most time to take a quiz when proctored. Overall, use of proctoring software resulted in lower quiz scores, shorter quiz taking times, and less variation in quiz performance across exams, implying greater compliance with academic integrity compared with when the quiz was taken without proctoring software. These results affirm the value of using proctoring software for online tests and quizzes, especially when exam difficulty progresses over time, and to address the uneven performances by student major.

Limitations and Future Study

This study was limited to a particular course that has a high degree of memorization of terms. While there were multiple ways of assessing student learning in this course (e.g., discussions, case studies), tests primarily included objective questions, with one best answer. The results may not be generalized to more

broad-based courses that incorporate theory, calculations, and subjective type questions. Future studies should examine a wide range of courses in a variety of majors that reflect a wider breadth of assessment.

Cheating, whether it is planned or acutely panic driven, results in students violating test taking rules (Bunn, Caudill, & Gropper, 1992), which leaves the burden on faculty and administrators to prevent, detect, and when appropriate, hold accountable, students who engage in academic dishonesty. This is no small task, with estimates of undergraduate cheating that ranges from 30% to 96% of students (Nonis & Swift, 2001). Identifying when cheating occurs is time consuming and stressful as it requires instructors and proctors to gather evidence of the infraction. An allegation of academic dishonesty then follows an established protocol at the institution that includes due process with evidence presented and all sides heard. Ultimately, a decision is made on whether or not academic dishonesty occurred followed by an appropriate disciplinary action, such as exoneration, or warning, suspension, or expulsion of students found responsible of academic dishonesty. Universities would benefit from systematic integrity practices that include clear preventative guidelines to faculty and students, as well as products designed to prevent academic dishonesty, so that academic integrity can be assured using the best evidence-based strategies.

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Appendix A

List of Student Majors in Each Major Category

Field of study	Included majors	Number of students
KNH-kin	Kinesiology	40
BioSci	Biology, Zoology, Microbiology, Ecology, Chemistry, Biochemistry, and Psychology	22
KNH-health	Sports Leadership and Management, Public Health, Nutrition, Athletic Training, and Healthcare Professionals	17
PreMed	Biochemistry, Microbiology, Biology, University Studies or Healthcare Professionals *with a declared pre-med emphasis*.	8
Business	Accounting, Marketing, Supply Chain and Operations Management, and Finance	6
Other	Speech Pathology and Audiology, Interactive Media Studies, and University Studies	4

Appendix B

Fitted Model Coefficients for Student Quiz Scores Model

Model term	Value	SE	DF	t-value	p-value	
(Intercept)	91.78	1.936	240	47.416	< 0.001	
Proctored	-1.184	2.618	240	-0.452	0.651	
Quiz 2	-2.831	2.283	240	-1.240	0.216	
Quiz 3	-8.601	1.906	240	-4.512	< 0.001	*
Quiz 4	-3.101	1.702	240	-1.822	0.070	*
Proctored* Quiz 2	-5.742	3.557	240	-1.614	0.108	
Proctored* Quiz 3	-7.136	3.169	240	-2.252	0.025	*
Proctored* Quiz 4	-9.276	3.031	240	-3.061	0.002	*
KNH-Hlth	-6.641	2.936	73	-2.262	0.027	*
PreMed	-2.854	3.664	73	-0.779	0.438	
Business	-1.647	4.062	73	-0.405	0.686	
BioSci	1.850	2.519	73	0.735	0.465	
Other	-5.815	4.742	73	-1.226	0.224	
Proctored* KNH-Hlth	5.283	2.819	240	1.874	0.062	**
Proctored* PreMed	-7.711	3.534	240	-2.182	0.030	*
Proctored* Business	-5.611	3.868	240	-1.450	0.148	
Proctored* BioSci	-1.761	2.456	240	-0.717	0.474	
Proctored* Other	-0.892	4.695	240	-0.190	0.849	

Note. *denotes a statistically significant result at the $\alpha = 0.05$ level; **denotes a statistically significant result at the $\alpha = 0.1$ level.

Appendix C

Fitted Model Coefficients for Student Quiz Time Taken Model

Model term	Value	SE	DF	t-value	p-value	
(Intercept)	14.354	2.286	245	6.279	< 0.001	
Proctored	-0.491	1.937	245	-0.254	0.800	
Quiz 2	5.473	1.937	245	2.826	0.005	*
Quiz 3	10.106	1.564	245	6.461	< 0.001	*
Quiz 4	9.267	1.383	245	6.703	< 0.001	*
Proctored* Quiz2	-6.999	3.151	245	-2.221	0.027	*
Proctored* Quiz 3	-6.453	2.708	245	-2.383	0.018	*
Proctored* Quiz 4	-10.353	2.522	245	-4.104	< 0.001	*
KNH-Hlth	-2.177	2.565	73	-0.849	0.399	
PreMed	4.020	3.584	73	1.122	0.266	
Business	10.396	3.571	73	2.911	0.005	*
BioSci	3.391	2.191	73	1.548	0.126	
Other	1.482	4.067	73	0.365	0.717	

Note. *denotes a statistically significant result at the $\alpha = 0.05$ level; **denotes a statistically significant result at the $\alpha = 0.1$ level.

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Making Sense of Learning Analytics Dashboards: A Technology Acceptance Perspective of 95 Teachers

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Abstract

The importance of teachers in online learning is widely acknowledged to effectively support and stimulate learners. With the increasing availability of learning analytics data, online teachers might be able to use learning analytics dashboards to facilitate learners with different learning needs. However, deployment of learning analytics visualisations by teachers also requires buy-in from teachers. Using the principles of technology acceptance model, in this embedded case-study, we explored teachers' readiness for learning analytics visualisations amongst 95 experienced teaching staff at one of the largest distance learning universities by using an innovative training method called Analytics4Action Workshop. The findings indicated that participants appreciated the interactive and hands-on approach, but at the same time were skeptical about the perceived ease of use of learning analytics tools they were offered. Most teachers indicated a need for additional training and follow-up support for working with learning analytics tools. Our results highlight a need for institutions to provide effective professional development opportunities for learning analytics.

Keywords: learning analytics, information visualisation, learning dashboards, distance education

Introduction

Over 20 years of research has consistently found that teachers play an essential role in online, open and distributed learning (Lawless & Pellegrino, 2007; Mishra & Koehler, 2006; Shattuck & Anderson, 2013; van Leeuwen, Janssen, Erkens, & Brekelmans, 2015). Beyond managing the learning process, providing pedagogical support, and evaluating learning progression and outcomes, several authors (Muñoz Carril, González Sanmamed, & Hernández Sellés, 2013; Rienties, Brouwer, & Lygo-Baker, 2013; Shattuck, Dubins, & Zilberman, 2011) have highlighted that online teachers also have a social, personal, and counselling role in online learning. With recent advancements in learning analytics, teachers will increasingly receive an unprecedented amount of information, insight, and knowledge about their learners and their diverging needs. Learning analytics dashboards in particular may provide teachers with opportunities to support learner progression, and perhaps personalised, rich learning on a medium to large scale (Fynn, 2016; Rienties, Cross, & Zdrahal, 2016; Tempelaar, Rienties, & Giesbers, 2015).

With the increasing availability of learner data (i.e., "static data" about the learner; such as demographics or prior educational success) and learning data (i.e., "dynamic data" about the behaviour of a learner; such as engagement in a virtual learning environment, library swipes or number of discussion forum messages) in most institutions (Fynn, 2016; Heath & Fulcher, 2017; Rienties, Giesbers, Lygo-Baker, Ma, & Rees, 2016), powerful analytics engines (Hlosta, Herrmannova, Zdrahal, & Wolff, 2015) that offer visualisations of student learning journeys (Charleer, Klerkx, Duval, De Laet, & Verbert, 2016; Daley, Hillaire, & Sutherland, 2016; Jivet, Scheffel, Specht, & Drachsler, 2018) may enable teachers to provide effective support to diverse groups of learners. Indeed, two recent systematic reviews of learning analytics dashboards (Jivet et al., 2018; Schwendimann et al., 2017), which reviewed 26 and 55 studies respectively, indicated that teachers and students will be able to obtain (almost) real-time information about how, where, and when to study. Several authors have also indicated that learning analytics dashboards may empower teachers to provide just-in-time support (Daley et al., 2016; Herodotou et al., 2017; Mor, Ferguson, & Wasson, 2015; Verbert, Duval, Klerkx, Govaerts, & Santos, 2013) and help them to fine-tune the learning design; especially if large numbers of students are struggling with the same task (Rienties, Boroowa et al., 2016; Rienties & Toetenel, 2016).

While many studies (e.g., Ferguson et al., 2016; Heath & Fulcher, 2017; Papamitsiou & Economides, 2016; Schwendimann et al., 2017) have indicated the potential of learning analytics, the success of learning analytics adoption ultimately relies on the endorsement of the teacher. Teachers are one of the key stakeholders who will access and interpret learning analytics data, draw conclusions about students' performance, take actions to support students, and improve the curricula. Several studies (e.g., Muñoz Carril et al., 2013; Rienties & Toetenel, 2016; Shattuck & Anderson, 2013; Shattuck et al., 2011) have indicated that institutions may need to empower teachers further by introducing appropriate professional development activities to develop teachers' skills in effectively using technology and learning analytics dashboards.

Although several studies have recently indicated a need for a better understanding of how teachers make sense of learning analytics dashboards (Charleer et al., 2016; Ferguson et al., 2016; Schwendimann et al., 2017; van Leeuwen et al., 2015), to the best of our knowledge, no large-scale study is available that has explored and tested how online teachers may make sense of such learning analytics dashboards and interrelated data. In particular, it is important to unpack why some teachers might be more willing and able to adopt these new learning analytics dashboards into practice than others who struggle to make

sense of the technology. One common approach to understand the uptake of new technologies is the Technology Acceptance Model (TAM) by Davis and colleagues (1989) which distinguishes between perceived ease of use and perceived usefulness of technology as key drivers for adoption by teachers. In this study, we therefore aim to unpack how teachers who attended a two hour Analytics4Action Workshop (A4AW) tried to make sense of learning analytics dashboards in an embedded case-study and whether (or not) teachers' technology acceptance influenced how they engaged in A4AW and their overall satisfaction.

Learning Analytics Dashboards and the Role of Technology Acceptance

Several recent studies in this journal have highlighted that the role of teachers in providing effective support in online learning is essential (e.g., Shattuck & Anderson, 2013; Stenbom, Jansson, & Hulkko, 2016). For example, in a review of 14 studies of online teaching models, Muñoz Carril et al. (2013) identified 26 different but overlapping roles that teachers perform online; from advisor, to content expert, to trainer. With the increased availability of learning analytics data (Daley et al., 2016; Herodotou et al., 2017; Jivet et al., 2018; Schwendimann et al., 2017; Verbert et al., 2013) and the provision of learning analytics dashboards to provide visual overviews of data, there are also growing expectations on teachers to keep track of their students' learning.

In order to implement learning analytics in education, teachers need to be aware of the complex interplay between technology, pedagogy, and discipline-specific knowledge (Herodotou et al., 2017; Mishra & Koehler, 2006; Rienties & Toetenel, 2016; Verbert et al., 2013). However, research has shown that providing learning analytics dashboards to teachers that lead to actionable insight is not always straightforward (Schwendimann et al., 2017). For example, a recent study by Herodotou et al. (2017) comparing how 240 teachers used learning analytics visualisations at the Open University (OU), indicated that most teachers found it relatively easy to engage with the visualisations. However, many teachers struggled to put learning analytics recommendations into concrete actions for students in need (Herodotou et al., 2017). Follow-up qualitative interviews indicated that some teachers preferred to learn a new learning analytics system using an auto-didactic approach, that is, experimenting and testing the various functionalities of learning analytics dashboards by trial-and-error (Herodotou et al., 2017).

One crucial, potentially distinguishing factor as to whether (or not) teachers start and continue to (actively) use technology and learning analytics dashboards is their acceptance of technology (Rienties, Giesbers et al., 2016; Šumak, Heričko, & Pušnik, 2011; Teo, 2010). Technology acceptance research (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) originates from the information systems (IS) domain developed models which have successfully been applied to educational settings (Pynoo et al., 2011; Sanchez-Franco, 2010; Šumak et al., 2011). The TAM model is founded on the well-established Theory of Planned Behaviour (Ajzen, 1991), which states that human behaviour is directly preceded by the intention to perform this behaviour. In turn, three factors influence intentions, namely: personal beliefs about one's own behaviour, one's norms, and the (perceived) amount of behavioural control one has.

Building on this theory, TAM states that the intention to use learning analytics dashboards by teachers is influenced by two main factors: the perceived usefulness (i.e., PU: the extent to which a teacher believes the use of learning analytics dashboards and visualisations will, for example, enhance the quality of his/her teaching or increase academic retention) and the perceived ease of use (i.e., PEU: the perceived effort it would take to use learning analytics). The influence of PU and PEU has been

consistently shown in educational research (Pynoo et al., 2011; Sanchez-Franco, 2010). For example, Teo (2010) found that PU and PEU were key determinants for 239 pre-service teachers' attitudes towards computer use. In an experimental study of 36 teachers using a completely new Virtual Learning Environment (VLE), with and without video support materials, Rienties, Giesbers et al. (2016) found that PEU significantly predicted whether teachers successfully completed the various VLE tasks, while PU was not significantly predictive of behaviour and training needs.

In addition, a wide range of literature has found that individual and discipline factors influence the uptake of technology and innovative practice in education. For example, Teo and Zhou (2016) indicate that age, gender, teaching experience, and technology experience might influence teachers' technology acceptance. Similarly, a study comparing 151 learning designs at the OU, Rienties and Toetenel (2016) found significant differences in the way teachers designed courses and implemented technology across various disciplines.

Research Context and Research Questions

This study is nested within the context of the OU, which provides open-entry education for 150,000+ "non-traditional" students. In 2014, as part of a large suite of initiatives to provide support to its diverse learners, the OU introduced a significant innovation project called The Analytics Project. The Analytics Project, which had a budget of £2 million, was tasked with attempting to better understand how learning analytics approaches could be developed, tested, and applied on an institutional scale. The Analytics Project established an ethics framework (Slade & Boroowa, 2014), introduced predictive modelling tools (Herodotou et al., 2017; Hlosta et al., 2015; Rienties, Cross et al., 2016), and developed a hands-on support structure called the Analytics4Action (A4A) Framework. The purpose of the A4A was to help teachers make informed design alterations and interventions based upon learning analytics data (Rienties, Boroowa et al., 2016). One element within this A4A Framework is specifically focussed on professional development of OU staff; the context in which this study was conducted.

In line with Muñoz Carril et al. (2013), the OU academic staff and non-academic staff (e.g., instructional designers, curriculum managers) perform a range of interconnected teaching roles; jointly design, implement, and evaluate online modules as part of module teams (Herodotou et al., 2017; Rienties, Boroowa et al., 2016; Rienties, Cross et al., 2016; Rienties & Toetenel, 2016). As a result, the 26 online teaching roles identified by Muñoz Carril et al. (2013) are shared by all OU teaching staff and therefore our professional development focussed on a wide range of academic and non-academic staff.

Working together with the OU A4A team, we trained 95 experienced teaching staff using an innovative training method called Analytics4Action Workshop (A4AW). Within this A4AW, a range of learning analytics tools was provided to teachers in order to learn where the key affordances and limitations of the data visualisation tools were (Rienties, Boroowa et al., 2016). We worked together with teachers to understand how to improve our learning analytics dashboards to enhance the power of learning analytics in daily practice. Therefore, this study will address the following two research questions:

1. What lessons were learned from the A4AW, and to what extent were participants satisfied with the A4AW?

2. To what extent did technology acceptance and other individual differences (e.g., academic profile, gender and discipline) influence the implementation of A4AW?

Method

Design and Procedure

A4AW was developed and implemented by five training experts within the OU with years of practical and evidence-based training experience to accommodate different learning approaches for teachers. The innovative and interactive workshop was designed to test the effectiveness of learning analytics dashboards. Rather than providing an instructor-heavy "click-here-and-now-there" demonstration, we designed an interactive training programme with opportunities for flexibility and adaptivity where participants could "authentically" work on their own contexts. The training was broken down into two phases, whereby during each phase participants had ample time to work and experiment with the various learning analytics dashboards and tools while at the same time bringing lessons learned together as the end of each phase. Within the structure of A4AW, the types of learning activities, patterns of engagement, and the various learning dashboards used are described in Table 1.

Table 1

Design of A4AW Professional Development

Phase	Duration in minutes	Pedagogy	Data source	Software type	Update frequency	Data type
0	10	Instructors	General introduction of approach and explanation of case-study	-	-	-
1	30	Pair	Module Profile Tool	SAS	Daily	Demographic / Previous and concurrent study data.
			Module Activity Chart	Tableau	Fortnightly	VLE usage / Retention /Teacher marked assessments (TMAs).
			SeAM Data Workbook	Tableau	Bi-annually	End of module student satisfaction survey data.
	20	Whole class	Discussion and Reflection			
2	40	Pair	VLE Module Workbook	Tableau	Fortnightly	VLE / tools /resources usage
			Learning Design Tools	Web interface	Ad hoc	Workload mapping / activity type spread.
	10	Whole class	Discussion and Reflection			
	10	Instructors	Lessons Learned			
	-	Individually	Evaluation			

Note. The duration of each of these activities was dependent on the "flow" of the respective group in order to allow for participants to maximise their professional development opportunities.

In the first 10 minutes, the instructors introduced the purpose of A4AW as well as the authentic case-study, in an open, undirected manner. Within the module, participants were asked to take on the role

of a team chair (i.e., teacher) who had unexpectedly taken on responsibility for a large scale introductory module on computer science. Participants were paired with another participant and sat together behind one PC with a large screen. In this way, if one participant did not know how to use a particular learning analytics tool or where to click, it was expected that the paired participant might provide some advice; a less intrusive approach than continuously having an instructor "breathing down their neck". In case participants got stuck, two instructors were available in the room to provide support and help.

Subsequently, in Phase 1, or "monitoring data," the participants were expected to explore the data from the various learning analytics dashboards in a self-directed way for around 30 minutes, then record their findings on paper or in a digital repository. Participants had access to existing data sources which allowed them to monitor the "health" of the module in the case-study, establish a context, and compare this with their own expertise in their own teaching modules. An example of this is Table 2, which provided a breakdown of students of the case-study module in the last four implementations, whereby both learner characteristics (e.g., previous education, socio-economic, ethnicity) and learning behaviour (e.g., pass rates, concurrent study) were presented. In particular, Table 2 illustrates other modules students were following in parallel, in order to help teachers identify whether there were overlaps in assessment timings.

Table 2

Breakdown of Composition of Students in Case-Study

	Guidance prompt	Relevant Table and Column	13J		14B		14J		15B	
1	Completion rate	All Students (% Completed / Reg 25)	60		55		64		n/a	
2	Pass rate	All Students (% Credit / Reg 25)	55		50		60		n/a	
3	New / continuing student diff	All Students (%)	New 68	Con 32	New 61	Con 38	New 64	Con 36	New 62	Con 38
4	Largest qualification	Top 10 Qualifications at 25% Fee Point Old & New (%)	Old	New	Old	New	Old	New	Old	New
5	Ethnic origin	Ethnic Origin (%)	88% White		86% White		87% White		86% White	
6	Lower than A Level PEQ	Grouped Educational Qual (%)	41%		41%		42%		45%	
7	Low socio-economic background	Socio-Economic Data	22%		22%		22%		23%	
8	Concurrent Study	Concurrency – Modules beginning at same time as… (%)	34%	27%	36%	28%	28%	42%	29%	47%

Another example of a data set is in Figure 1, which provided teachers with a visual overview of the percentage of students who completed the various teacher-marked assessments (TMAs). The right column of Figure 1 illustrates the relative drop-off of assessment submissions in comparison to the previous assessment point. Instructors were on hand to guide when required but attempted only to provide assistance in navigation and confirming instructions as far as possible. In order to encourage relevancy and reduce abstraction, participants were also encouraged to spend around 5-10 minutes

looking at the data for the module to which they were affiliated. At the end of the 30 minute session, the group was brought back together; a whole class discussion and reflection took place for 20 minutes, facilitated by the instructors, on what learning had been achieved. Participants were encouraged to share their experiences, interpretations, problems, and successes with the group in an inclusive way, as indicated in Table 1.

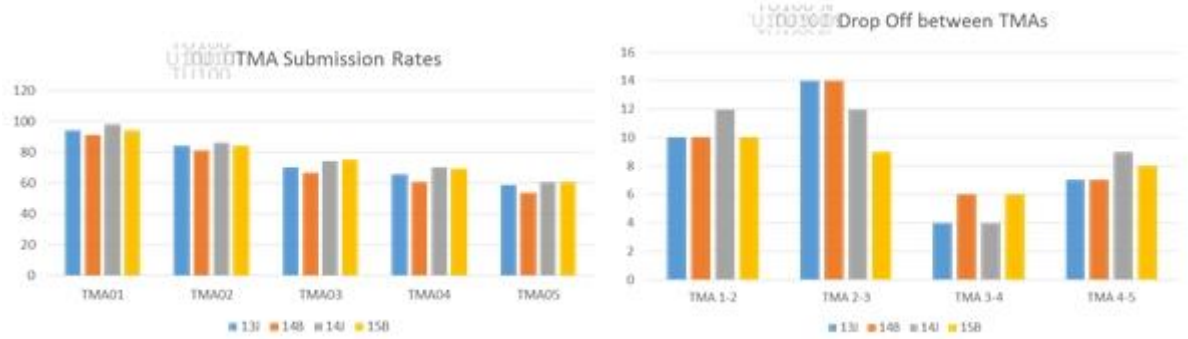

Figure 1. Assessment submission rates over time.

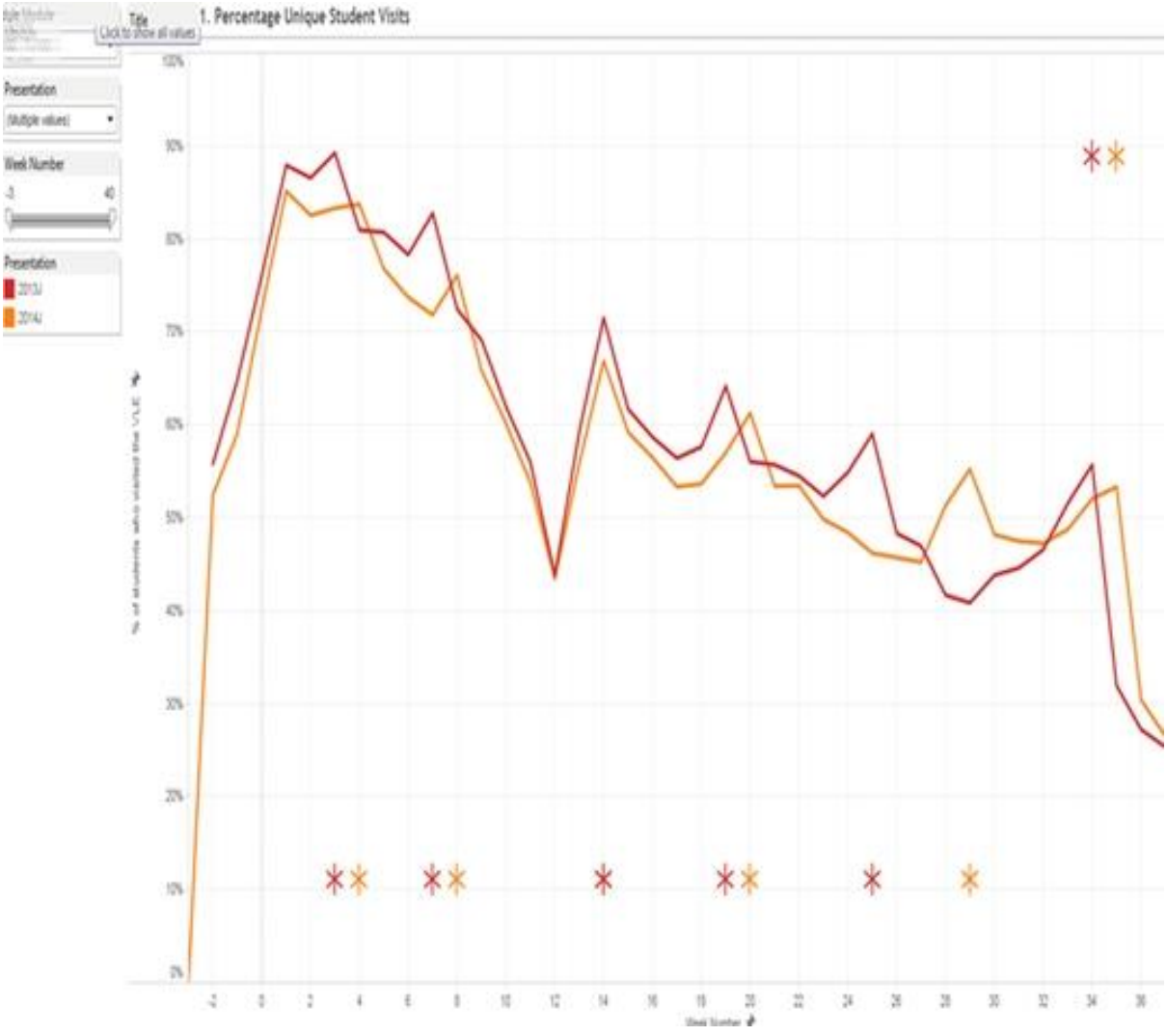

Figure 2. VLE engagement in case-study.

In Phase 2, module teams had access to more fine-grained data to allow them to "drill-down" and investigate further performance concerns or issues flagged in the "monitoring data" phase. Phase 2 was referred to as "investigating issues". Participants were encouraged to interrogate more fine-grained learning design and actual VLE engagement data (see Figure 2), to attempt to identify potential issues, and where feasible, to use the dashboards for their own taught modules in order to explore the affordances and limitations of these dashboards (40 minutes). Afterwards, again in a whole-class format, the participants shared notes and discussed their experiences with using the various learning analytics dashboards (10 minutes). Finally, the instructors presented some of their own findings and reflections of the case-study module in order to confirm, contrast, and explore further the findings with the participants (10 minutes).

Setting and Participants

Participants within this study were academic staff and instructional designers from the largest university in Europe, the Open University (OU). Participants were recruited in the spring of 2016 in two ways. First of all, as part of a wider strategic Analytics4Action project (Rienties, Boroowa et al., 2016), 50 module teams of academics, who participated in bi-monthly one-to-one sessions with learning analytics specialists to help them to use learning analytics data to intervene in their modules, were invited to join the A4AW sessions. Secondly, instructional designers and curriculum managers affiliated with these modules were invited to join the A4AW session, as well as any other member of staff who indicated an interest to join the learning analytics professional development training.

Participants were enrolled in one of ten sessions of two hours each in a large computer lab according to their time preference. In total 95 members of staff joined the A4AW, of which 63 (66%) completed the survey (see next section). Of the 63 participants, 43 indicated their name (which was optional), of whom 65% were female. Using web-crawling and OU Management Information techniques, 25 participants were identified as academics (2 professors; 9 senior lecturers/associate professors; 12 lecturers/assistant professors; 1 staff tutor; 1 PhD student), 16 were non-academics (1 senior regional manager; 1 senior instructional designer; 4 regional managers; 10 curriculum/qualification managers).

Instruments

Measurement of technology acceptance model. At the end of the A4AW session, participants were asked to complete a paper-based survey about their PEU of the OU learning analytics data visualisation tools and their PU. Given that many of the learning analytics tools were in beta stages of development, it was important for us to know how easy and useful these tools were perceived to be by teachers. The TAM scales of Davis (1989) typically consist of two times six items on PU and PEU. As most TAM questionnaires have focussed on users and students in particular rather than teachers, in line with Rienties, Giesbers et al. (2016), we rephrased the items to fit our teacher context.

Measurement of perceived training needs and satisfaction with A4AW format. In addition to the six items of TAM, in line with Muñoz Carril et al. (2013), participants were asked to indicate after the A4AW whether other members would need specific professional development training to use the OU learning analytics tools (i.e., Do you expect most staff will need formal training on the data tool?). In addition, two items on the quality of the instructional provision were included (e.g., Did the instructors provide clear instructions on what to do?), and one overall satisfaction item (i.e., Overall, were you satisfied with the training?). All instruments used a Likert response scale of 1 (totally disagree)

to 5 (totally agree). Finally, two open questions were included about "What do you like?" and "What could be improved?" in terms of A4AW.

Control variables. In line with Teo and Zhou (2016), we controlled for differences in A4AW experiences based upon gender, (non) academic profile, seniority, discipline, and level of teaching (e.g., year 1, 2, 3, post-graduate**).**

Data Procedure and Analysis

An embedded case-study was undertaken to examine the characteristics of a single individual unit (recognising its individuality and uniqueness); namely, teacher, designer, or an organisation (Jindal-Snape & Topping, 2010). Yin (2009) emphasised that a case-study investigates a phenomenon in-depth and in its natural context. Therefore, the purpose of a case-study is to get in-depth information of what is happening, why it is happening and what are the effects of what is happening. As part of the embedded case-study, the five authors were involved in the design, implementation and evaluation of the A4AW. The first, third, and fifth author originally designed and implemented the first two out of ten A4AW sessions. Afterwards, the third, fourth, and fifth author supported the implementation of the remaining eight A4AW sessions, whereby the second author and first author independently analysed and discussed the data (i.e., surveys, materials, notes, post-briefings) from the participants and the three trainers. By combining both quantitative and qualitative data from participants as well as qualitative data and reflections from the five instructors, rich intertwined narratives emerged during the ten implementations of A4AW.

Results

RQ1 Lessons Learned and Satisfaction With A4AW Programme

With a mean score of 4.44 (SD = 0.59; Range: 2.67 - 5) the vast majority of respondents were satisfied with the A4AW provision. In line with Rienties, Giesber et al. (2016), taking a positive cut-off value of 3.5 and a negative cut-off value of < 3.0, 89% of the participants indicated they were satisfied with the A4AW programme and 96% were satisfied with instructors in particular. In terms of perceived training needs for working with learning analytics tools at the OU, the vast majority of participants (86%) indicated that members of staff would need additional training and follow-up support. Furthermore, no significant differences in satisfaction were found in terms of gender, discipline, or functional role, indicating that participants in general were positive about the A4AW programme. In terms of open comments, several participants indicated that the format of the A4AW was appropriate, in particular the worked-out example, the instructional support, and working in pairs: "Good to have a sample module and data set to identify key issues. Short sharp and focused. Clear instructions. Excellent explanation" (R12, female, senior lecturer, business); "Briefing session good, interesting tools, good to work in pairs. Looking forward to exploring the tools further in my own time and surgeries in the new [academic] year" (R60, female, curriculum manager, health and social care). Several participants responded with positive observations about the hands-on, practical, approach that the trainings adopted: "Preferred the hands on experience to a presentation. Need to play with tools and respond with issues" (R33, female, senior instructional designer, central unit); "Hands on and practical sessions. Good opportunity to ask questions" (R11, female, academic, business).

One of the advantages of using this interactive approach may be that participants felt more in control and were able to interrogate the data in a way that gave them ownership of their learning. Participants were free to experiment and trial ideas with peers rather than being presented with the "right" solution,

or "best" approach to click through the learning analytics visualisations. This flexibility supported teacher autonomy, which is found to relate to greater satisfaction and engagement (Lawless & Pellegrino, 2007; Mishra & Koehler, 2006; Rienties et al., 2013). In line with the explicit purpose of the A4AW programme, the instructors specifically encouraged participants to provide constructive feedback on how to improve the current tools. At the time when the A4AW sessions were held, most OU tools visualised real/static data per module, which might have made it more difficult to make meaningful comparisons between modules: "Briefing uncovered much more info available on the module. It would be helpful to have comparative data to add context to module" (R42, Male, Regional manager, business).

Furthermore, several participants indicated that they would need more time and support to unpack the various learning analytics tools and underlying data sources: "More work on how to interpret issues underlying data/results" (R10, Female, Lecturer, law); "To have more time to work on our own modules and have list of tasks, e.g. find x, y, z, in your module. Also, we need help to interpret the data" (R49, Female, Lecturer, education). At the same time, some participants indicated that they were worried how to implement these tools in practice given their busy lives: "Very interesting, learned a lot, but there is so much data and so little time. Not sure how I will find the time to process and then use all of it" (R56, Female, lecturer, social science).

RQ2 Technology Acceptance, Individual Differences, and Success of A4AW

In terms of PEU of the OU learning analytics tools after the end of A4AW, as illustrated in Table 2, only 34% of participants were positive (M = 3.31, SD = 0.75, Range: 2 - 5). In contrast, most of the participants (68%) were positive in terms of PU of OU learning analytics tools (M = 3.76, SD = 0.63, Range: 2-5). In a way, this result was as expected, as participants had to navigate with five different visualisation tools during the training. Several of these tools, such as the VLE Module Workbook (i.e., VLE activity per week per resource & activity, searchable) and SeAM Data Workbook (i.e., student satisfaction data sortable based upon student characteristics) were new or in beta format for some participants, while the Module Profile Tool (i.e., detailed data on the students studying a particular module presentation), Module Activity Chart (i.e., data on a week-by-week basis about number of students still registered, VLE site activity, and assessment submission) and Learning Design Tools (i.e., blueprint of learning design activities, and workload per activity per week) were already available to members of staff previously. In other words, the relatively low PEU scores of the OU learning analytics tools are probably due to the beta stage of development. Thus, most participants were optimistic about the potential affordances of learning analytics tools to allow teachers to help to support their learners, while several participants indicated that the actual tools that were available might not be as intuitive and easy to use.

Table 3

Correlation Matrix of TAM, Satisfaction and Training Needs

Scale	M	SD	*α*	*1*	*2*	*3*
1. Perceived ease of use (PEU)	3.31	0.75	.902			

2. Perceived usefulness (PU)	3.76	0.62	.831	.244		
3. Perceived need for training	4.24	0.82		-.086	.158	
4. Satisfaction training	4.44	0.59	.846	.435**	.421**	.089

Note. $^{**}p < .01$

In Table 3, both PEU and PU were positively correlated with satisfaction of the training, indicating that teachers and members of staff who had higher technology acceptance were more positive about the merits of the training. Conversely, teachers with a low technology acceptance were less satisfied with the format and approach of the A4AW. Given that most participants indicated that staff members needed professional development to use learning analytics tools, no significant correlations were found in terms of technology acceptance and perceived need of training for staff at the OU. In line with findings from Teo and Zhou (2016), follow-up analyses (not illustrated) indicated no significant effects in terms of gender, academic profile, level of teaching, and discipline, indicating that the identified features were common across all participants. In other words, across the board and irrespective of teachers' technology acceptance, the clear steer from participants was that additional training and support would be needed to understand, unpack, and evaluate the various learning analytics visualisations and data approaches before teachers could actively use them to support students.

Discussion

A vast number of institutions are currently exploring whether or not to start to use learning analytics (Ferguson et al., 2016; Tempelaar et al., 2015). While several studies have indicated that professional development of online teachers is essential to effectively use technology (Muñoz Carril et al., 2013; Shattuck & Anderson, 2013) and learning analytics in particular (McKenney & Mor, 2015; Mor et al., 2015), to the best of our knowledge, we were the first to test such a learning analytics training approach on a large sample of 95 teaching staff. Using an embedded case-study approach (Jindal-Snape & Topping, 2010; Yin, 2009), in this study we aimed to unpack the lived experiences of 95 experienced teachers in an interactive learning analytics training methodology coined as Analytics for Action Workshop (A4AW), which aimed to support higher education institution staff on how to use and interpret learning analytics tools and data.

In itself, both from the perspectives of the participants as well as the A4AW trainers (who are the authors of this study), the A4AW approach seemed to work well in order to unpack how teachers are using innovative learning analytics tools (see Research Question 1). In particular, pairing up participants allowed them to work in a safe, inclusive environment to discover some of the complexities of the various learning analytics tools. At the same time, in our own hands-on experiences in the ten

sessions, we saw considerable anxieties engaging with technologies and learning analytics dashboards; how these new approaches may impact the teachers' identities and roles in an uncertain future.

Data collected from post-training paper-based surveys revealed that almost all of the participants were satisfied with the format and delivery of A4AW and the instructors. Nonetheless, 86% of participants indicated a need for additional training and follow-up support for working with learning analytics tools, which is in line with previous findings in the broader context of online learning (Muñoz Carril et al., 2013; Shattuck et al., 2011; Stenbom et al., 2016). Qualitative data from open-ended questions pointed to satisfaction due to the hands-on and practical nature of the training. Despite satisfaction with the training, the majority of participants found the learning analytics dashboards difficult to use (low PEU); yet this outcome could be explained by the fact that the tools were at a beta stage of development. This was also reflected from the post-briefings with and reflections of the A4AW trainers, whereby many participants seemed to struggle with some of the basic functionalities of the various learning analytics dashboards.

In accordance with the main principles of TAM and studies examining teachers' acceptance of technology (Šumak et al. (2011), both PEU and PU were positively correlated with satisfaction of the learning analytics training. This indicated that participants with higher technology acceptance irrespective of job role and other demographic variables were more positive about the merits of the training; whereas those with lower technology acceptance were less satisfied with the format and approach of the A4AW (see Research Question 2). In addition and in contrast to TAM assumptions, there was no relationship between PU and PEU. This could perhaps be explained by the fact that the tools were not fully developed and as user-friendly as they were at a beta testing stage. We do acknowledge that this could be the case even when teachers interact with a refined final version of the tools.

As indicated by this study and others (Herodotou et al., 2017; Schwendimann et al., 2017; van Leeuwen et al., 2015), providing teachers with data visualisations to prompt them to start with a teacher inquiry process and to intervene in an evidence-based manner is notoriously complex. In particular, as most institutions have various learner (e.g., demographics) and learning data (e.g., last access to library, number of lectures attended) of their students stored in various data sets that are not necessarily linked or using the same data definitions, providing a holistic perspective of the learning journey of each student is a challenge (Heath & Fulcher, 2017; Rienties, Boroowa et al., 2016). Especially as learners and teachers are increasingly using technologies outside the formal learning environment (e.g., Facebook, WhatsApp), teachers need to be made aware during their professional development that every data visualisation using learning analytics is by definition an abstraction of reality (Fynn, 2016; Slade & Boroowa, 2014).

Limitations and Future Research

A limitation of this study is the self-reported nature of measurements of teachers' level of technology acceptance, although we contrasted the self-reported nature with the lived experiences of the five trainers during and after the sessions. Potentially, more fine-grained insights could be gained if interactions with learning analytics tools and peers were also captured. Moreover, as this embedded case-study was nested within one large distance learning organisation, this raises issues of

generalisability of the outcomes across universities', academic, or other staff. Also, institutions that offer time and space to staff to experiment with learning analytics tools and data might present a different picture in terms of usefulness and acceptance. Allowing time for experimentation might lead teachers to engage with tools more effectively due to the absence of time pressure and potential anxiety (Rienties et al., 2013).

It would be fruitful if future research examined staff engagement with learning analytics tools over time to capture how initial perceptions of ease of use and usefulness might have changed after they gained the skills to use these tools effectively. Towards this direction, more research is needed to examine training methodologies that could support interaction with learning analytics tools and alleviate any fears and concerns related to the tools' use and acceptance. Despite the above mentioned limitations, we believe we are one of the first to provide a large numbers of staff with hands-on professional development opportunities to use learning analytics dashboards. Our findings do suggest that if institutions want to adopt learning analytics approaches, it is essential to provide effective professional development opportunities for learning analytics and in particular provide extra support for teachers and instructional design staff with low technology acceptance.

Conclusion and Personal Reflections by the Authors

In general, our study amongst 95 experienced teachers indicated that most teachers found our learning analytics dashboards a potentially useful addition to their teaching and learning practice. Also, the interactive format of the A4AW approach was mostly appreciated, in particular, the opportunities to work in pairs and to get "one's hands dirty" with actual data and visualisations. At the same time, our own lived experiences during these 10 A4AW sessions indicated that many teachers found it difficult to interpret the various data sources and learning dashboards; to make meaningful connections between the various data components. In part this may be due to the lab environment situation and task design, but in part this also highlighted a need for data literacy and further training to unpack the information from the various learning analytics dashboards.

Some participants felt more comfortable exploring the various dashboards and data in an autodidactic manner, perhaps given their academic role or (quantitative) research background; while others struggled to make sense of the various dashboards. Therefore, we are currently working at the OU to provide more personalised professional development programmes, while at the same time providing simple hands-on sessions for early-adopters and "proficient" teachers who already have a strong TAM and understanding of OU data. As highlighted in this and other studies, making sense of data using learning analytics dashboards is not as straightforward as the beautiful visualisations seem to suggest.

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Hacking History: Redressing Gender Inequities on Wikipedia Through an Editathon

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Abstract

Editathons are a relatively new type of learning event, which enable participants to create or edit Wikipedia content on a particular topic. This paper explores the experiences of nine participants of an editathon at the University of Edinburgh on the topic of the *Edinburgh Seven,* who were the first women to attend medical school in 19th century United Kingdom. This study draws on the critical approach to learning technology to position and explore an editathon as a learning opportunity to increase participants' critical awareness of how the Internet, open resources, and Wikipedia are shaping how we engage with information and construct knowledge. Within this, there is a particular focus on recognising persisting gender inequities and biases online. The qualitative interviews captured rich narrative learning stories, which traced the journey participants took during the editathon. Participants transformed from being online information consumers to active contributors (editors), prompting new critical understandings and an evolving sense of agency. The participants' learning was focused in three primary areas: (1) a rewriting of history that redresses gender inequities and the championing of the female voice on Wikipedia (both as editors and subject matter); (2) the role of Wikipedia in shaping society's access to and engagement with information, particularly information on traditionally marginalised subjects, and the interplay of the individual and the collective in developing and owning that knowledge; and (3) the positioning of traditional media in the digital age.

Keywords: editathon, critical approach, gender, Wikipedia, learning

Background

Editathons are a relatively new type of learning event, which enable participants to create or edit Wikipedia content on a particular topic. Events enable budding editors to learn together at a scheduled time, often in a designated physical location. They introduce participants to the Wikipedia community, supporting the development of new skills and knowledge, and often include basic editing training. Frequently, editathons have a secondary purpose of addressing biases within Wikipedia by raising awareness of the gender, cultural, and geographic disparities that affect both the content and the editing community on Wikipedia (Collier & Bear, 2012; Hargittai & Shaw, 2015). As such, editathons support new forms of knowledge construction, which allow opportunities for the democratisation of knowledge (Knorr-Centina, 2007, 2008) and trigger new roles and accountabilities around how knowledge is created.

This paper focuses on an editathon that took place in 2015 at the University of Edinburgh on the topic of the *Edinburgh Seven*, the name given to the first group of women to studied medicine at the University. The primary purposes of the event were to develop among participants an understanding of the community norms and rules governing Wikipedia, and to build their technical know-how and confidence to edit Wikipedia entries. This study was designed to explore the editathon as an informal, professional learning event. Eraut (2000) positions *informal learning* as learning that is not planned around or structured by a bounded course, imposed learning outcomes, or formal assessment, but instead driven by the motivations and agency of individual learners who navigate their own learning journey. Participation in the editathon was voluntary, with individuals determining the nature and level of their engagement throughout event. There were no expectations around how much or even if they would edit or contribute new content to Wikipedia.

This study was initially conceived as a project to explore the employment of social network analysis [SNA] to trace the contributions of individual participants during and after the editathon event. Qualitative interviews with nine of the 47 participants were undertaken to explore in more detail the editathon as a learning event. They focused particularly on how participants self-organised to facilitate open information exchange and how participants accumulated knowledge during the event. The interviews provided insight into the learning, which moved beyond the scope of the original project. Embedded within the narratives of the nine interviewees was an evolving understanding of the ways in which the Internet and digital media shape the information with which they engage and how they interpret and utilise this information to construct particular historical narratives. The participants also discussed an emerging sense of agency as they not only recognised prevailing norms of online representation and behaviour, but also actively addressed and redressed these.

The recognition of these themes within the participants' narratives prompted a critical re-reading of the editathon. This re-reading explored how the topic of the editathon combined with participants' transitioned from consumers of information to knowledge producers provoked new insight into their contexts of operation – historical, institutional, professional, and personal. It explores the potential of an informal learning event to provoke new understandings and the adoption of new roles by participants, and to raise awareness of how the non-neutral construction of knowledge and artefacts on the Internet permeates our understandings and constructs particular realities, of which, too often, we are not actively cognisant.

Literature Review

Wikipedia

Wikis, such as Wikipedia, are edited by a number of individuals who keep track of the changes and adaptations that are being made. Their ongoing development and growth, therefore, is reliant on the co-construction of content by a *community* of editors who collectively take ownership for contributing and updating information.

These new social digital tools have transformed information production and distribution by requiring people to take on new roles and responsibilities, raising questions around how information is generated and produced (Fenwick, Nerland, & Jensen, 2012; Knorr-Cetina, 2007). Ebersbach and Glaser (2004) argue that wikis are predicated on decentralised, egalitarian structures that offer individuals the flexibility and opportunity to engage with, and contribute to, the wikis in their own personal way. While offering potentially new opportunities for information construction, and theoretically opening up information creation and dissemination to a much broader population than previously has been possible using traditional media, research suggests that most user-generated content on the Internet conforms to pre-existing economic, social, and political models (Manovich, 2009). The reported systematic and structural biases exist in spite of Wikipedia's espoused neutral point of view policy, which states "All encyclopaedic content on Wikipedia must be written from a neutral point of view [NPOV], which means representing fairly, proportionately, and as far as possible, without editorial bias, all of the significant views that have been published by reliable sources on a topic" (Wikipedia, 2016).

Women and Wikipedia

Gender biases are apparent in both the presentation and production of content on Wikipedia, as well as in the gender distribution of contributors to Wikipedia. Research suggests that only 8 to 18% of editors on Wikipedia are female (Antin, Yee, Cheshire, & Nov, 2011; Cohen, 2011; Collier & Bear, 2012; Glott, Ghosh, & Schmidt, 2010; Hill & Shaw, 2013; Lam et al., 2011; Wikimedia Foundation, 2011). The gender divide exists not only in terms of absolute numbers but also in the treatment of women editors. Lam et al. (2011) found that women are more reverted than men (their contributions are discarded), while Collier and Bear (2012) report that women's lower levels of contribution result from aggressive behaviour towards them.

The (re)presentation of women on Wikipedia also differs substantially from that of men. Biographies of women are less well-developed and male editors are less likely to edit women's biographies (Reagle & Rhue, 2011). Studies also have found that the use of language varies between biographies of men and women (Graells-Garrido, Lalmas, & Menczer, 2015; Wagner, Graells-Garrido, Garcia, & Menczer, 2016). Wagner et al. (2016) determined that articles on women were more likely to include gendered words like "women," "female," and "lady" compared with articles about men that rarely use gendered words such as "man," "male," or "gentleman." Graells-Garrido, Lalmas, and Menczer (2015) similarly found that women were more likely to be associated with gendered words, and in particular, entries on women were strongly associated with "her husband" and "first woman." Amanda Filipacchi, in a widely cited 2013 opinion piece in *The New York Times,* reported the editorial decision of women being removed from the *American Novelists* category and moved to a subcategory for *American Women Novelists*.

This positioning and treatment of women (both as subjects and editors/contributors) on Wikipedia mirrors trends identified in other online environments. For example, gender inequity is present in the most popular political blogs (Harp & Tremayne, 2006) and sexism and misogyny continues to prevail in mainstream and social media. While some commentators have suggested that one might expect greater gender equity online because of its "openness" and the apparent ease of entry, as Couldry (2012) reminds us ""we perform identity and develop public or quasi-public profiles within the constraints of platforms … as a result, we risk a deep penetration by market logics into the very lineaments of self-reflection and self-expression" (p. 57). Dominant discourses and the continued marginalization of traditionally excluded voices and histories prevails in the online environment. However, Shaw (2014) suggests that at their most powerful digital tools allow groups to produce new forms of knowledge and posit counter-discourses.

Context and Methods

Theoretical Framework

This study draws on the critical approach to learning technology to position and explore an editathon as a learning opportunity to increase participants' critical awareness of how the Internet, open resources, and Wikipedia are shaping how we engage with information and construct knowledge. The critical approach emphasises the positioning of learning and technology within its broader organisational, political, economic, and social contexts in order to explore how it can foster, support, and counteract issues of empowerment, equality, and social justice (Bakardijieva & Smith, 2001; Gunter, 2009; Selwyn, 2008, 2010). Bakardijieva and Smith (2001) suggest the potential for individuals to develop new agency when engaging with the Internet, and the ability to contribute actively to, and to generate new interpretations of, technology in order to promote democratic, feminist, or revisionist history aims. Oliver (2011) builds on these ideas positioning the critical approach as facilitating a movement beyond the immediate context of learning gains or patterns of interaction, to question the broader positioning and role of technology and how it is shaping both individual lived experiences and system-wide expectations, patterns of behaviour, and modes of thinking.

The adoption of the critical approach allows this study to move beyond its initial scope of exploring the socially collaborative nature of learning in an editathon and the tracking of the learning process through the network social ties. The critical approach enables an exploration of participants' adoption of new roles and new agency and how these are positioned within their wider experiences of the Internet, learning, and Wikipedia. That is, an examination of participants' experiences of an editathon through the lens of what Selwyn (2010) terms the social milieu of technology use.

Re-analysing participants' accounts utilising a critical framework enables an exploration of how an editathon can build new capacity in participants as they transition from consumers and users of online material to producers of that material. This active awakening of new understandings and repositioning of the individual connects with Mellucci's (1996) notion of cognitive liberation. That is, through engaging in particular activities – both as an individual and as part of a wider group – an individual gains awareness of a broader movement (the marginalisation of women online) and reframes themselves – their beliefs and activity – in relation to this new understanding, and as such

joins a collective movement to redress inequity online. This opens possibilities for a cyberfeminist reading of participants' learning journeys, as they recognise how the Internet and their actions as knowledge producers provide avenues to liberate (or oppress) women (Shaw, 2014).

Context

This study is situated within an editathon event on the theme of the Edinburgh Seven, the first women to study medicine at the University of Edinburgh. The event took place at the University of Edinburgh and was led by the University's Information Services in conjunction with the School of Literature, Languages and Cultures, the Moray House School of Education, EDINA, and the National Library of Scotland. The editathon was open to everyone, but particularly targeted students, university staff and faculty, and members of the public who had an interest in developing their knowledge of Wikipedia.

The editathon was held over four afternoons in a large, interactive learning classroom. Participants determined how much of the event they attended as well as their level of engagement. A total of 47 participants engaged in online editing. During the event participants had access to library archivists and media specialists, academic colleagues and Wikimedia experts, including a Wikimedian trainer in residence, who provided training on how to edit Wikipedia and participate in an open knowledge community. Many of these people functioned in the dual role of expert teacher and fellow editathon participant. Participants also were able to access a range of artefacts including archived materials such as newspaper reports and photographs, books, and online sources.

Methods

Following the editathon event, nine participants were invited to partake in an interview to discuss their experiences of the event. The participants were purposively selected using the quantitative data that traced the online edits of the 47 active editathon participants. This analysis exposed the wiki pages that each of the participants had made edits to, enabling insight into both the activity level of each participant (Littlejohn & Hood, 2018). Two participants were central in the online network, two had been active in terms of minor changes, two had been active on wiki pages not covered by others, one had not made any edits, and two were co-ordinators of the event.

The one-hour interviews were conducted via Skype using a semi-structured instrument. During the interview participants were asked to comment on their experience of the editathon, including what and how they had learned during the event, their engagement with other participants, and their behaviour and activity since the editathon. Participants were also shown the network analysis diagrams and discussed their node and level of interactivity. The interviews were audio-recorded and transcribed verbatim.

The original data analysis process was focused on constructing an individual learning profile for each of the interviewees, which enabled comparisons to be drawn both between the SNA and interview data, and between the knowledge construction behaviours of the nine participants (Littlejohn & Hood, 2018). However, during the first two-coding round, which developed the content and first thematic codes (Miles & Huberman, 1994), the emergence of content and themes that lay outside the original scope of the study emerged from the data. Embedded within the participants' narrative accounts was a developing understanding of the ability of an editathon to prompt changes to the ways that participants conceptualised and engaged with Wikipedia and the Internet more generally, and the development of new agency among participants for the role they could play in repurposing Wikipedia,

rewriting history, and reclaiming traditional media in the digital age. These observations of the data prompted a new analysis process, which laid a critical lens over the data. A third round of data analysis, separate from the original analysis process, was conducted. Four new thematic codes were developed: 1. the rewriting of women in history, 2. the role of Wikipedia in shaping access to and presentation of information, 3. the role of traditional media in a digital world, and 4. and the developing sense of agency and ownership among participants for the topic and constructing historical accounts.

Findings and Discussion

The findings presented below explore how participants created new meanings, adopted new roles, and developed new social relations through their participation in the editathon and as they developed into their new roles as editors. It considers how adopting the role of editor and the new understandings and shift in perspective this brought, contributed to new interpretations and evolving engagement with the Internet. The interviewees' accounts of their participation in the editathon are discussed here in relation to three themes: 1. rewriting history and the development of the female voice on Wikipedia, 2. the role of Wikipedia in shaping society's access to and engagement with information and the interplay of the individual and the collective in developing and owning that knowledge; and 3. the positioning of traditional media in the digital age.

Becoming Editors and Rewriting History

As the participants grew into their new roles as Wikipedia editors they came to realise the responsibility they had to represent history and to shape how others engage with historical information. The participants described an evolving realisation that: (a) previously the historical actions of the Edinburgh Seven women either were not available or (largely) had been interpreted and represented in a biased way; (b) they held responsibility for disseminating their interpretation of what the women had achieved; and (c) they struggled with how to represent the women in the social media space.

For a majority of interviewees, the primary motivation for their participation in the editathon was to develop practical, technical knowledge about how to contribute to and edit Wikipedia entries. Eight out of the 10 participants interviewed knew little about the topic of the editathon before the event. While the subject did not drive initial engagement for many interviewees, it emerged as a recurring theme running through the narratives of their learning journeys as the participants became aware of their new roles as the writers and recorders of the history of the Edinburgh Seven.

The Edinburgh Seven became the specific example through which participants could develop their understanding of the place and (re)presentation of women in history, and the role the Internet plays in perpetuating male-dominated historical narratives. This intersection between the specific topic of the editathon and the construction of a more macro-level understanding of the continuation of the traditional male-dominated discourse on the Internet, together with the behaviour that can accompany this dominance, permeated participants' narratives. Emma reflected that the "behaviour of people in protecting Wikipedia, maybe over zealously protecting it, or being sexist about it, which was interesting in relation to the topic itself," while Louise commented on lack of existing online material or information on the women of the Edinburgh Seven.

Through actively creating content for Wikipedia, participants developed new understandings of how the presentation of media on the Internet shapes the meanings and interpretations consumers of information construct. Nick discussed the (negative) discourses that can be attached to female figures:

> The person I was writing a page on it was much easier to find information about the fact that she'd accused some people of witchcraft as a child than it was about her history as an innovator and technologist in the thread industry and where you saw one you didn't usually see the other one connected, but it does seem to be the same person.

The editathon not only prompted new understandings of how particular stories and messages become associated with female historical figures, but also the power of different digital objects to promote and perpetuate particular historical narratives. The merging of text and image on the Internet plays an important role in shaping understandings of events and people. Justine described her growing appreciation of how images inform historical accounts:

> She does look like a battle axe in the picture and it is the picture that you often use, but then I had this book and there was a very nice picture of her and I was thinking why is this other picture always used and why shouldn't it be this one? So I changed it. ...this is a really good opportunity to change that story, to change this image of the woman and the associations that get made about her. ...I deliberately sought out the pictures that are softer.

This quote demonstrates not only an understanding of the messages implicit within online information but also a developing sense of agency in participant nine of her ability and obligation to rewrite history.

The editathon provided an opportunity for participants not only to develop their understanding of the historical narratives surrounding women but also equipped them with the skills and evolving agency to actively challenge and rewrite history. While only three interviewees felt comfortable editing Wikipedia entries prior to the editathon event, all nine felt confident to contribute content after the event. Justine reflected on her shift from passive consumer to active contributor:

> You know I am much more likely now to go into Wikipedia and think "oh I'll just add a sentence in there about this because it's relevant and appropriate to do so," whereas before I'd just say "oh there's nothing on Wikipedia about this."

This new sense of agency and responsibility was similarly reflected in Anna's comment:

> Once I got into the thing on the day I continued to edit pages that I started on that day ...there was one woman who didn't have a page at all and I put her page in there and so now I feel quite motivated to keep going and feel I do have strong ownership.

This sense of agency appeared to develop over the editathon. While at first it was connected to developing confidence and knowledge of how to edit entries, over the course of the editathon, participants' agency was also connected to their understanding of the responsibilities and opportunities being a Wikipedia editor provides for constructing history, or at least accounts of historical events.

By moving participants from passive consumers of online content to active contributors who have a commitment to, and feel ownership over, the substance and presentation of content on Wikipedia, the editathon developed participants' understanding of the role that the Internet can play in advancing new histories and providing a voice to women and events that otherwise go unrecognised. As Anna explained: "I think we uncovered things which, well while it wasn't new information, it's always been sitting there waiting to be discovered. We uncovered information and brought it out into the light I would say." This quote demonstrates an emerging recognition that history and its presentation on and through digital media are not static. Rather, they are able to be redeveloped, re-mixed, and reoriented in ways that can challenge traditional narratives and perspectives and promote new discourses.

Power of Wikipedia

Participating in the editathon not only provided participants with a more critical lens for viewing and interpreting information online, but also gave rise to new understandings of how Wikipedia shapes access to information and influences prevailing discourses. Exploring the intersection between Wikipedia and the scholarly and academic conventions and traditions of the university was one of the objectives of the the editathon, as one of the organizers, Marie, explained:

> Instead of avoiding Wikipedia and seeing it as a problem and we shouldn't go anywhere near it if we're real academics, it's actually a fascinating and wonderful tool to engage with to develop academic competencies. So that's why I wanted to organise such an event and convert other people to seeing Wikipedia in potentially a different light to how they had been trained to see it.

The editathon provided in participants with insight into the tensions between openness and authority, enabling them to reflect on the role that Wikipedia plays both within their own lives and more broadly in society. Carolyn described Wikipedia as an "extension of [her] memory." Participating in the editathon, however, also caused her to (re)think her positioning towards Wikipedia and how she engaged with it in her role as an academic:

> We often refer to Wikipedia, but actually thinking about how it's created, how it's put together is part of the whole digital education change, it's part of how everybody is coming into a more open forms of learning and engagement, more democratic perhaps, although, immediately when I went to my first meeting I learned a lot about how it's not as democratic as it looks.

Participants further developed their understanding of how digital media and the Internet changes the ways in which information is presented, interpreted, and used, and how this in turn alters or influences the construction of history and historical narratives. While information and history has never been static, the Internet enables the adaptation and modification of information, as well as the juxtaposition of multiple narratives at a rate that previously was not achievable. Justine described her new understanding of the fluidity of information in the digital age:

> I mean the story is fluid on Wikipedia that's the danger of it, I guess that's the difference between writing a peer reviewed paper isn't it. But yeah it's made me realise the importance of how you do tell that story and how you make it a living part of our history.

Participating in the editathon also raised participants understanding of the powerful role Wikipedia plays in shaping our engagement with, and access to, information. A Wikipedia entry has become a symbol of legitimacy and value. There exists a tension between the fluidity and transience of digital information and the *visible presence* this digital information enables. The power of Wikipedia to elevate information is exemplified by Sarah's experience:

> I did a quite Google search and within I'd say less than 2 hours of me putting her page in place it was the top hit that came back in Google when I Googled it and I just thought that's it, that's impact right there and the British Medical Journal obituary started dropping down. So that was a moment as well, less connected with the subject matter and more with the power of engaging with that kind of resource.

The Intersection of Traditional Media and Digital Media

Participating in the editathon prompted participants to reflect on the tensions that exist between traditional media and digital media. These tensions are shaping presentations of history. For many participants, (re)engaging with traditional media, including books and archival material, was one of the highlights of their editathon experience. It provided renewed understanding of what these traditional media offer. As Melanie explained, "there's information in these books that needs to get online and [we] need to put it there." This is further elaborated in the account of participant two who discussed the role of traditional media in a digital age:

> I'm very interested in how we take old forms of print and even pre-print and even things from the oral tradition as well. How we take them forward into new media and incorporate them and change them in the process. It's really interesting.

Embedded within participants' accounts is an awareness of the materiality of Wikipedia as a constructed artefact, and the relationship between the physical objects from the archives, the printed history contained within physical books, and the digital representation that ultimately is developed on Wikipedia.

Underpinning the discussions of media and materiality are changing constructions of information and history in a digital age and, more specifically, increasing awareness that if material or information is not in digital form, it does not readily form part of the ongoing historical narrative. As Justine explained in relation to her engagement with 19th century newspapers from the archives during the editathon: "the more that I read in the newspapers about this, the more I just felt like we need to bring this all to life, you know it's all forgotten, it's not there anymore, and it's really important."

Wikipedia represents a powerful modality and mechanism for bringing to life forgotten information and lost histories. The editathon motivated participants to *open up* knowledge and make it more accessible. However, the relationships between the physical and the digital are troubling in several ways. It raises issues around copyright, what was referred to by Elizabeth as "kind of locking away your content so no one can see or use them," and also the use of primary secondary data. These issues raise tensions between the new role of the Wikipedia editor and the conventional role of the archivists and librarians involved in the event.

Participating in the editathon further prompted a growing recognition of the position and role of institutions within these tensions between traditional, non-digital, and digital media. Seven of the nine participants discussed how their increased awareness of digital media, and issues of access and openness of information and resources, was prompting changes in how they approached their work and professional roles at the University. For two participants (Grant and Melanie), these ideas emerged as their most significant learning from the editathon. Grant, a librarian at the University, described the current University copyright policy around its images as "kind of locking away your content so no one can see or use them." His new appreciation for the importance of how media is licensed, and the impact this has on their ability to be accessed online, has prompted him to push for changes to the University's policies.

Marie similarly has used her new understanding of the interplay between primary and secondary evidence to influence her work. She described this learning journey:

> one of the real restrictions that we've got is that with Wikipedia you're not allowed to draw on primary data you have to draw on secondary data and so we weren't allowed to use any of the primary data that we had access to. That was a real learning point for me. Actually thinking back on it I didn't expect to learn about it because I didn't know about it … it's helped me to understand how we need to change or develop as an institution in order to function better in an open educational resource world.

Underpinning the accounts of participants three and five is the appreciation of the potential Wikipedia, and the Internet more generally, has for democratising access to information and challenging the roles of traditional gatekeepers of this information. This notion of possibilities and potentialities of openness, however, is counterbalanced in both participants' narratives by their reflection of how digital media can and does perpetuate traditional inequalities.

Conclusions

Analysing the narratives of editathon participants' learning journeys, through the lens of the critical approach, provides new insights into the potential of editathons to enable individuals to develop new understandings of the role and power that comes with moving from being a consumer to a producer of knowledge online, and how this impacts on the form, focus, and *truth* of the information that is disseminated.

Growing into the editor role, the participants recognise their personal responsibility for representing historical people and events that traditionally have been under-represented. As participants' knowledge of the editor role grows, their understanding of the power of social media and the troubled relationship between physical and virtual spaces and histories, as well as, past and present interpretations and representations of people and events, compels them (or at least some of them) to become active in ways they had not foreseen. Here Melluci's (1996) concept of cognitive liberation becomes particularly relevant. The participants' experiences enabled them to connect the abstract ideas about the under and misrepresentation of women and minorities both in contemporary media and in historical discourses, to more tangible examples with which they were actively involved. Participants recognised how new media forms are continuing to perpetrate existing cultural norms

and inequities, and that by becoming knowledge producers they were in a position to challenge and redress these inequities.

Participants' advocacy for making openly available and accessible forgotten or under-represented histories aligns with the term *information activism*, which refers to the role, typically of librarians and archivists, of promoting access to, and the removal of, barriers to information. Inherent in this term is the need to expose the structural and systematic biases that exist in the selection, presentation, and dissemination of information. The topic of the editathon provided an opportunity for participants to gain an understanding of the gender disparities that exist in the treatment and presentation of women on Wikipedia. Participation further enabled participants to develop their technical, practical knowledge, and skills in how to edit Wikipedia pages and their induction into the norms and culture of the Wikipedia community, provided the opportunity and the development of agency among participants to actively challenge these biases.

It is important to note that the themes and ideas explored in this paper were not the focus of the interviews. Similarly, as only just over 20% of editathon participants were interviewed, they represent only a sub-set of those involved. . The analysis presented here, however, does suggest the potential power of editathons as learning events and provides several directions for future research. Designing a study that seeks to capture the narratives of editathon participants as they undertake the journey to becoming editors could provide greater insight into the observations identified in this study.

The design and structure of the editathon as a learning event that combines online activity with offline, in-person collaboration and interaction, and participants' engagement with a range of artefacts and types of media developed in participants' new understandings of issues of materiality, and more particularly, issues of materiality in a digital world. Similarly to the understandings emerging from participants' narratives of the role of the Internet in shaping their access to, and engagement with, information in their everyday lives, participants' accounts also contained reference to notions of socio-materiality. Participants moved from seeing artefacts as discrete objects that convey information to the objects as entangled in complex and dynamic processes that are embedded within their everyday practices and lives (Sorensen, 2009) with each material pattern producing different forms of knowledge.

The learning journeys emerging from the interviews moves beyond traditional conceptions of knowledge as acquisition or transfer, to learning and knowledge as participation within and through interactions with different content, processes, tools, technologies, social relations, and contexts (Fenwick, 2015). Fenwick (2015) suggests that material things are performative; that they act, with other things and forces, to regulate particular forms of participation and to promote particular relations. The editathon developed participants' understanding of how this complex interplay of materials, technology, and social relations is played on Wikipedia and how this in turn influences how consumers engage with information. By becoming contributors rather than just consumers of information on Wikipedia during the editathon event, participants developed new awareness and understanding of Wikipedia as heterogeneous assemblages (Barad, 2007). That is nature, technologies, humanity, and materials act together on Wikipedia to bring forth particular messages and information in our everyday life.

The adoption of the critical approach in the analysis of the personal narratives of participants' experiences of an editathon event provides a new lens on the range of editathon learning opportunities. By moving beyond the original approach of this study, which was concerned with an understanding of how the construction of social ties between participants facilitated new knowledge construction and learning, this paper has explored the depth of learning and new understandings that an informal learning event can promote. It further suggests the potential and power of an editathon to support new critical understandings and responses, and an evolving sense of agency among participants.

These findings identify valuable learning for improving the study were it to be run with another group. In particular, the range of learning and new knowledge that participants acquired during the editathon suggests that there is potential to further expand the interview schedule in order to more fully capture the development of new understandings that emerged. Future studies would benefit from greater consideration of the qualitative data collection techniques that could be utilised to capture the rich narrative learning emerging from the participants. Conducting interviews prior to the editathon, as well as at its conclusion, would further support the development of rich datasets that more fully captured the journey participants underwent when transitioning from primarily consumers or users of online information to contributors of knowledge, and the factors that supported and impeded this journey.

By focusing on the editathon as an informal, active, experiential learning activity, offers several implications for those involved in the research and delivery of online and distance learning. It reinforces the importance of experiential learning events where participants have the opportunity to shape their own engagement and are not bound by predefined learning intentions or outcomes. Not only did participants develop a greater knowledge of Wikipedia and editing conventions, as the researchers imagined at the beginning of the study, but they also experienced a much deeper learning. It was through the act of moving from consumer to contributor and becoming part of the community of editors, that participants could not only more fully understand issues of bias and structural inequities on Wikipedia, but also actively challenge and address these issues. Furthermore, by negotiating the intersection of traditional, non-digital media with digital media and open source, participants developed new understandings of materiality in a digital age. This suggests that there is substantial learning opportunities if instructional designers consider how they can support learners to take more active roles contributing to online environments.

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The Inherent Tensions of "Instant Education": A Critical Review of Mobile Instant Messaging

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Abstract

This paper critically reviews literature on the role of Mobile Instant Messaging (MIM) applications, such as WhatsApp, in supporting learning and teaching practice. Using formal qualitative synthesis as its methodology, and dialectical theory as an analytical framework, our main objective was to identify tensions, affordances, constraints, and resolution strategies in educational uses of MIM. In contrast to prior work, the analysis offers a nuanced and complex picture of the use of MIM in learning and teaching settings. Instead of facilitating the creation of educational outcomes in a straightforward manner, the realities of MIM use are socially constructed and the subject of conflictual negotiations. The educational use of MIM requires users to navigate the interdependent dialectical tensions of immediacy versus delays (temporal dimension), intimacy versus detachment (relationship dimension) and task versus ludic orientation (intellectual dimension). The findings also reveal a number of behavioural and technical resolution strategies that users deploy to manage these tensions.

Keywords: instant messaging, mobile instant messaging, educational technology, mobile learning, social media, dialectical theory

Introduction

MIM and Education

The use of Mobile Instant Messaging (MIM) applications such as WhatsApp, Snapchat, iMessage, KakaoTalk, and WeChat has grown tremendously in the last five years and presents a dominant mode of contemporary communication. For example, MIM application WhatsApp is rated as the third most popular social media platform after Facebook and YouTube (Statista, 2017). Contemporary MIM applications typically allow for both real-time and asynchronous communication. Their key features are alert mechanisms such as popups, sounds, or vibration that immediately notify users of incoming messages.

Surprisingly, relatively little is known about the role of instant messaging (IM) in learning and teaching. A few authors reviewed instant messaging before its proliferation on mobile platforms. For example, Quan-Haase (2008) noted in her review of university students' IM behaviour that they used these platforms predominantly for social purposes, i.e., maintaining and nurturing distant and proximate social ties. Interestingly, in this early and non-mobile-focused analysis, several tensions came to the fore, which included students' "improper" writing while using IM and the detrimental effects of distraction and multitasking on their academic performance.

The use of IM on mobile devices (MIM) is under-researched; the only systematic review of MIM research is Tang and Hew's (2017). However, what is frequently acknowledged in the literature is MIM's ability to foster various forms of social presence in educational settings, and its informal use alone points to its relevance as part of students' personal learning environments. MIM's value in enabling knowledge development and cognitive outcomes in more formal education settings is less conclusive. In their review, Tang and Hew identified only a very small number of robust studies in educational settings. Of these seven studies, five showed positive outcomes and two showed no or even negative knowledge effects. However, similar to Quan-Haase's (2008) observations in her IM review, Tang and Hew identified a number of challenges. These included improper use of language, intrusion in private life, and irrelevant, inappropriate, and incoherent conversations. In this sense, IM and MIM have mixed effects and their use is associated with a number of tensions, ambiguities, and opposing characteristics that can alternately support and hinder students' academic work.

Theoretical Framework

To systematically uncover and understand these tensions, we used dialectical theory as an analytical framework because it is centred on understanding opposing dynamics. Dialectical perspectives originate from Baxter and Montgomery's (1996) dialectical theory. Its original focus was to study the dynamics of contradictions and their resolution in social relationships, such as the dialectical struggle between the relational opposites of being together versus being independent in a romantic relationship. These opposites cannot be seen as mutually exclusive either/or choices, but, in the sense of a resolution, require the partners to address both simultaneously. This is not a one-time decision, but rather manifests as a continuous and ongoing process of negotiation (Montgomery, 1993).

Beyond interpersonal relationships, dialectical approaches have been used to describe affordances and constraints of information technology. Broadly speaking, the notion of affordances does not describe physical or functional properties of a technology, but, from a user perspective, the range of perceived possibilities of what the objects could be used for (Gibson, 1986). In contrast, constraints are widely viewed as the ways in which technology users are held back from achieving a specific goal (Majchrzak & Markus, 2012). Integrating these concepts with the theory of dialectical tensions, Gibbs, Rozaidi, and Eisenberg (2013) studied how the affordances of social media created tensions among distributed workers of an engineering division. Instead of simply increasing open communication and knowledge sharing, the use of social media prompted employees to manage dialectical tensions between visibility and invisibility, engagement and disengagement, and sharing and control.

In the field of technology-enhanced learning, dialectical approaches have seen only limited use. Perhaps the most prominent example is activity theory, which Engeström and Sannino (2010) conceive as dialectic in that the implementation of technology in a system produces contradictions that stem from sociocultural tensions, and which can be identified and addressed using their activity system model. However, although activity theory, particularly elements of Engeström and Sannino's model such as subjects, rules, and community, are popular in educational technology research, the ideas of contradictions and tensions from Engeström and Sannino's (2010) model are less commonly used. Dialectical approaches have also been used implicitly, for example in the concept of technological ambivalence, which has been used to describe tensions between the collaborative use of social media and the pressure that it generates to work individually and privately at the same time (Rambe & Nel, 2015). The use of dialectical theory is also related to what Selwyn (2010) refers to as the critical study of educational technology. Broadly speaking, mainstream research in educational technology tends to conceive of digital technology as either a neutral, de-contextualised, and value-free medium that produces certain educational outcomes (Surry & Baker, 2016), or as a space that favours a particular educational direction, an approach called soft determinism (Selwyn, 2012). In contrast, critical approaches do justice to the complex, compromised, constrained, and often conflicting realities of educational technology use, which is socially constructed and negotiated rather than predetermined (Selwyn, 2010).

Approach and Methods

Research Question and Literature Search

What follows from the initial literature review from above is that the proliferation of MIM, while being potentially beneficial for learning and teaching, brings about considerable tensions and contradictions that need to be better understood. Accordingly, we formulated the following research question:

> What are the dialectical tensions in the educational use of mobile instant messaging, and what strategies do users apply to navigate and resolve these tensions?

The goal of this research was thus not a systematic review of the effects of MIM, which has been carried out elsewhere (Tang & Hew, 2017). Instead, we sought to better understand and conceptualise the underlying and opposing dynamics in the form of dialectical tensions by conducting a critical review. To build our arguments on a solid foundation, we conducted a systematic literature search using the databases PsycINFO, ERIC, Ovid, MEDLINE (via Ovid®), and Web of Science. We searched for the key term "mobile instant messaging," as well as names of applications (WhatsApp, iMessage, KakaoTalk, WeChat, BlackBerry Messenger, Facebook Messenger and Snapchat). In the Web of Science database, we refined the results by using the research area "education and educational research." We also carried out selective searches in Google Scholar and back-searched the reference sections of the articles we identified through those selective searches for further literature. We then reviewed abstracts using four main criteria (see Table 1); we retrieved and analysed only the articles that met these criteria.

Table 1

Eligibility Criteria for Studies

	Criteria	Description
1.	**Primary data**	Studies generated empirical data through qualitative, quantitative, or mixed-methods designs.
2.	**Sound & conceptually grounded**	Study results were available, scientifically traceable, plausible, and grounded in educational/instructional (or related social science) concepts, theories, or frameworks.
3.	**Learning and teaching activities**	Studies focused on the research and evaluation of concrete learning or teaching activities (e.g., we excluded administrative educational activities).
4.	**Use of mobile instant messaging features**	Studies involved the use of MIM applications; we excluded research that examined more traditional text messaging applications, such as SMS or MMS.

Data Analysis

Twenty-one studies met our criteria for inclusion. To make sense of the predominantly qualitative research data in this emerging field of educational research, we used thematic analysis as our methodological approach to formal qualitative synthesis. In studies employing qualitative synthesis, findings are systematically interpreted through a series of expert judgments to represent the meaning of the collected work (Bearman & Dawson, 2013). Thematic analysis involves repeated reading and analysis of texts and the identification of key themes and concepts across diverse studies. Here, we identified dialectical tensions, i.e., themes that contradicted or opposed one another, and associated affordances, constraints, and resolution strategies by reading and rereading the literature. The method was inductive in that individual

tensions were not derived from previous literature but were identified directly from the data. However, the concepts of tensions (opposing poles), affordances, constraints, and resolution strategies were derived from the theory of dialectical tensions. In other words, while the analysis of the content was inductive, the methods were applied in a deductive manner. By identifying dialectical tensions through an interpretive review, we construed an analytical layer that extended beyond the themes described in the individual studies (Bearman & Dawson, 2013). Per Bearman and Dawson's (2013) recommendations, the authors iteratively discussed emerging findings, and diverging interpretations were resolved upon discussion (Pope, Ziebland, & Mays, 2000).

Sample Characteristics

In Table 2, we briefly summarise the key characteristics of the sample.

Table 2

Designs, Tools, and Settings of MIM Studies

Category	Description
MIM apps	Seventeen studies examined WhatsApp use. Other apps featured in studies were KakaoTalk (Kim, Lee, & Kim, 2014), Mxit (Botha & Butgereit, 2012; Butgereit, 2007; van Rooyen, 2010), and MSN and Skype (Timmis, 2012).
Social formation	The 21 studies featured a number of 23 different social formations, the most common being group learning designs (n=17). In group learning designs peers interacted in joint spaces exclusively among themselves (n=2) or with educators (n=15). In addition, in four studies one-to-one conversations were reported between educator and learner; and in one study between individual learners. (Two studies incorporated individual and group learning designs, and in one study this was unclear).
Degree of formality	In 17 of the 21 studies, the MIM activity formed an explicit part of formal education settings. In four studies, the use of MIM in educational settings was informal, i.e., not directly integrated with formal educational activities.
Media integration	MIM learning and teaching activities were mainly linked with face-to-face teaching, which resulted in blended learning designs (n=14). Only three studies examined exclusively digital/mobile educational settings, and in another four studies this this was not discernible.

Course/ module	The most dominant educational subjects were computer science (n=7), four each of business, education, and health, and two each of mathematics and research methods. One study (Gachago et al., 2015) had three different educational subjects.
Education level	Seventeen of the 21 studies examined MIM in higher education. Two studies involved students from secondary education (Botha & Butgereit, 2012; Bouhnik & Deshen, 2014; Butgereit, 2007), one focused on the nature of learning and supervision in work-related education (Henry et al., 2015), and in one study this was not discernible (Alabbasi, 2016).
Location	The studies had a broad geographical scope. Most studies (n=12) were conducted in South Africa; other studies were conducted in Europe (Castrillo, Martín-Monje, & Bárcena, 2014; Timmis, 2012), the Middle East (Aburezeq & Ishtaiwa, 2013; Alabbasi, 2016; Bouhnik & Deshen), and Asia (Kim et al., 2014; Lam, 2015; So, 2016).

Results

Three central pairs of oppositions emerged in the analysis of the data: immediacy versus delays, intimacy versus detachment, and task versus ludic orientation. These are summarised in Table 3, which presents the affordances and constraints associated with these tensions, as well as the strategies that learners and educators applied to resolve them.

Table 3

Overview of Tensions, Affordances, Constraints, and Resolution Strategies

Tensions	Affordances	Constraints	Resolution strategies
Immediacy vs. delays Temporal dimension	Immediacy provides logistical benefits (quicker access to learning resources) and mediates development of shared goals, actions, and understanding.	Immediacy creates pressure on users to respond quickly.	*Behavioural strategies*: Educators can foster immediacy through providing guidelines on response times, developing a schedule for synchronous discussions, and enforcing delays by postponing

			answers.
	Delayed conversations allow ongoing engagement and widen opportunities for participation.	Delays cause frustration if learning conversations are interrupted	*Technical strategy*: Educators and learners can mute alerts.
Intimacy vs. detachment Relationship dimension	Intimacy involves creation of closer relationships between learners and educators. Detachment reflects demands for private spaces and non-educational commitments.	Intimacy is perceived as an intrusion on privacy, e.g., through obtrusive pop-up features and discussions during time considered to be personal. Educators are challenged by the intimacy of informal language Pronounced detachment (in the form of disengagement) is perceived critically.	*Technical strategy*: Learners limit intrusions by using distinct channels for personal and educational discussions. *Behavioural strategies*: Educators implement language rules and sanctions to avoid intimate/inadequate conversations, and adhere to office hours/pre-determined schedules.
Ludic vs. task orientation Intellectual dimension	A ludic orientation is critical for immersion in focused use of MIM. Performativity in the form of playfulness and enactment of existing relations	Students and educators are critical of an abundance of playful and socialising messages not related to content.	*Behavioural strategy*: Educators define posting requirements and evaluation criteria regarding the quality of content. *Technical strategy:* Educators "flag" key content.

	assist in the creation of shared experience.
	Task orientation results in focused collaborative learning.

Immediacy Versus Delays: Timing Communication

The communicative tension that learners and educators need to negotiate is situated on the continuum between immediacy and delays. This tension is rooted in the capacity of MIM to allow for near-to-synchronous communication as well as asynchronous and delayed communication.

Immediacy. One of the most salient qualities of instant messaging is its enablement of ad-hoc and real-time learning conversations, which are facilitated by visual (pop-up), acoustic (sound), and tactile (vibration) alerts. Accordingly, many studies emphasised the affordances of MIM to provide instantaneous learning communications stressing an added value, which is rather logistic than pedagogic (Aburezeq & Ishtaiwa, 2013; Bere, 2012; Kim et al., 2014; Lam, 2015; Rambe & Bere, 2013a; Ramukumba, 2015; Willemse & Bozalek, 2015).

These logistical qualities included quick access to educator and peer assistance (Aburezeq & Ishtaiwa, 2013; Bere, 2012; Willemse & Bozalek, 2015), as illustrated in this student's statement: "[The use of a WhatsApp group] alerts you to [...] ideas from classmates instantly" (Bere, 2012, p. 10). This was deemed to be particularly important in work-based learning settings, where learners received immediate advice from their tutors in solving more complex problems (Willemse & Bozalek, 2015). The mixed-method case study of Rambe and Bere (2013b) emphasised the use of MIM to provide South African IT students with prompt feedback in question-based consultations from peers and lecturers, which helped them solve problems and discuss academic issues. Groups of students from an educational technology course that used the MIM application KakaoTalk to solve pedagogical problems reported that the application provided opportunities to arrange ad-hoc learning conversations and to facilitate communication among distributed students (Kim et al., 2014). These students were contrasted with groups who used desktop applications and who found it difficult to schedule a time when all team members could log into their PCs. In addition to logistical benefits, Timmis (2012) identified the co-temporality of MIM-based learning conversations as a relevant mediator for the development of joint goals and actions and a shared understanding.

Although immediacy was considered an advantage in learning and teaching settings, it also created pressures on learners and educators to respond quickly. In this sense, "instant education" not only allows but demands immediate responses. For example, Bouhnik and Deshen (2014) described students'

expectations that educators would be available 24/7. Another demand for immediacy in their study was voiced by educators who reported correcting mistakes as soon as they occurred to prevent them from "striking roots" and spreading in the digital spaces.

Delays. Immediate responses were often not possible due to situational and technical constraints, and users were required to balance their communication continuously between immediate and delayed responses. In other words, a considerable number of learning conversations were interrupted by users who dropped in and out, and who sometimes took up conversations after short breaks but other times after several hours (Timmis, 2012). Interrupted educational discourse was described as "annoying" in some studies; learners were often concerned about lack of immediate feedback from their instructors (Aburezeq & Ishtaiwa, 2013) or frustrated with their unavailability during certain times (Rambe & Bere, 2013b). In contrast, asynchronous features that allowed users to retrieve messages at a later point in time also created benefits (Rambe & Bere, 2013a; Willemse, 2015). Rambe & Bere (2013a) observed that delayed participation afforded multiple and temporally distributed interaction modes and thus widened the opportunities for student involvement. Delays also allowed for a deeper reflection on peers' ideas (Aburezeq & Ishtaiwa, 2013; Rambe & Bere, 2013a). For example, one of Aburezeq and Ishtaiwa's participants described how access to past conversations encouraged critical engagement and reflection: "Furthermore, I had to access previous discussions on WhatsApp platform to review some ideas before formulating my final answer. It is burdensome, but it is beneficial" (2013, p. 171).

The ambivalent ways in which learners perceive the interplay of immediacy and delays to create a different sense of connectedness is illustrated by a student who characterised the communication patterns of their group on KakaoTalk by using the seemingly contradictory statements of "all day long" versus "short time," which nicely showcases the perceived duality of communication practice: "I think our team discussed the topic all day long because we talked whenever we are available. Although it's short time" (Kim et al., 2014, p. 38).

Resolution strategies. In balancing the poles of immediacy versus delays, different behavioural and technical resolution strategies were developed and deployed. To keep conversations fluent, learners were asked to respond to instructor and peer questions within a given period of time (Aburezeq & Ishtaiwa, 2013), or as quickly as possible (Rambe & Bere, 2013a). Teachers also sought to adhere to reasonable response times (So, 2016). Moreover, lecturers developed schedules with sessions dedicated to synchronous discussions and information exchange as another approach to promoting immediate interaction (Ramukumba, 2015; So, 2016). In contrast, and as a means to develop temporal distance, educators also reported deliberately delaying their answers, answering flexibly (Bouhnik & Deshen, 2014), and defining specific times to respond to learners' questions (Gachago, Strydom, Hanekom, Simons, & Walters, 2015). To do so, they used technical measures that included muting the alert signals in their MIM applications (Bouhnik & Deshen, 2014; Gachago, Strydom, Hanekom, Simons & Walters, 2015).

Intimacy versus Detachment: Negotiating Social Relationships

The second duality spans the continuum of intimacy versus detachment, i.e., social proximity versus distancing oneself from the educational community.

Intimacy. The observation that MIM affords high levels of intimacy, especially in contrast to other social media such as social network sites (Karapanos, Teixeira, & Gouveia, 2016), was a predominant theme in many of the cited studies. MIM use was found to be conducive to the development of intimate, affective, and emotional learning spaces (Bere, 2012; Bouhnik & Deshen, 2014; Castrillo et al., 2014; Henry et al., 2015; Kim et al., 2014; Timmis, 2012; van Rooyen, 2010), even in anonymous tutoring services (Butgereit, 2007). For example, Bouhnik and Deshen (2014) highlighted in their qualitative study that the advantages of WhatsApp groups reside in nurturing the social atmosphere and improving interpersonal relationships between educators and students. The high school teachers they interviewed felt that they would get to know their students better and learn about "what bothers them, what helps them" (Bouhnik & Deshen, 2014, p. 226). Similarly, Castrillo et al. (2014) found several indicators of the development of group solidarity in their discourse analysis of WhatsApp-based language learning, including the reduction of social distance and the declaration of group membership. Kim et al. (2014) also identified emotional closeness as a key construct in their qualitative analysis. The facilitation of social proximity was deemed to be especially relevant in settings where learners suffered from professional isolation, such as the in-service teachers in Gachago et al.'s (2015) South African study.

The association between the co-construction of intimacy and MIM use was also identified in informal, "student-only" conversations. Timmis (2012) observed that the intimacy and affective behaviour that were nourished by shared history and co-produced social relations were nearly exclusively found in MIM use and not in the use of other digital communication tools.

Feelings of intimacy and closeness were, in part, rooted in the perception of MIM platforms as a personal space that afforded the use of informal language (Bere, 2012; Castrillo et al., 2014; Kim et al., 2014; Rambe & Chipunza, 2013). As a student in Bere's study commented, "On WhatsApp I am free to express myself in anyway meaning that street language is acceptable and the platform is very informal" (2012, p. 13). This feeling was particularly evident in comparison with the formal language tied to the use of traditional learning management systems. However, in Bouhnik and Deshen's (2014) study, while learners tended to associate the day-to-day language used in instant messaging with intimacy and closeness, some educators felt challenged by their students' informal ways of expression, raising questions about whether to intervene, and, if so, how often.

Detachment. In opposition to intimacy, users and educators also perceived the use of MIM as an intrusion into their personal lives. While intrusive communication patterns did not present a burden to all users — as one educator commented, "I allowed my private space to be invaded but I did not mind" (Ramukumba, 2015, p. 8) — many studies revealed users' need for detachment from increasingly ubiquitous learning communities (Aburezeq & Ishtaiwa, 2013; Bere, 2012; Bouhnik & Deshen, 2014; Rambe & Bere, 2013a; Smit, 2015; So, 2016; Willemse & Bozalek, 2015). One reason that triggered users' needs for

detachment were discussions that reached into time they perceived as personal. For example, Bere and Rambe (2016) observed that twice as many interactions took place between 6 and 11 p.m. than during the day. Moreover, and in contrast to the pull mechanisms of classic learning environments in which learners decide when and how to engage, the push messages associated with MIM use were perceived to be intrusive (Bere, 2012).Intrusion also manifested in terms of inappropriate content, perhaps most dramatically in the South African Dr. Math project, in which online tutors received numerous sexual propositions from pupils in the anonymous conversations (Butgereit, 2007).

The tension between intimate conversations and the need for withdrawal was especially observed in more mature learners (Aburezeq & Ishtaiwa, 2013; Bere, 2012; Rambe & Bere, 2013a; Willemse & Bozalek, 2015) and in teachers, especially if they had many groups to moderate and if conversations took place during late hours (Bouhnik & Deshen, 2014). However, some learners also criticised that other users' detachment was too pronounced, especially for the ones with very limited participation (Aburezeq & Ishtaiwa, 2013).

Resolution strategies. Some users managed the tensions of intimacy and detachment by implicitly restricting their conversation times to office schedules (Castrillo et al., 2014) or to pre-arranged conversation times (Willemse & Bozalek, 2015). This strategy is not only reflective of users' need to distance themselves from the learning community but also discloses the perception of MIM-based learning activities as explicit and formal educational practices. Intimacy and detachment were also managed by the selection of digital channels (Henry et al., 2015; Timmis, 2012). For example, Timmis (2012) observed that students tended to use separate spaces for their university and private communications to maintain these pre-established boundaries. Another way to protect the privacy of learners and educators was the establishment of guidelines and sanctions. In the Dr. Math project, the tutors were not allowed to reveal any information regarding their age, sex, and location (Butgereit, 2007). Students were also warned and even removed from the system if they used inappropriate language. As an additional control, textual conversations were recorded and spot-checked by administrators (Botha & Butgereit, 2012).

Task Versus Ludic Orientation: Managing the Depth of Intellectual Engagement

The third tension that was reinforced through the educational appropriation of MIM and that needed to be addressed by learners and educators was the opposition between task orientation, in the sense of focused cognitive or meta-cognitive reasoning, and ludic orientation, a less profound intellectual engagement that resembles forms of playing and socialising.

Task orientation. A number of the studies we examined reported focused learning in MIM spaces, mostly based on conversation analysis and interviews (Henry et al., 2015; Kim et al., 2014; Lam, 2015; Rambe & Bere, 2013a; So, 2016; Timmis, 2012; Willemse, 2015). For example, in their content analysis, Rambe and Bere (2013a) identified critical engagement with learning resources. This finding was corroborated through post-surveys, in which the majority of students associated the academic use of WhatsApp with knowledge creation and deep reflection. In Kim et al.'s (2014) study, students deemed MIM conversations to allow for sufficient time to review the contributions of other learners and to provide thoughtful feedback, especially compared with face-to-face discussions. Even in peer-to-peer learning

settings not prescribed by educators, students engaged in MIM to discuss content and task-related issues (Lam, 2015; Timmis, 2012), for example carrying out mathematical calculation exercises (Lam, 2015). In some studies, focused engagement resulted in enhanced levels of cognition and knowledge, as highlighted in Tang and Hew's review (2017). One example is So's (2016) experimental work, which examined the effects of a WhatsApp group used to provide short multimedia materials and to facilitate interaction between learners and the lecturer in addition to classroom-based lectures. The intervention group scored significantly higher in the post-test compared with the control group, which used WhatsApp only for administrative purposes.

Ludic orientation. In contrast to promoting cognitive and metacognitive learning activities, considerable parts of the conversations in other studies tended to be less focused, involving socialising and playing (Aburezeq & Ishtaiwa, 2013; Bouhnik & Deshen, 2014; Gachago et al., 2015; Kim et al., 2014). The tension was especially evident in Gachago et al.'s (2015) study, where, despite the efforts of the educator to keep the conversations strictly academic, the space became increasingly social. Aburezeq and Ishtaiwa (2013) noted that in their study nearly half of all postings had fewer than 20 words and were based on brief and quick interactions rather than on reflective, critical, or deep thoughts. Kim et al. (2014) affirmed these tendencies towards playfulness and socialising in the quantitative content analysis of their mixed-method study. They found that MIM (and also desktop-based IM) groups were associated with higher levels of social and affective communication and with fewer cognitive and metacognitive interactions compared with the bulletin board groups. Their qualitative analysis indicated a lack of recursive and convergent utterances, with some of the learners in the MIM groups tending to simply state their opinions without reviewing or considering others' posts.

One reason offered for this tension is the implementation in formal education settings of a private tool (MIM) that is often used for hedonic purposes (Aburezeq & Ishtaiwa, 2013; Willemse & Bozalek, 2015). One learner characterised WhatsApp as "a toy for socializing and having fun, it is not for learning" (Aburezeq & Ishtaiwa, 2013, p. 173). In addition, learners underlined the distractive potential of MIM due to its tempting proximity to other entertaining mobile phone applications, such as social network sites (Aburezeq & Ishtaiwa, 2013). Another reason for these extraneous conversations lies in learners' ubiquitous use of MIM. Instead of concentrating on the learning activity, MIM is embedded in everyday life, and the associated multitasking is likely to result in a less focused cognitive engagement, as this student suggests: "These days I can easy [sic] post and get answers on WhatsApp even when I am shopping if I see or hear anything confusing related to my studies" (Bere, 2012, p. 11).

The educational implications of messages with playful and socialising content were perceived ambiguously. In part, messages that were not directly relevant to education were criticised by learners (Aburezeq & Ishtaiwa, 2013) and deemed by educators to be upsetting (Bouhnik & Deshen, 2014). However, drawing on content analysis, some authors observed that playful and extraneous discussions, albeit lacking strong intellectual qualities, can be viewed as a necessary social immersion in the productive use of MIM and can thus lay a foundation for its more intellectual use (Rambe & Bere, 2013b). Similarly, Timmis (2012), who

found significant indictors for playfulness and socialising in her discourse analysis, concluded that the creation and maintenance of a shared social experience is a relevant component of collaborative learning.

Resolution strategies. Behavioural resolution strategies that educators used to strike the balance between ludic and task orientation, and particularly, to orient learners towards a more focused and productive engagement, were the development of specific posting requirements and evaluation criteria (Aburezeq & Ishtaiwa, 2013; Gachago et al., 2015). In Aburezeq and Ishtaiwa's (2013) interview study, learners' messages were required to reflect the course content and include new ideas, reflections, opinions, and critical thinking beyond mere description or summary. Learners in this study found the established criteria relevant and tied them to deeper levels of reflection and critical thinking. As a technical strategy, educators in Gachago et al.'s (2015) study flagged key discussions with emoticons. This allowed learners who did not participate in the socialising discussions, and who accessed WhatsApp only occasionally, to review the content and identify central information in an efficient manner.

Discussion

Our review and analysis of the literature has revealed a nuanced picture of the use of MIM in learning and teaching settings. By describing the conflicting dynamics of educational use of MIM, it adds to prior work which simply conceives the affordances of MIM to be "temporal, user-friendly, minimal cost, and multi-modality features" and which explains its convenience as permitting users to "easily chat with peers or teachers anytime and anywhere they prefer" (Tang & Hew, 2017, p. 100). In contrast, our findings suggest that instead of learning in a convenient and "straightforward" manner, both learners and educators need to navigate dialectical tensions that relate to time, relationship, and intellectual depth. This research has shown how the idiosyncrasy of MIM shapes, affords, and confines the ways in which learning and teaching play out, and, in the same way, how educational benefits are realised. What follows is that, despite the perception of MIM platforms as hugely popular low threshold applications (TLT Group, 2015), MIM is not easily implemented in more formal learning and teaching settings.

The effective navigation of tensions and opposing forces identified in this study requires users to develop a new set of skills that reaches far beyond the technical aspects of using mobile devices and applications. Balancing issues of timing, managing social distance, and weighing task against ludic engagement necessitates competencies that are not considered in classic media literacy definitions that typically incorporate the access, analysis, evaluation, and creation of content (Livingstone, 2004; Redecker, 2017). The skills to manage these tensions in the use of MIM spaces do not only play out at an individual level but need to be negotiated and calibrated collectively (e.g. in a group space), which can be a complex and conflictual process. For example, Pimmer, Mhango, Mzumara, and Mbvundula (2017) found that one of the prevailing challenges in the use of WhatsApp groups was the ongoing negotiation and reconciliation of users' divergent expectations regarding social versus task-oriented use of the space. What complicates this

process further is that the poles which create these tensions are neither valuable nor damaging by themselves. Instead, they have unique qualities that cannot be played off against one another.

In contrast with the broader field of mobile learning, in which instructionist, transmissive, and non-conversational educational approaches have prevailed to date (Frohberg, Göth, & Schwabe, 2009; Pimmer, Mateescu, & Gröhbiel, 2016), the main route for learning and teaching in the MIM settings we reviewed was centred on social interaction. Given its strong capacity to develop and maintain a social presence in learning and teaching settings, MIM can be especially valuable in contexts in which the development, strengthening, and maintenance of social ties is central, as in the initial phase of online learning described in Salmon's (2003) five step model of e-moderation. According to Salmon, at this stage, moderators should familiarise students with the online environment through socialisation and provide bridges between sociocultural aspects of offline and online learning environments in ways that increase familiarity with peers and reduce social distance among them. Beyond a "sequential" perspective, socialising can be conceived as an inherent part of effective learning itself. This is reflected, for example, in the "social presence" dimension of the Community of Inquiry theory (Rourke, Anderson, Garrison, & Archer, 2007), and, even more so, in the "participation" metaphor, in which the main route of learning is understood as growing into a community of practice (Lave & Wenger, 1991; Paavola, Lipponen & Hakkarainen, 2004).

Our study on the educational use of MIM technologies suggests several directions for future research. Our findings represent a snapshot in time; the rapid transformation of MIM technology and associated communication practices alone necessitate further research. For example, calling and voice notes are new functionalities that were recently added to a number of MIM applications, but which have not been addressed in the corpus of studies we examined. Another area that requires further exploration is the professionalisation of MIM-based tutoring. A recent BBC report describes an emerging tutoring industry based on "WhatsApp-style instant messaging environments." They highlight the example of "Snapask," which connects about 5,000 tutors with 100,000 students from Hong Kong, Taiwan, and Singapore. Students raise questions and the software matches them immediately with a tutor for an instant learning session (Jackson, 2016).

From a methodological perspective, the current body of literature consists primarily of qualitative research, some descriptive quantitative investigations, and a very limited number of studies that incorporate experimental designs. We thus agree with Tang and Hew (2017) that there is an obvious need for more rigorous quantitative research designs that more systematically and rigorously compare, for example, the differences between MIM and other communication modes. However, in line with dialectical theory, we argue that there is also a need for more thick and rich descriptions (Geertz, 1973), which further our understanding of the dialectical dynamics, especially how, in the course of MIM use, the relationship between oppositional forces may change. This could, for example, play out in the sense of a helical model, whereby the response to one dialectical pole creates pressure to attend to the opposite pole and, in consequence, the relationship pair cycles back and forth over time but never reaches precisely the same place as before (Baxter, 2003). Applied to MIM, this can be addressed, for example, by an examination that explores how the relationship between ludic and task orientation changes over time.

Conclusions

This study has sought to contribute to the conceptualisation of a more fine-grained understanding of the conflicting and negotiated realities of the use of MIM in learning and teaching settings. One of its main contributions is the establishment of a framework that shows how the educational affordances and constraints of MIM unfold in the ways in which learners and educators navigate the dialectical tensions of immediacy versus delays, intimacy versus detachment, and task versus ludic orientation. This framework might not only help readers to make sense of learning in current *mobile* instant messaging environments, but it could also help to inform our understanding about the emerging practice of ubiquitous messaging, as several large tech companies are in the process of offering unified mobile and desktop messaging applications.

Moreover, the dialectical theory of Baxter and Montgomery (1996), proved a helpful framework with which to critically analyse and problematise the use of educational technology, an approach that might also help scholars in the exploration of other fields of technology-enhanced learning.

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Co-Construction Concept Through Cloud-Based Social Network Platform Design, Implementation, and Evaluation

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Abstract

Today's learners can easily share their thoughts on their social networks, and this movement, undoubtedly, has been affecting their learning. However, learners in such an ad hoc social network environment need a deliberate design to support their idea sharing and concept exchange. Gaining insights into how to stimulate concept sharing in a social network helps learners learn. To this end, this study examined how to design a cloud-based concept construction platform, and analyzed the users' interaction behaviours on the platform. A cloud-based platform named CoCoing.info was implemented to achieve the aim. The platform has three major functions: (a) co-construction concept building, (b) social network organization, and (c) concept circulation among social networks. Seven hundred and twenty-six accounts registered on the platform. Users constructed 2,121 concepts using 20,049 nodes, and 1,618 files were established. The access statistics results indicated that the platform was used throughout the day, in which the ratio of in-class to after-class access was 0.59:0.41. Among the interactions, 31.24% belonged to concept construction and 68.76% were user responses. Meanwhile, the key player social networking analysis results indicated that teachers appear to play a crucial role in initiating concept construction and triggering social interaction within the type of concept construction social network.

Keywords: co-construction concept, social networking organization, cloud-based platform

Introduction

Social networking applications, such as Facebook, Line, Academia.edu, and ResearchGate, have become ubiquitous in everyday life, and their potential functions for learning and open education have begun to be considered (Lampe, Wohn, Vitak, Ellison, & Wash, 2011; Meishar-Tal & Pieterse, 2017). However, these social networking applications, commonly used in our day-to-day lives, may not be easy to use in education if they lack important functionalities that enable learning (Mnkandla & Minnaar, 2017). Currently, most of the social networking applications focus on encouraging users to be constantly aware of what their friends do or care about; rarely do they foster a persistent sense of idea or concept construction (Lewis, Pea, & Rosen, 2010). Providing users an online space exclusively may not assure their learning. Learners actually require some well-designed learning activities, such as concept construction and exchange, in order to learn successfully.

Technology, such as Web 2.0, knowledge building, and computer-supportive collaborative learning, indicates that users on the Internet are able to extensively collaborate and serve as active contributors (O'Reilly, 2005; Scardamalia & Bereiter, 2014; Wasson, Ludvigsen, & Hoppe, 2013). In particular, users who have similar interests can create their own knowledge and learn together rather than only discover knowledge. Such users' work is primarily valued for what it contributes to the group. More specifically, with the linking capacity and ability to integrate users' contributions, social networking applications have the potential to be useful in guiding people away from the popular "participation" framing model to a "co-creation" model (Lewis et al., 2010).

To this end, this study examines (a) how to support learners in taking the initiative to construct their concepts individually and collaboratively, and (b) how to help learners circulate their concepts in a social networking environment. In terms of supporting learners to construct their concepts, a concept map may be a useful tool because it is well established and widely used in many learning environments. In terms of circulating a learner's concept, a seamless cloud-based social networking platform can be an effective approach because it provides instant feedback to users anytime and anywhere. On the basis of the aforementioned arguments, this study investigated the effects of learners' co-construction concept and evaluated how learners can interact and learn from social networking platforms seamlessly and effectively.

Background

As mentioned above, the use of social networking applications has surged globally in recent years; however, a low percentage of students and instructors use social networking applications for educational purposes since using them for learning requires a deliberate learning design, either in formal or informal learning environments (Chen & Bryer, 2012). From the learning perspective, a social networking application combined with a concept map design can facilitate learners' social interaction

and organization of concepts. Therefore, in this section, we elaborate upon Social Networking Enhanced Learning and Concept Map factors.

Social Networking Enhanced Learning

Social media and social networking applications demonstrate the potential for facilitating students' social interaction. By participating in an online social network, people who share common interests and goals can interact and exchange information and knowledge (Scardamalia & Bereiter, 2014). Such phenomenon is consistent with the results obtained by Al-Rahmi, Othman, and Yusuf (2015) that social media can facilitate collaborative learning and engagement. Social networking technology has additional affordances that may enable new forms of learning to be performed in online communities, such as massive open online courses (Sharples, Kloos, Dimitriadis, Garlatti, & Specht, 2015), and provide new opportunities for designing and implementing advanced learning environments (Hwang, Wang, & Lai, 2015). Students' social interactions in online communities have contributed to the development of new paradigms and methodologies in education (Putnik et al., 2016).

However, Gülbahar, Rapp, Kilis, and Sitnikova (2017) argued that social media and social networking applications cannot achieve educational purposes without a deliberate learning activity design. With a deliberate learning activity design, learners can achieve higher learning performance. For example, Mnkandla and Minnaar (2017) found that social media could adopt a conceptual framework for online collaborative learning (OCL) to facilitate deep learning and the creation of knowledge in e-learning at higher educational institutions. Gülbahar et al. (2017) also found that providing instructors with a social media toolkit served as a guide to steer the students' discussions in the appropriate direction. Such social media toolkit provides instructors with guidance regarding the effective selection and integration of social media into their courses. These findings indicate that the social networking technology is a promising tool for learning purposes; however, these findings also point out that deliberate learning activity designs are the most critical barriers to adopting social networking technology in online learning.

Concept Map

A concept map is regarded as a tool to construct complex knowledge through logical and systematic summarization and organization. In the presence of the sequence of concepts and the relation among structures and hierarchies, concept maps can thus promote meaningful learning (Novak, 1998). The concept map tool is widely used in various knowledge creation and modeling fields such as web-based information-seeking activities (Chu, Hwang, & Liang, 2014), instructional design (Hwang, Yang, & Wang, 2013), achievement and interests of learners (Chiou, 2008) and computer-based knowledge assessment (Weinerth, Koenig, Brunner, & Martin, 2014). Moreover, because of its connective ability, a concept map can be modified to encourage learners to organize their social networking organization, represent their knowledge, and circulate their knowledge among friends.

Most of a learner's knowledge is implicit, and a mechanism is required to lead the learner to organize

and circulate his or her concepts in a learning activity (Sun & Chen, 2016). Specifically, certain learning activities, such as concept construction and exchange, should be merged into the social networking application design. Technology-enhanced concept maps help learners easily construct concepts, facilitate modification to enable the maps to manage large representations for a complex domain, and allow groups of people to participate in their creation (Cañas & Novak, 2008). Therefore, using cloud-based computing technology and a concept map design enables knowledge to be easily organized and transmitted. Digitalized concept maps, in particular, help learners to discuss their ideas with peers through their social networks.

Cloud-Based CoCoing.info Platform

To gain insights into how to stimulate concept-sharing in the social network, a platform named CoCoing.info was implemented. On the platform, learners could construct and share their personal concepts of themselves (for archiving), to their friends and groups (for peer-sharing), and to the public (for dissemination). As shown in Figure 1, the CoCoing.info has three main mechanisms: (a) co-construction concept building, (b) social network organization, and (c) concept circulation among social networks. The details of these functions are elaborated in the following paragraphs.

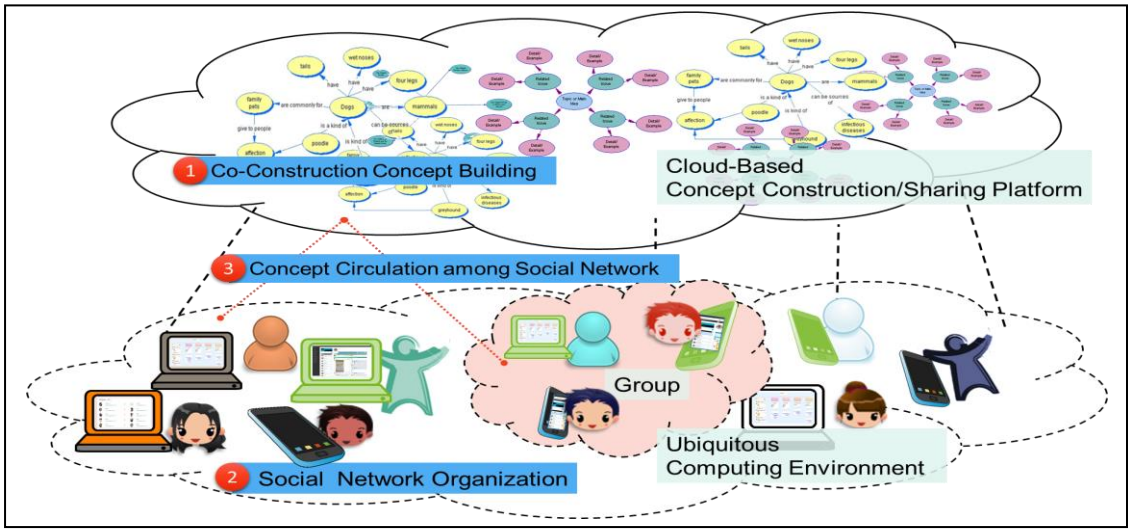

Figure 1. Cloud-based concept construction and sharing platform scenario.

Co-Construction Concept Building

To help learners represent and explicate their personal concepts systematically, the connective property of a concept map was applied. Specifically, the co-construction concept building function on the CoCoing.info platform allowed the learners to construct, edit, or share concepts in the cloud-based online environment individually or collaboratively. Learners could explicate their ideas by organizing their thoughts into a map that had creating, editing, and archiving functions on various devices (e.g., desktop computer, tablet computer, or mobile phone).

Figure 2 illustrates several concept construction functions, namely (a) adding a node, (b) deleting a node, (c) editing a node, (d) colouring a node, and (e) receiving peer responses.

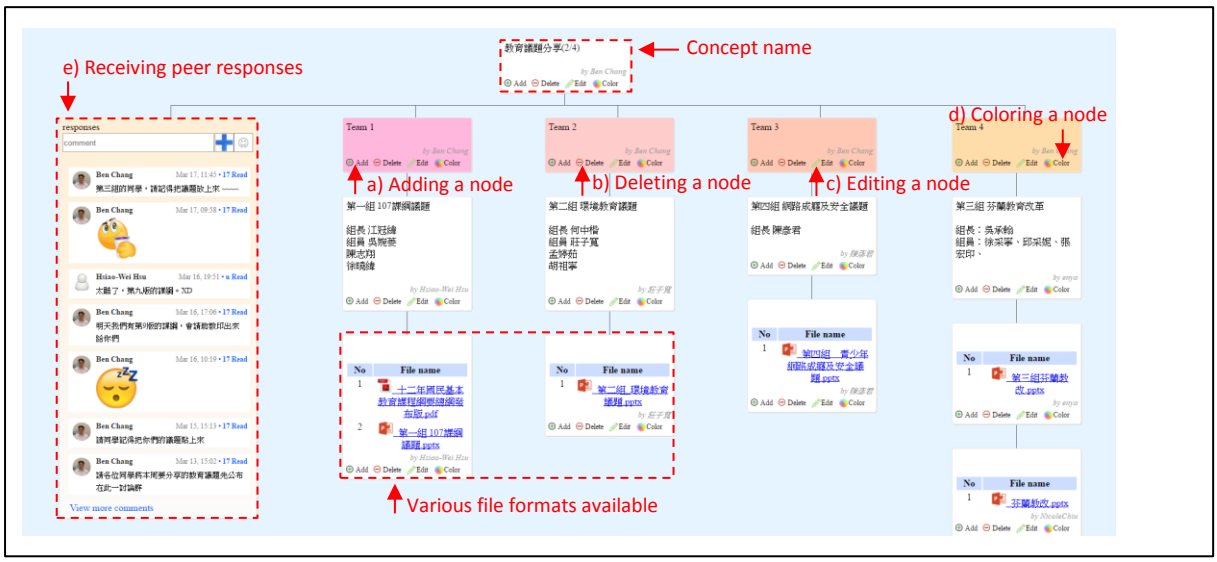

Figure 2. Co-construction concept building function interface.

The details of each function are elaborated as follows:

a) Adding a node: Upon clicking the “Add” button at any node, an associated child node was created. Learners could add more nodes by continuously clicking on the “Add a node” button.

b) Deleting a node: Upon clicking the “Delete” button at any node, the selected node was removed. With the “Add a node” and “Delete a node” functions, learners were able to draw the concept outline.

c) Editing a node: The abundance of Internet resources provides users with various integrated applications. To offer users a convenient method for editing a concept node in different data files, a concept node editing interface (Figure 3) was provided. Within the interface, a learner can:

1. insert a sentence to describe a concept node;
2. post a URL to link a concept to a resource on the Internet;
3. upload files, including Word, Excel, PowerPoint, PDF, and GIF files; and
4. share photos captured on mobile phones instantly.

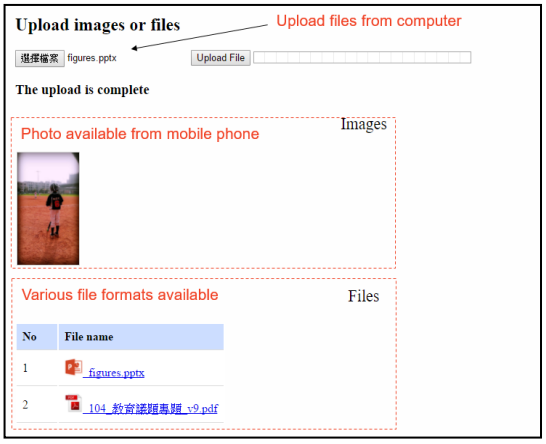

Figure 3. Concept node editing interface.

d) Colouring a node: A computer palette was provided so that users could change a node's colour according to their preference.

e) Receiving peer responses: Accompanying each created concept was a section called the "responses area," in which a learner's peers could provide feedback to the learner. To enable the learner's peers to provide their feedback rapidly and conveniently, response content in the form of either text or emoji icon was enabled, which allowed the peers to offer various and vivid responses.

Social Network Organization

On the CoCoing.info platform, learners could develop their owned social network by linking with their peers, and learners could also organize their friends into a common interest group. The platform also automatically recommended new friends to learners; learners only needed to click on a confirmation button to accept. As shown in Figure 4, the social network building interface has six subfunctions. They are:

a) Searching for people on the CoCoing.info platform: Learners could search for their peers on the CoCoing.info by providing either the peer's name or email address.

b) Searching for a group on the CoCoing.info platform: Similarly, learners could search for groups on the CoCoing.info by inputting the group name.

c) Adding a new friend: Learners could add their friends by inputting the friends' email addresses. Registered users could also invite their friends to join their social network by adding the friends' email addresses. Once an invited user approved the invitation, the invited friend was added to the user's social network.

d) Recommending friends: The CoCoing.info platform automatically recommended some friends

to a learner based on the learner's social network analysis results. The guiding rule for recommending friends was that a friend's friends should also be the user's friends.

e) Group management: Learners could join common interest groups and share their idea through those established groups.

f) Seeing a user's friend list: All learners' friends were listed with their photo and email in the users' friend list.

Figure 4. Social network organization function interface.

Concept Circulation Among Social Networks

The circulation of users' created concepts among their social networks is crucial because circulating these concepts creates more value. On the CoCoing.info platform, learners showed their collected personal concept list, as depicted in Figure 5. The concept list source was derived from learners' peers who share ideas with them. More specifically, all of the structured concept maps created by learners and their peers were collected as a concept list (Figure 5); within the concepts list, learners could view all of the concept created by themselves or shared by their friends. Each concept was displayed as an idea block. Two colours, green and blue, were adopted to represent the concepts that had been created by learners or shared by their peers, respectively.

The details of the concept circulation among social networks subfunctions are:

a) Concept sharing with learners' peers: This function enabled learners to share their concepts with their friends or to a group of people.

b) Concept list: All concepts shared by peers were collected and listed in a concept list. Learners could select one of the nodes listed in a concept list to peruse the details of the concept. The details were listed on the right-hand side of a concepts list, which was divided into the content of the concept division and peers' responses on the concept division.

c) Concept operation utility: The utility features of a concept, including forward, share, collect, and edit, were also provided for learners. The concept construction interface presented in Figure 2 was displayed when a learner selected the edit button on the utility.

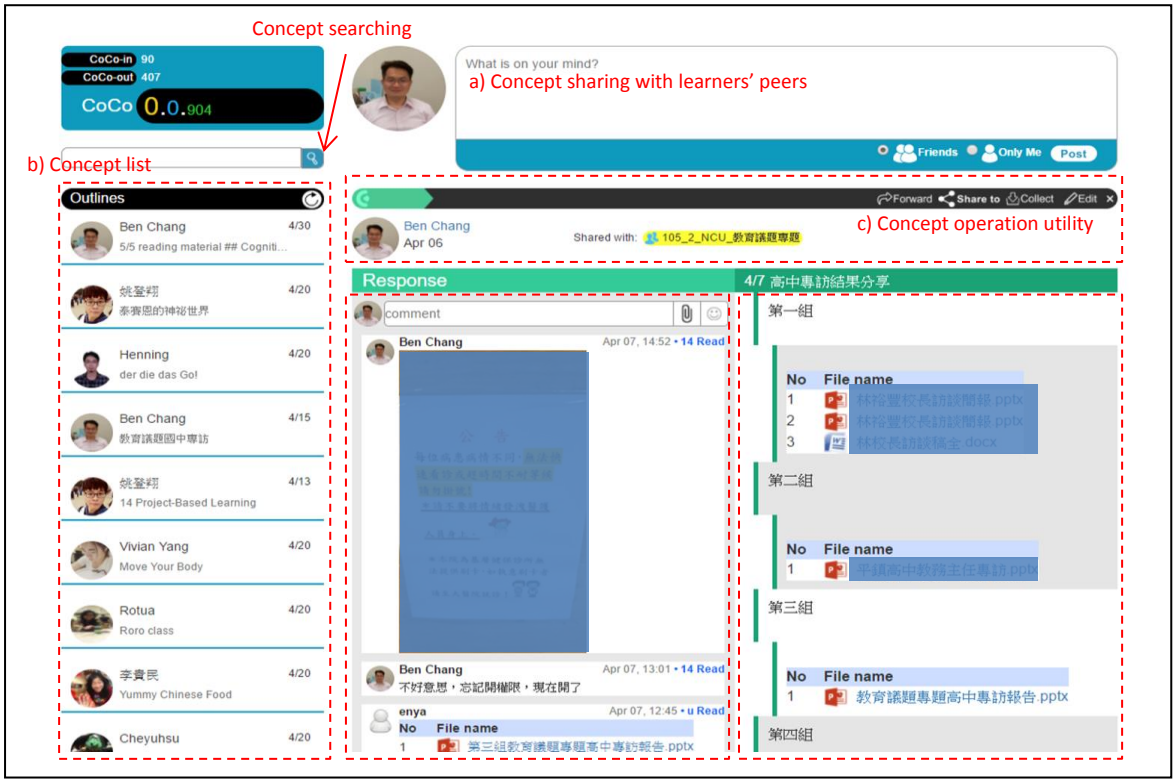

Figure 5. Concept list interface on a personal computer browser.

To enable learners to access the CoCoing.info platform on different devices, responsive web design (RWD) technology was adopted; this provided a different user interface for various devices. For example, Figure 5 shows a personal computer browser interface, and Figure 6 presents a mobile phone user interface.

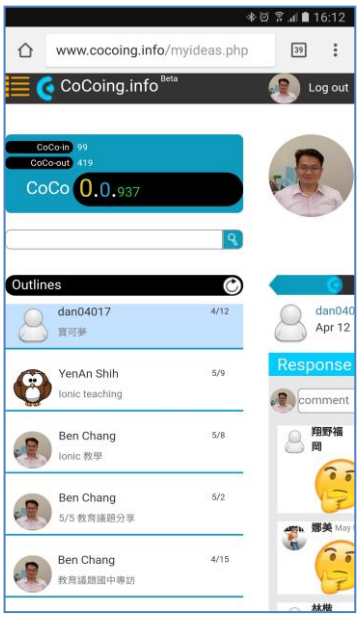

Figure 6. Concept list interface on a mobile phone browser.

Learners had four avenues through which to share their ideas:

a) Archive: Learners could only edit their own concepts and were able to archive these concepts to their personal collections on the CoCoing.info platform.

b) Share their concepts with selected friends: Learners select some friends with whom they wanted to share their thoughts.

c) Share their concepts with a group of friends: Learners could organize an unlimited number of groups and could share their thoughts with those groups.

d) Share their concepts with the public: Learners could share their ideas with the public so that anybody who has Internet access could view their ideas.

Results and Discussion

The CoCoing.info platform was available online on November 1, 2016. To evaluate the platform effects, the user data spanning from the launch date of the site to the end of April 2017 were obtained and analyzed. The current study was designed as a descriptive study to explain events and more thoroughly understand the platform. A series of evaluations covering Access Statistics, Concept Creation versus Responses, and Keyplayer Metrics were conducted to study learners' preferences toward those functions.

Access Statistics

The login information of all users was saved into the databases for analysis. Figure 7 displays the access statistics results, revealing that the CoCoing.info system was used throughout the day. The very high access rates were noted between 08:00 and 12:00 noon, and between 13:00 and 17:00, which are in-class times. The system also had high access rates after class. The ratio of in-class to after-class access was 0.59:0.41 (approximately 6:4). The comparing rate indicates that the system was used both during and after classes. This phenomenon could lead to a "breaking of the walls" of physical classrooms.

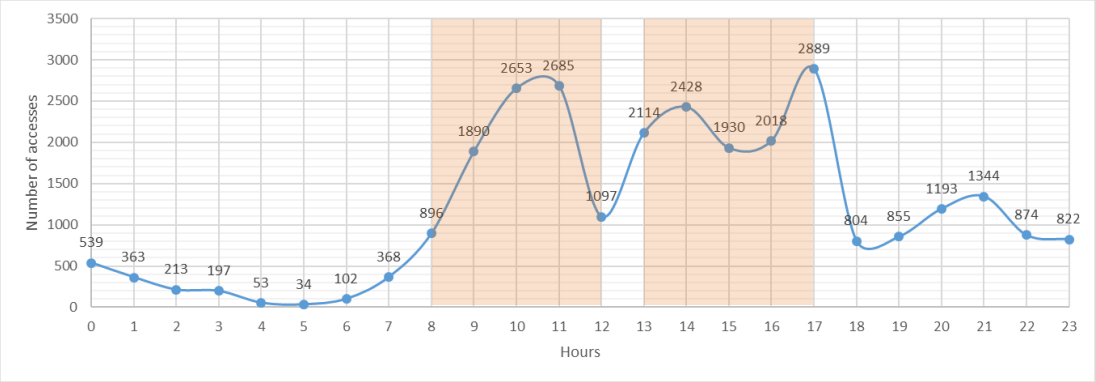

Figure 7. CoCoing.info platform users' access distribution.

Concept Creation vs. Responses

By the end of the study period, the data on the CoCoing.info platform revealed that 726 accounts had been registered and 2,121 concepts had been established. The established concepts were constructed using 20,049 nodes and 1,618 files, which indicated that each concept, on average, had 9.45 nodes (edited by concept owners) and 0.76 files uploaded. In addition, 4,663 user responses were posted to discuss those concepts. Of the total interactive activities on the CoCoing.info platform, 31.24% belonged to concept construction and 68.76% were user responses.

The result indicated that learners on the CoCoing.info platform did not only focus on participating in the learning activity but also on concept creation and peer responses. Such result reveals that learners create concepts and consume those concepts, which leads to the positive circulation of ideas on the CoCoing.info platform.

Key Player Metrics

A widely used tool, Ucinet, was adopted to analyze social network interaction data (Borgatti, Everett, & Freeman, 2002), and the Ucinet subfunction NetDraw helped visualize users' social interactions (Borgatti, 2002). Figure 8 shows the social network interaction result.

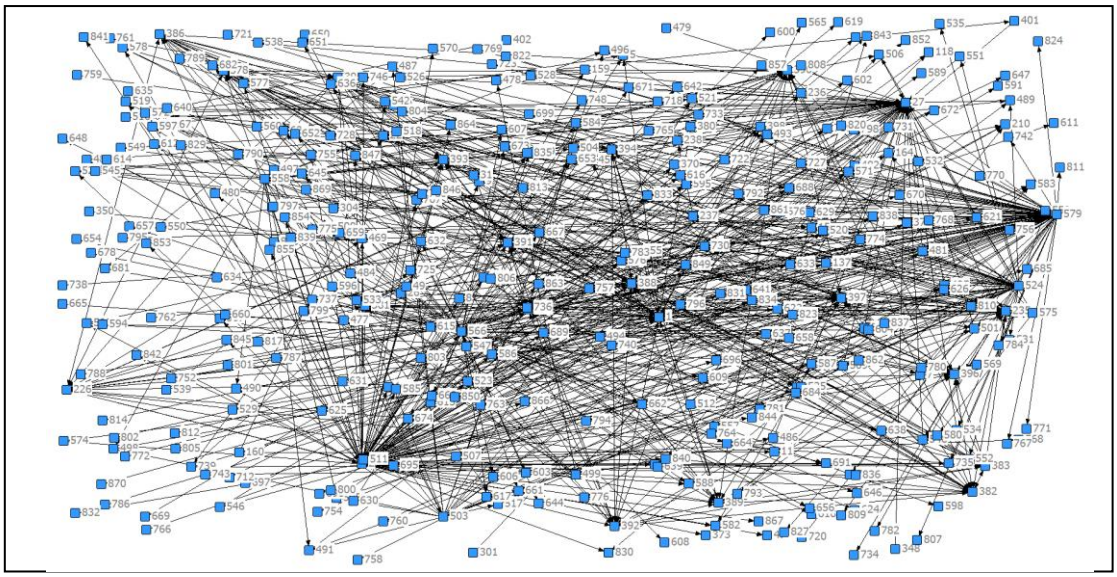

Figure 8. Original network interaction on the CoCoing.info.

However, Figure 8 is too complex to obtain useful information. Therefore, an interactive threshold value of five was set to filter less interactive users and to identify key players in the social network. Figure 9 presents the threshold-five network interaction on the CoCoing.info platform.

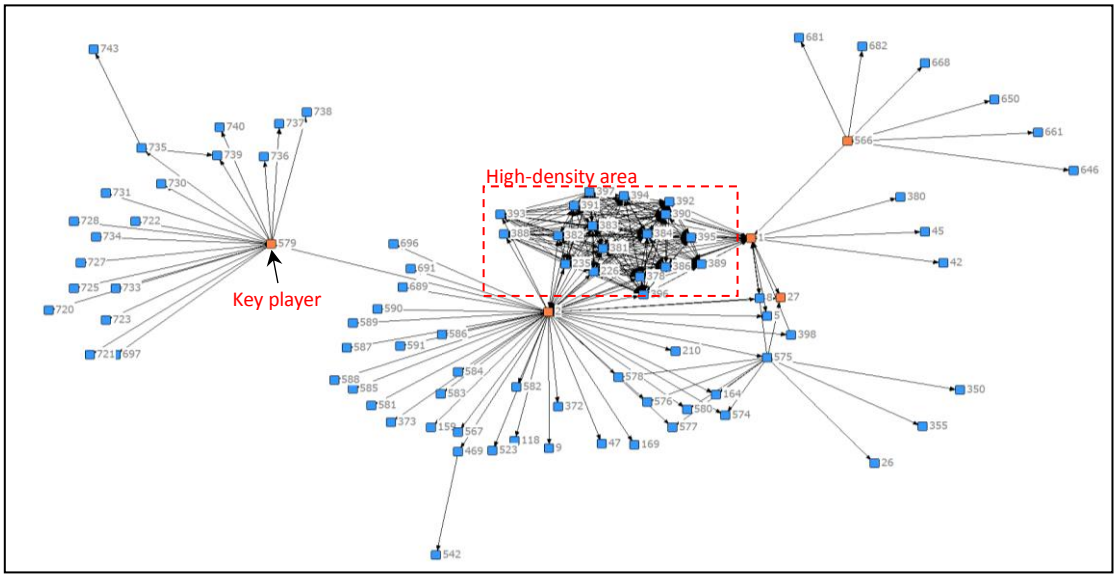

Figure 9. Threshold-five network interaction on the CoCoing.info.

Two notable results are showcased in Figure 9. First, the brown colour nodes represent key player roles. After reviewing the databases, those brown colour nodes were determined to be teachers, suggesting that teachers on the CoCoing.info had key player roles. In other words, teachers appear to play a crucial role in initiating concept construction and triggering social interaction, even within the type of concept construction social network. Second, a high-density area was identified within which a group of highly interactive classmates regularly used the CoCoing.info platform.

Although the access statistics indicated that learners accessed the website throughout the entire day, however, the key player metrics analysis revealed that teachers played the primary role in leading concept construction, concept circulation, sharing, and discussion activities. More specifically, teachers led these knowledge construction activities and provided clear guidelines and direction for students. Such guidelines and directions are supportive for students and encourage them to practice their platform activities. This finding is consistent with the work of de Lima and Zorrilla (2017), which indicates that social learning communities are built and continue only while the course is open and while the teachers are involved in fostering participation.

Conclusion

As social networking and social media technology approach maturity, they have become applicable to learning activities and online learning thereby facilitating learning interactions among teachers and students (Mnkandla & Minnaar, 2017). However, from a learning design perspective, social networking applications specifically designed for learning must be more functional than simply encouraging users to be constantly aware of what their friends do or care about. To achieve this goal, additional learning activities, such as concept construction and exchange, should be merged into the social networking application design. Therefore, a co-construction concept through a cloud-based social networking platform, namely CoCoing.info, was designed to perform an experimental study. In the platform, three major functions—co-construction concept building, social network organization, and concept circulation among social networks—were implemented.

The experimental results indicated that with accessibility to the Internet, users on the CoCoing.info platform can easily locate and interact with their friends through the social networking design. In addition, the platform can help integrate the concepts users have proposed in idea co-construction into a shared concept map. Moreover, the CoCoing.info platform enables users to link their concepts to resources on the Internet, including Web pages, images, video clip, and animations. These various online resources enriched the content of the concept maps created by users. It is noteworthy that learners on the platform focused not only on participating in learning activities but also on concept creation and peer responses, which lead to a positive circulation of ideas on the platform. Furthermore, teachers appear to play a crucial role in this type of social networking of concept construction.

Compared with commercial social networking applications, the data obtained in this study are limited. However, these data revealed several interesting findings, which help us to understand how such a learning-oriented social networking application can be designed, and how users behave on such a platform. Currently, the system is still in its developing stage. In the future, social networking study and users' analytics should be applied to more closely examine users' interactive data.

Acknowledgements

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Mitigating Suburban English Writing Teachers' Constrained Professional Development Through Distance Education: One Case Study

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Abstract

This study reports on how a Chinese suburban English writing teacher responded to systemic functional linguistics (SFL)-based distance education. The study draws on qualitative content analyses of the teacher's reflections, interviews, and classroom interactions. The results show that through SFL-based distance education, the teacher, interacting with his agency, overcame multiple constraints and developed academically in terms of how to understand valued academic writing. Additionally, the teacher also harnessed this newfound knowledge to support students' socialization into academic English discourse. The study concludes the effectiveness of SFL-based distance education for English writing teachers in similarly constrained contexts, which could be enhanced by teachers' agency. Implications of the study include synergizing the SFL-based curriculum with distance teacher education so that language educators can better assist students in gaining the knowledge needed for navigating academic English literacy.

Keywords: distance education, constrained context, English writing instruction, agency, systemic functional linguistics

Introduction

Because of uneven economic distribution and limited transportation, in-service teachers in suburban/rural areas often face more difficulties gaining access to equitable resources than those in urban or developed areas (McConnell et al., 2013). In English writing classrooms in particular, due to a lack of effective teacher education, teachers often teach vocabulary or sentential accuracy, failing to unveil the complexity of English writing at both the level of content and language features (Schleppegrell, 2016). Additionally, distant education for language teachers typically only offers them a global perspective on teaching (i.e., how these programs should be implemented and what guidelines should be in place; Shin & Kang, 2017), failing to help them understand what specific language resources underpin a text's content (i.e., meaning-making knowledge) and how to efficiently help students deconstruct or reproduce school texts (Harman, 2018).

On the other hand, teachers themselves (i.e., their agency) have been identified as a crucial factor in assisting in their own professional development (Beach, 2017). That is, teachers, based on their existing or past teaching and learning experiences, discover issues related to their current teaching context, finding solutions and resolving challenges (Smith, 2017). However, most teachers fail to rely on themselves because of the complexity of self as a power source (Beach, 2017). Indeed, teachers' self-based development follows a trajectory of joint learning from an expert before their independent decision-making emerges (e.g., complex terms from a teaching and learning theory might need experts' clarification; Mushayikwa & Lubben, 2009). The optimal learning context thus would be the one where mediation occurs between an expert and teacher trainees, with the expert giving certain guidance while also providing space for teacher trainees' agency to grow (Liu & Kleinsasser, 2015; Smith, 2017). Unfortunately, teachers' agency is underexplored in the field of distance education, which results in teachers' continued struggle with their own teaching when exiting distance education.

In sum, given the need for more accessible writing teaching knowledge among language teachers in underdeveloped areas, and the importance of maximizing their own agency, it is imperative that more research be devoted to language teachers' experiences in distance education. To address this gap in the literature, this paper investigates what language teachers can gain from a distance education curriculum that includes content/language-based writing instruction and a focus on teachers' agency.

Literature Review

Distance Education for English Language Teachers

In the field of English language teaching, including English as a foreign language (EFL) or English as a second language (ESL), research about distance education for EFL/ESL teachers is still limited (Knox, 2017). In particular, among the few studies in the field on English language teaching, Shin (2017) showed that pre-service English teachers in the United States were able to gain increased awareness of interaction with each other through on-line platforms. Similarly, Liu and Kleinsasser's (2012) study showed that EFL teachers in Taiwan, through on-line based professional development, had positive experiences in sharing ideas, resources, and constructing knowledge in relation to their teaching. However, while these previous studies on distance education for English language teachers, similarly

to other fields, such as science (McConnell, et al., 2012), demonstrated the power of distance education in overcoming geographical constraints, they were limited to providing teachers with general teaching methodologies (e.g., Liu & Kleinsasser, 2012). As such, Hall and Knox (2009) argued for innovative distance education that can allow language teachers to conduct "theoretically grounded discourse analysis of materials" (p. 77). As Schleppegrell (2016) also noted, "teachers now need new ways of incorporating a focus on language in the content classroom so that they teach language and content simultaneously" (p. 116). That is, to better facilitate distance teacher education for language teachers, it is necessary to guide them in gaining a more micro understanding of English language literacy at the level of both language and content.

Teachers' Agency

Teachers' agency is defined as "the power of teachers (both individually and collectively) to actively and purposefully direct their own working lives within structurally determined limits" (Hilferty, 2008, p. 167) and is "motivated by teachers' sense of responsibility toward their students and their academic wellbeing" (Phan & Hamid, 2017, p. 40). What this definition suggests is that teachers' agency is also important because it offers an interface for teachers to tailor their instruction to their own local classroom (Smith, 2017). That is, they can make their own efforts to reflect on their past and present teaching experiences and use those reflections to make changes to their ongoing practices.

While abundant research has highlighted teachers' agency in establishing their efficacy in traditional classrooms (e.g., Phan & Hamid, 2017), surprisingly little attention has been cast on how distance teacher education supports (or does not) teachers' agency on their journey of knowledge internalization. One marginally relevant study was conducted by Mushayikwa and Lubben (2009), in which science and mathematics teachers from high schools were first trained and then encouraged to rely on themselves in terms of how to use internet resources. The result of this study showed that teachers became more confident through self-exploration and better at enhancing their classroom teaching (e.g., teachers' flexible use of multiple teaching methods in fostering students' critical thinking). As Mushayikwa and Lubben (2009) further noted, "maximizing the self-direction drive… ensures that beneficiaries take ownership of the programmes and help in sustaining them" (p. 382). In other words, the interaction between teachers' agency and their ongoing practices serves as a catalyst in helping them internalize knowledge or innovate curriculum when exiting teacher education programs. Given the importance of both distance education and teachers' agency, it is therefore imperative to investigate how the two factors impact language teachers' professional development.

SFL-Based Distance Education

The applicability of Halliday and Matthiessen's (2014), Systemic Functional Linguistics (SFL) in teacher education is particularly marked by its trinocular illustration on the relationship between context, meaning (i.e., content), and the linguistic features (grammar/vocabulary) of a particular text or stretch of discourse, and is thus helpful in addressing the complexity of English academic literacy in the classroom (Schleppegrell, 2016). In particular, SFL primarily uses the following constructs to unveil the myth of language activities: genre, context of situation, three meta-meanings, and lexicon/grammar. Genre (the type and sequence of communicative activities) regulates language

activities in a larger cultural context. For example, in expository writing, the discourse may unfold itself from an introduction into body paragraphs and a conclusion (Schleppegrell, 2016). Within the matrix of genre, SFL further employs the construct of register variables to show how discourse meaning is constructed (writing texts) or deconstructed (reading texts). The three variables are field (what is going on), tenor (the relationship between discourse participants and their evaluative stances), and mode (the channel of communication). These variables are semantically related to the three meanings respectively constructing/revealing the content of discourse: Ideational meaning (language users' experience of the world), interpersonal meaning (the way of interacting with discourse participants as well as their evaluative stances to the subject matter), and textual meaning (the way of organizing information).

SFL also provides its own categories for showing how the three dimensions of meanings in texts are labeled and understood (Halliday & Matthiessen, 2014). For example, participants (noun phrases) and process (verbs) show that inanimate subjects are preferred in academic writing (e.g., nominalization). The labels provided by appraisal system, on the other hand, includes attitude (language options that project language users' attitude), graduation (language options that intensify or weaken discourse), and engagement (language options that show the source or certainty of information). Additionally, cohesive ties (e.g., transitional words) and theme patterns (e.g., the repetition of the beginning parts of adjacent sentences) explain how discourse is coherently combined. Indeed, all these constructs from SFL illuminate the complexity of academic English writing in an accessible way by providing teachers with knowledge of written discourse at the level of both meaning and linguistic resources.

The advantages of SFL as an instructional tool, as illustrated above, have been widely documented in traditional face-to-face teacher preparation programs, especially for secondary level English teachers in the United States (Harman, 2018). For instance, Huang, Berg, Siegrist, and Damsri (2017) showed that, through exposure to the tenets of SFL, secondary mathematic teachers in a U.S. school were able to conduct discourse analysis and help students write appropriate answers to questions (e.g., students' use of conjunction words, or the use of mathematic terms instead of everyday language). In the field of language teaching, Gebhard, Chen, Graham, and Gunawan's (2013) SFL-based education of pre-service and in-service English teachers who were enrolled in a Master's program in the United States illustrated that these teachers (including those from an EFL context) were able to understand writing and reading as a meaning-making process and demonstrate interactions between meaning and linguistic resources in their own texts (e.g., projecting objective tone through nominalization or inanimate subjects). Despite the power of SFL in assisting language teachers' development as shown in these studies, limited research has highlighted the challenges of teaching/learning SFL in the language classroom (Zhang, 2018), with the relevant previous studies focusing on teachers' academic performance following training (e.g., Huang et al, 2017). In addition, there is almost no such research in the field of distance teacher education for teachers in constrained contexts.

In sum, given the three lines of literature above, there exists a crucial research gap: while distance education is a venue for engaging suburban/rural teachers in equitable professional education, there is a lack of empirical research in the context of English language teaching, let alone how to best guide teachers in overcoming challenges of learning through a new curriculum, understanding the complexity of academic English writing, and fostering their agency in their own classroom. To fill this

research gap, this current case study, with a focus on a suburban English teacher from a constrained educational context in China, explores the following research question: How does the teacher (1) develop himself through SFL-based distance education and (2) conduct follow-up writing instruction on his own?

Methodology

A qualitative case study approach is useful and convenient for unearthing the complexity of a phenomenon in a particular context (Yin, 2014). Given that this study attempts to show how teachers in the EFL context where teaching was limited to language accuracy responded to SFL-based distance education, a qualitative case study approach is an optimal fit for this project.

Research Context

The focus of this one-year study was derived from a larger project on language teachers' agency, teacher education, and classroom teaching. Because there have been few efforts to offer SFL-based distanced education for EFL teachers, let alone in China, I initiated this project by connecting with teachers in suburban universities in China who could not access effective professional development opportunities because of traveling or finance constraints. I invited teachers, known directly or indirectly, from suburban universities to participate in this year-long SFL-informed project. Seven of those teachers voluntarily chose to participate.

The SFL-based distance teacher education occurred in two phases corresponding to each academic semester. In the first phase of this project, which took place during the first six months of the academic year, the education included teachers' self-learning of SFL-based materials assigned by me, followed by my mediation (primarily in Chinese) of their reading via a chatting tool called Wechat (Wechat is a mobile application used widely in China where teachers and I can talk audio-visually and share materials with one another). The online weekly meeting lasted about one hour and ten minutes; the meeting for each teacher was on an individual basis and depended largely on their availability (e.g., the focal teacher in this study had his meeting time scheduled on Thursdays from 8:00pm-9:30pm). The learning materials used during this study corresponded to each of the main constructs of SFL. These reading materials (e.g., academic papers, audio-visual resources) were selected online based on the accessibility of their content relevant to the background of each teacher in particular (e.g., Schleppegrell, 2016; see also Zhang, 2018).

In the second phase of the project (i.e., the second semester), teachers were encouraged to use their newly gained knowledge, if any, in their own classroom. During this process, I did not provide any intervention measures. Instead, I only read and analyzed teachers' recordings to see how, if at all, particular teaching activities related to SFL were used. If the teachers expressed any confusion, I would send materials to them and ask them to explore the needed information.

Participants

John (a pseudonym) was selected as the focal participant in this study because he was able to share

his audio-recordings with me, as well as his students' writing samples. In addition, John taught expository writing, a primary focus of this current study. Most importantly, John's teaching knowledge about the English language, like the majority of EFL teachers in China and other contexts, was limited to rule-based grammar (Zhang, 2017), which made him an interesting case to explore given the differences between that approach and this SFL-informed one.

John was born and raised in China. He had been an English teacher in a third-tier suburban college in China for about five years prior to his enrollment in this study. With a Master's degree in English literature, John's primary job was teaching expository writing to college students on a weekly basis, and was focused on skills-based writing, such as sentence-level grammar. Being unsatisfied with this approach and accepting the status quo, John wanted to better himself—and did so by joining this project.

Data Collection and Analysis

Data collection and analysis was a simultaneous process (Marshall & Rossman, 2014), informed by a qualitative case study approach as well as a SFL multilayered perspective on writing as a meaning-making process (Schleppegrell, 2016). To answer the first part of the research question—how John developed himself through SFL-based distance education—reflective journals (in John's first language, Chinese) based on John's independent reading prior to each training session, were collected. Reflections included his thoughts on the reading materials. Altogether, 23 reflections were collected. In addition, reflective journals were sent to me two days before each training session, and based on the reflective journals, semi-structured interviews were conducted before and after each training session. The language spoken during the interviews was Chinese, John's first language, so as to maximally elicit his response to the SFL-based distance education, and, at the same time, also to clarify some confusion in his reflective journals. To answer the second part of the research question—how John relied on himself in his follow-up teaching—evidence of John's teaching practices was collected during the second semester. That data, however, was provided by John himself, and also collected by him. In particular, the data included recordings of three classroom units, which ranged from 90 to 125 minutes each. At the same time, following the listening of these audio-recordings, follow-up interviews for clarification purposes were also conducted.

Data analysis was primarily inductively conducted through content analysis by the researcher of this project (Marshall & Rossman, 2014). In particular, to ensure the trustworthiness of the analysis, a constant comparison and condensation within datasets (among interviews, reflections, and in-class teaching) was conducted (Marshall & Rossman, 2014). That is, each of the transcribed texts was read many times until initial codes were identified (e.g., teachers' constraints). Later on, these codes were combined to yield themes. Notably, although in the final report of this study the English version of interview excerpts (IE), reflection excerpts (RE), and John and his students' interaction were presented, the initial data analysis was transcribed and analyzed in Chinese, the language used in the interviews, reflections, and in John's classroom. Meanwhile, the research question and previous studies (e.g., Beach, 2017) were also examined in order to facilitate analysis. To further ensure internal validity, themes generalized from the dataset were reviewed by a research assistant and two experts on SFL-based teacher education, all of whom approved the analysis. In addition, when the

paper was completed, I also sent it to John, who read and agreed with the reported findings in this current study.

Findings

Finding 1: John's Tortuous Development Through Exposure to SFL-based Education

In the first half of the semester of SFL-based distance education, John learned the importance of SFL's perspective on writing and displayed an enhanced awareness of agency in learning new knowledge. Nevertheless, John's development interacted with diverse factors, such as his prior education and the external mediation from the researcher.

John's Initial Attitude Toward SFL-Based Education: Interesting Yet Realistic

At the beginning of the project, John was pleased with the SFL-based distance teacher education he was about to be immersed in. He reflected, "The distance education seems a good choice to me.... I really do not have time and money to travel so far, and I have my family to take care of" (RE1); and "SFL's perspective on writing seems interesting and might be useful.... Its instructional focus is on both language and content instruction, [which] I have never had before" (IE1). As shown in these two excerpts, the SFL-based distance education looked promising to the suburban teacher who wanted to improve himself but found it challenging because he had time and financial constraints.

John's enthusiasm for SFL-based teaching instruction was particularly propelled by his determination to be a better teacher who could help his students academically: "They cannot write well... but they have to prepare all kinds of academic writing, for their future study. I worry because I am an English teacher... it is my responsibility to train them well" (RE2); and "I have tried...you know...they cannot even have correct sentences...and they cannot write coherently... except teaching grammar, what else can I do?" (IE2). In other words, in observing the difficulties his students faced and weighing that against what he perceived to be a lack of effective methodology, John was motivated to join this distance education program with the hope of better preparing his students for academic success.

However, John was also realistic about distance education, with the expectation that no course would be perfect and be used directly without the teachers' own efforts in making adaptations: "I am not sure everything I learn will be useful.... Classroom teaching is different...and it cannot teach everything. Teachers have to do some part by themselves" (RE3); and

> I did some on-line learning...(and) it seemed vague to me, such as genre-based teaching.... It has no dialogue with me.... It is very short...and I do not understand [the content].... These experiences taught me a [positive] attitude toward distance education. (IE3)

Despite the fact that John was willing and ready to embrace SFL-based distance education, he was aware that he would need to make additional efforts on his own to implement SFL and integrate it into his own curriculum following training. John's realistic attitude toward distance education emerged from his previous negative experiences with non-traditional classroom learning (i.e., online learning).

Increased Alignment and Refreshed Conceptualization as a Result of Mediation and Teachers' Agency

John's professional background coupled with the time he had to digest the SFL-based reading materials also created challenges for him. As John reflected, "I had never learned linguistics, so it took much time for me to understand sometimes… although the materials were carefully selected" [RE4]. In the interview he further added, "I am optimistic, but in the process, I had times of doubting what I was learning: could I really understand most of the content in the reading materials on my own?" [IE4]. Despite his investment in the distance education program, John's experience was mixed because of how his prior knowledge and background were interacting with the new materials.

Unsurprisingly, there was a time in which John complained about the effectiveness and suitability of SFL and the reading materials because of their complexity: "It [the construct of appraisal system] was so complex; my students are not that advanced…. They might feel more challenged…. (and if) I were to make them [fail]…my department would also blame me" [IE5]; and "I just periodically feel a construct is getting complex. I am not sure whether that is my illusion… or because it is hard to grasp the theory" [RE5].

Thus, with increasing information from the distance education program, John sometimes felt overwhelmed or doubtful because he perceived a mismatch between his students' level of writing and the seemingly complex and dense processes that the SFL-based readings called for. John's anxiety was mitigated, however, with the triadic interaction among his increased knowledge, agency, and external mediation, which helped him to achieve a balanced perspective on knowledge appropriation. John explains that "I know at this time I cannot apply the knowledge to my own classroom teaching…but I will…because I understand the importance of what this education can do, like how I am scaffolded to understand SFL during on-line meetings" [IE6]; and

> I often rush. I realize it is not good…knowledge and the whole system of a theory takes time to understand…. In the past month, when I have settled down I have found everything becomes clearer to me. Also, you[the researcher] helped me and encouraged me to face up to the complexity of theory… all we need to do is to patiently understand it…by myself and with assistance"[RE6].

In other words, he realized that the initial bumpy road of learning was a result of his own desire to quickly understand the materials, which caused him to underestimate the complexity of a language theory. These challenges were obviously diluted in the latter phase of the project as a result of the interaction between John's agency and the external mediation by the researcher.

Indeed, unlike his previous experiences with on-line resources and instruction, John gradually experienced the benefits of SFL-based distance education because of his galvanized agency and external mediation. As he said, "The reading materials were really arranged in a gradual way, so following this, I can really figure out the most content of on-line resources by myself… I feel a sense of achievement" [IE7]; and "Any learner has to rely on themselves ultimately….In the process of mediation, I feel the teacher is really prompting me to think. I feel more confident to continue to rely on myself" [RE7]. As evidenced by these excerpts, John's consciousness of agency (i.e., his reliance on

himself) was further enhanced in a context where mediation from the researcher was provided through multimodal channels. As such, John felt more aligned with SFL's perspective on language learning.

Most importantly, John's conceptualization of distance teacher education was also gradually reformed as he realized that there was not a need to be a thorough theoretical linguist, but instead a good-enough applied linguist. As John shared, "I felt I also shed my stubborn beliefs about thoroughly understanding everything before application…. To be an educator, we could draw on parts of theories or the most important tenets" [RE8]; and "I mistakenly thought that only when we know everything of a theory can we apply it, which seemed impossible for an educator…. Instead, we can learn by action and use what we already know" [IE8]. That is, John formed a more flexible stance toward the teacher education program; his constant battle with his prior teaching methodologies, the mediated instruction, and an increase in his self-efficacy all helped shape him into a confident teacher and good-enough curriculum innovator.

Emerging Meta-Linguistic Awareness and Agentive Attempts in Curriculum Design

The SFL-based constructs of register, the three meta-meanings, genre, and the related linguistic features, ultimately catalyzed John's re-conceptualization of writing to primarily as a meaning-making process. As John reflected, "While I have not applied SFL-based constructs to my classroom, it really promotes my thinking of writing not just at the sentence level, but also at the meaning-making level" [RE9]. Yet, because of the students' level at John's university, he also had a peripheral belief about the importance of teaching sentential grammar to his students. As John emphasized,

> For me, I have realized how both content and language are important, especially how to make students write meaningfully, but I feel it would be unrealistic to ignore students' basic language skills in my university. They also need grammar teaching. (IE 9)

In other words, John constructed a mixed meta-linguistic understanding about language learning and writing instruction, with meaning-making beliefs as the predominant factor. John's determination to transform himself into a meaning-making based writing instructor was particularly illustrated by his final reflections on the SFL-related constructs and his planning of the curriculum (Table 1 below).

Table 1

Johns' Understanding of SFL-Based Constructs and Relevant Curriculum Planning

Genre-based reflection	**John's reflections:** I had contact with genre before but did not know too much. It turned to be a semantic and a matrix concept that not just includes the structure of texts and social purposes but also linguistic features (e.g., the concise structure feature in writing). **John's curriculum design**: For this construct, I would let students know the following:

	1. Know the purpose of different genres (e.g., expository, argumentative). 2. Know the linguistic features specific to different genres.
Register-based reflection	**John's reflections**: I used to know the difference between spoken English and written English. But I did not know why. Now, with the three variables, I understand why English writing has its unique features (such as its tone or its text flow). **John's curriculum design**: I will teach the three variables in a plain language (presumably students' first language-Chinese). 1. Field: Remind student of events (or topics) they are writing about. I have noticed my past students wandered off topic. 2. Tenor: Foster my students' reader-centered awareness, instead of focusing on grammatical accuracy. 3. Mode: Remind my students that our writing should be logically tightened, not as loose as spoken English.
Meanings and linguistic features	**Johns' reflections:** I used to focus on the accuracy of grammar or advanced vocabulary. I have ignored the interrelated relationship between lexicon/grammar and content (ideational meaning, interpersonal meaning, and textual meaning). In my future writing instruction, while I would help students focus on some traditional grammar knowledge (e.g., tense, run-on sentences), I will try my best to focus on how to connect grammar with content**.** **John's curriculum design for the two constructs:** I will teach the following elements: 1. Teach students that correct sentential grammar is not enough. 2. Use sample texts to highlight particular linguistic features specific to a genre (e.g., the teaching of impersonal tone in expository writing; the teaching of engagement resources to show credibility of information; the teaching of cohesive or thematic patterns in the text).

In other words, John's refreshed knowledge by the end of the first six months and his attempts in making his new writing curriculum informed by SFL-based constructs jointly illustrated his transformation due to the SFL-based distance education.

Finding 2: John's Further Exemplification of His Agentive Role in the Classroom

John's transformation was more saliently demonstrated by his agency in using the constructs of SFL when analyzing his students' work and mediating their understanding of writing in the second semester. Typically, John emphasized the importance of context before he delved into how to use contextually appropriate linguistic choices in making meanings in different types of writing. As shown in the following subsections, in the process, John typically showed students' writing excerpts to the whole class and guided students' re-conceptualization of writing, though he would also emphasize mechanical errors if he found them. In addition, John would use students' first language (albeit for the reader's convenience the translated English version is presented below) and understandable language (although many terms exist in SFL) in the classroom.

Interpersonal Meaning and John's Agentive Attempt

One vignette of Johns' agency in unpacking interpersonal meaning with students was exemplified by his instruction on how to soften tone in academic writing through his knowledge of the SFL-based appraisal system (i.e., engagement). In the dialogue below, John used one student's writing excerpt as an example. In relation to this excerpt, John and his students had the following interaction:

> **John**: The tone of statements has to be carefully projected in your writing. Think about Chinese [students' first language]….you use modal verbs, right? [The student's written sentence John was talking about: "Children imitate what they have seen on the internet, which is dangerous."]
>
> **Students**: But we are not conscious of this in Chinese.
>
> **John**: That is the thing. I was not aware of that, either. In English, we have also to know the importance of modulating your tone. All information you present is based on the strength of evidence or fact available [John re-showed the student's sentence]. Is the tone too assertive? Do you think it is event that must happen?
>
> **Students**: (After engaging in discussion with each other) No.
>
> **John**: How can we make ourselves more convincible? Think about some modal verbs and adverbs or other words that can soften our tone?
>
> **Students**: (Some students) Add "may" before "watch"… add "likely" before "dangerous."
>
> **John**: Great choices in this context. [Following his acknowledgement of the students' answer, John showed his version: "Children *tend to* imitate what they have seen and heard on the internet, which is *sometimes* dangerous."]

As illustrated above, John demonstrated his efforts in implementing his SFL-based knowledge about interpersonal meaning, which he acquired from the distance education. In particular, John highlighted the importance of engagement (certainty of statements) in projecting information. To further students' understanding of this dimension of interpersonal meaning, John also highlighted the linguistic repertoire students needed to use, such as *sometimes* and *tend to*. Johns' efforts in teaching this piece illuminated how he actively engaged in linking his knowledge with his current practices, and how he solved the problem his students were facing and helped them express a particular voice/tone in their academic writing.

John's Instruction of Ideational Meaning in His Classroom

John also emphasized how the contextual variable-field interacted with writing expectations. This interaction, like the one above, was also based on students' writing excerpts. The excerpt in this section, however, is from students' expository writing on the benefits of banning smoking on campus.

John: Following the topic sentence, what do we do for the rest of paragraph? [The student' writing work John referred to: "Banning smoking on campus has many advantages. In the first place, it prevents non-smokers from being exposed to polluted air. *I think* this is important."]

Students: Elaborate on the claim.

John: Yes. That is the activities you are supposed to do. See… you are providing facts or evidence…not your personal opinions… Look at the phrases here "I think." What does this prove? You should present information. But what is "I think" associated with?

One student: Too subjective (with other students nodding).

John: Words showing personal mental state should be avoided here… this is your personal projection. Here you are providing information… like you are writing facts… so avoid personal evaluation here.

John: How about this conclusion part? We have learned that English prefers explicit logical relationships. But how is this one? [The student work: "Smoking may help some people relax. Restricting smoking on campus is imperative in that it gives off pollutants, affects non-smokers, and harms their own health."]

Students: Looks good… no grammar mistakes.

John: But is the logical relationship clear between the first two sentences? The author is making a concession here.

One student: We can add "although" at the beginning of the first sentence.

John: (Acknowledged the answer and provided a sample: "*While* smoking may help some smokers release pressure, restricting smoking on campus is imperative in that it gives off pollutants, affects non-smokers, and harms their own health."]

In the above dialogue, John was demonstrating his knowledge of ideational meaning from SFL. Indeed, he was emphasizing how academic writers' experiences can be projected in a cultural and linguistically acceptable way. In doing so, John illustrated and emphasized the importance of avoiding inappropriate processes (e.g., personal mental process) in order to meet the generic purpose of expository writing, which is to present information. In addition, within the context of ideational meaning, John also helped students notice the importance of logical meaning in terms of using explicit linguistic signs in projecting reasoning. It was thus becoming apparent at this point that John's adapted teaching strategies were a result of both the SFL-based distance education and also his own investment in improving his language teaching.

John's Scaffolding of Textual Meaning

In this dimension, John tried to help students challenge themselves, moving their attention from individual sentences to the flow of semantic groups, which includes several sentences together. The writing topic was comparing and contrasting boarding school and a day school for high school students. John and his students had the following dialogue:

John: There is a grammar mistake here… where? [One student wrote: "Staying on campus might not be healthy for high school students' growth. Many are still young. Parents worry about them. Students may also easily (be) influenced by other bad ones."]

Students: (pause for a few minutes) should "be influenced."

John: Yes….Except that, do you think the information is jumpy? I mean the first two sentences.

Students: (silence) We do not understand.

John: You are talking about young students…. Suddenly, you talk about parents…. That is a surprise. Try to use the same topic phrases…"they," (or) "these young students." Let's do it together.

Students: They may not be able to.

John: [John followed his students' answer and said] deal with their life on their own.

John: Nice… you see, when you maintain the same topic phrases, your idea won't be disrupted. Now look at another sentence… it is a new supporting idea… so show readers the signals… remember transitional words you have learned.

Students: Oh…we can say… in addition, or additionally.

John: [Acknowledged students' answer] John pulled out his version: "Staying on campus might not be healthy for high school students' growth. First, *many* are still young, and *they* may have difficulty dealing with their life on their own. *In addition*, they may be easily influenced by bad students."

The above interaction displays John's effort in showing the importance of writing at the discourse level, not limited to individual sentences, such as grammar mistakes. John's practices particularly illustrated his agentive role in assisting his students in becoming aware of the constant thematic resources (e.g., *many, they*) in connecting interrelated semantic groups. In addition, within two semantic groups, John also highlighted the use of a cohesive devise (e.g., *in addition*) in scaffolding students for understanding and writing coherent writing at the discourse level. In all, John integrated his SFL-based education and agency in applying the relevant knowledge to his teaching, supporting his students' extension of writing knowledge from individual sentences to the textual level.

Discussion

This case study on providing SFL-based distance education to language teachers in constrained contexts has two important findings. First, the teacher was able to benefit from this SFL-based distance education, conceptualizing language teaching as a meaning-making process, although the path of his knowledge appropriation was bumpy. That is, the interaction between both facilitating factors (e.g., his agency) and constraining factors (e.g., his prior professional development) propelled John to renegotiate his own teaching practices. More importantly, during this education, John's agency was further galvanized by the trainer (the researcher of the project), assisting him as he bravely waded through tough moments and flexibly invested himself in redesigning his writing curriculum (i.e., SFL-based curriculum). The finding buttresses the previous research that distance education is an effective way for teachers to break away from the constraints of time, geography, limited in-service education, and funding for traveling (e.g., Knox, 2017).

Second, this study, among few other empirical studies (c.f., Mushayikwa & Lubben, 2009), further verified the importance of highlighting the mediation that happens between distance education trainers and teacher trainees. It empirically illuminates that in a constrained context, teachers could independently improve their teaching once their own agency was activated through external mediation, as illustrated by John's appropriation of instructional content and his willingness to challenge his prior teaching style and implement SFL-based curriculum.

Third, the study shows that SFL can have a positive impact on teachers' conceptualization and their practices. While previous studies have illustrated the impact of SFL on teacher education, they were limited to the traditional classroom context where teachers received face-to-face instruction and improved their teaching skills (e.g., Huang et al, 2017). This study complements existing SFL-based teacher education studies and illustrates how, in a non-traditional context (i.e., distance education), SFL praxis can help change teachers' perceptions and practices while also showcasing accompanying challenges encountered by the teacher. In addition, this current study offers an accessible SFL-based curriculum for distance education, supporting teachers' internalization of writing as a meaning-making process and complements existing distance education in the field of language education, where there is a lack of empirical studies on teachers' meta-linguistic knowledge (Knox, 2017).

Conclusion and Implications

While the findings of this research cannot be generalized, there are two important conclusions that those working in a similar context may find useful. First, SFL-based distance education seems to be an effective tool in helping teachers understand writing as a meaning-making process. Second, teachers' development is a result of the interaction between multiple factors such as self-determination of being a good teacher and external mediation from the distance education. Ultimately, teachers independently adapt their teaching, benefiting their students' socialization into authentic academic English writing communities.

Implications of this study include the following dimensions. One is that in many education contexts (e.g., underdeveloped areas), language teachers have limited access to effective teacher education and they struggle with how to teach genre-specific writing to students from different disciplines at different levels (e.g., mathematics, science; Huang et al., 2017; Schleppegrell, 2016). In response to the uneven and inequitable distribution of education and economical resources, SFL-based distance education, with its focus on both language and content, seems to be an optimal approach in assisting teachers in transcending the limitations of time or place. Additionally, given that distance teacher training programs are short, and teachers ultimately have to rely on themselves to gain new knowledge, this study suggests that teachers' agency should be effectively galvanized so that they can better regulate their teaching when exiting teacher programs. Finally, as a case study that was only focused on typical EFL teacher, findings should be carefully treated and can only be extended to similar contexts (Yin, 2014). Future studies could use a similar SFL-based approach and implement distance education for larger cohorts of teachers.

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An e-Learning Model for Teaching Mathematics on an Open Source Learning Platform

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Abstract

Throughout the world, mathematics plays a vital role for the educational and developmental aspirations of any country. The quest to teach mathematical knowledge in a viable and effective way so as to induce creativity and applicability among learners is an ongoing challenge, especially for developing countries. A better understanding of how students learn mathematics coupled with effective application of mathematical e-learning can enhance meaningful learning of mathematics and make the subject more exciting. In this note, we introduce a mathematical e-learning model suitable for the modern digital era based on the learning theories of social constructivism, social realism, and connectivity. We then discuss the feasibility of implementing the model on an open source e-learning platform. Our findings reveal that the platform offers a developer's tool for coding and customizing templates to attain higher levels of usage and interactivity in which learners can create and control learning objects while they observe the results.

Keywords: assessment and feedback, dynamic and interactive content, e-learning platform, learning theory, mathematical learning model

Introduction

E-learning practices have been incorporated in the teaching and learning processes. For effective mathematical e-learning, one needs appropriate software as well as well-known learning principles and theories to create mathematics content that fit the learners' needs and the teachers' overall intentions. In developed countries, high internet connectivity has enabled most universities and other teaching institutions to fully embrace e-learning. Nevertheless, e-learning practices are yet to attain full potential in developing countries, partly due to high initial costs of designing and setting up the platforms as well as low internet connectivity in developing countries.

To overcome the bottlenecks that impede successful and effective mathematical e-learning intervention in developing countries, e-learning implementers need to focus on three e-learning aspects, namely cost, usability, and impact on learning. Open source e-learning platform is a substantial alternative to meet these new demands. There are many open source platforms including eXelearning, Xerte Online Toolkits (XOT), and Course Builder (Berking, 2016). With these platforms, instructors can design mathematics content to suit their teaching and learning approaches. They provide a fully featured e-learning development environment for creating interactive learning materials (Yi & Trevino, 2015). In addition, the contents generated on them can easily be exported to another website or e-learning platform such as Moodle.

On the other hand, while efforts towards improving e-learning usage in developing countries are gathering pace, most of the works has been general in perspective and only few have emphasized mathematical e-learning specifically (Juan, Huertas, Cuypers, & Loch, 2012; Namukasa, Quinn, & Kaahwa, 2010; Elijah, 2012). Additionally, there is a big gap to fill with respect to designing new feasible mathematical e-learning models that are focused at revitalizing the interest, creativity, and applicability of mathematical knowledge for technological advancement in developing countries (Barnes & Venter, 2008). This note is to introduce a mathematical learning model for developing countries as a suitable and effective model for the modern digital era. First, we briefly explore three vital theories of learning to be considered as the basis of the model. Next, we propose a model and discuss the feasibility of implementing the model on an open source e-learning platform. We pose the following key questions that will guide our study: (i) what are the suitable underlying theories for effective mathematical e-learning in the model? And (ii) what are the key features a mathematical e-learning platform should offer that makes mathematics more discernible to learners?

Underlying Theories for the Model

Constructivism learning theory emphasizes knowledge construction based on a learner' past experience (Koohang, Riley, & Smith, 2009). The learning approach is student centered, flexible, and accommodating multiple perceptions, content, and context (Murphy, 1997; Treffers, 1987). We need to accommodate students' ideas, views, and frustrations over the mathematical concept we want to impart unto them. In addition, we should allow all forms of creative input from the students even though they are contrary to known ideas. Based on the many useful ideas of social constructivism, we emphasize the aspect of contextualizing mathematics to fit the local settings and tap into learners informal strategies so as to motivate and induce creativity to problem solving and applicability of mathematical knowledge.

Connectivism is concerned with linking a variety of ideas, specialized nodes, or information sources that all contribute to learning. Learning may reside in non-human appliances and learning is endless (Siemens, 2005). Relatedly, Gravemeijer, Stephan, Julie, Lin, and Ohtani (2017) observe that in the modern digital era in which computers can solve many mathematical problems, new approaches to mathematical pedagogy are necessary. They listed applying/modeling, understanding, and checking as mathematical competences required in the digital era. From these points of view, we derive the following guidelines to consider for effective mathematics learning in the digital era: Less emphasis laid on recall and reproducing knowledge (such as axioms, theories, formulae) since in the digital era, it is easy to store and extract knowledge in non-human appliances (Siemens, 2005).

The goal of realism in education is to encourage active learning that captures most of the senses of the human being (Ravi, 2016). Pedagogically, the teacher's role from the realism perspective is to pass on mathematical truth to students whose main role is to absorb the knowledge and make sense out of it. This approach was dominant before 1970s in the developed world (Young, 2008). However, unabated realism in the developing world has resulted in a teacher-centered approach, which has caused students to lag behind especially in science, technology, and mathematical application. In addition, the level of research publications in mathematics from developing countries is either very low or almost nonexistent (Barnes & Venter, 2008; Namukasa et al., 2010; Elijah, 2012).

In summary, constructivism tells us of the importance to rely on students' experiences and context to derive knowledge and guide the learning process. There is a need to carefully link all learning nodes, especially taking advantage of present day technologies as connectivism avers. However, realism reminds us that some mathematical knowledge can be considered as absolute and powerful, and challenges us to strike a balance between absolutism and socialisation of knowledge. Constructivism, connectivity and realism essentially emphasize motivation, context, and tapping into students' abilities and experiences as the key aspects of meaningful learning but without sacrificing the power and beauty of mathematics knowledge. These ideas lead us to propose the MCIEC (motivation, context, interactivity, evaluation, and connectivity) model. The model identifies five utmost important aspects of effective mathematics learning, namely motivation, context, interactivity at the front end of lesson planning and delivery, and dynamic evaluation and connectivity at the back end of lesson planning and delivery.

The MCIEC Model

In this section, we introduce the MCIEC model which, for the trial phase, was applied to two undergraduate mathematics courses namely *Linear Algebra 1* and *Introduction to Probability and Statistics*. We will reference materials developed in these two course units to explain the model.

Motivation

Figure 1 shows the overall structure of the MCIEC model. First, motivation is one of the three key pillars of the model. Many studies have explored the link between mathematics and motivation in terms of achievement and competence (Pokay & Blumenfeld, 1990; Midgley, Feldlaufer, & Eccles, 1989). In the MCIEC model, motivation focuses on the content being taught in terms of clearly manifesting the necessity of the content both in academic and practical value to the learners. A better understanding of how students learn mathematics coupled with effective application of mathematical e-learning can

enhance meaningful learning of mathematics and make the subject more exciting (Waege, 2009; McElroy, O'Loughlin, Townsend, & Simonovits, 2011).

Mathematics, especially at a higher level, appears abstract to students mainly because teachers put more emphasis on the process of mathematics content and put less emphasis on the necessity of the content. For example, when teaching eigenvalues, it is important for a teacher to extensively highlight on why the concept of eigenvalues is of much importance, both in academically and practically, before rushing to show how to solve for eigenvalues. As an illustration, in Lecture 1 of the course unit *Linear Algebra 1,* which we run, the motivation phase began by embedding a YouTube video that explains the real life applications of systems of linear equations. Students will appreciate the value of the knowledge being acquired and this can help to demystify the absoluteness and powerfulness of the knowledge. The interest will motivate the student to put more effort in learning the content and also imagine other ways of adding value to the content, which sparks creative thinking in the learners.

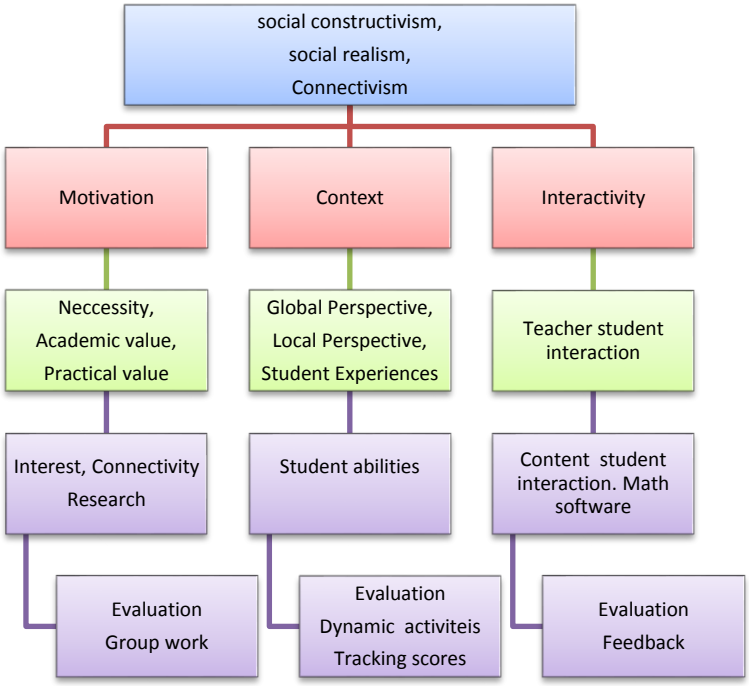

Figure 1. The structure of MCIEC model.

Context

The second key pillar of the MCIEC model is context. Koohang, Riley, and Smith (2009) view contextualization as the design of learning activities, and Perin (2011) identifies key themes of contextualization. Many studies are advocating for a form of contextualization in which much effort is spent on turning the mathematics content into a language the student clearly understands or is familiar to, so that the transition into the mathematical language of rules and symbols becomes a mere formality (Berns & Erickson, 2001; Guthrie, Anderson, Alao, & Rinehart, 1999; Klinger, 2011). In our model, contextualisation focuses on the need to align the content in terms of global perspective, local perspective, and students' experiences. The teacher guides in identifying world events, practices, and

issues to relate to the content, then incorporates in local matters as well as students' experiences and abilities. As an illustration for contextualization process, we relate the content to students' previous knowledge on solving simultaneous equations. We explain some word problems involving traffic flow, merchandize, and daily shopping, and then seek individual student abilities and rely on this to sequence the explanation and activities. This form of contextualisation will spur curiosity and also help align the content to student's pace of learning.

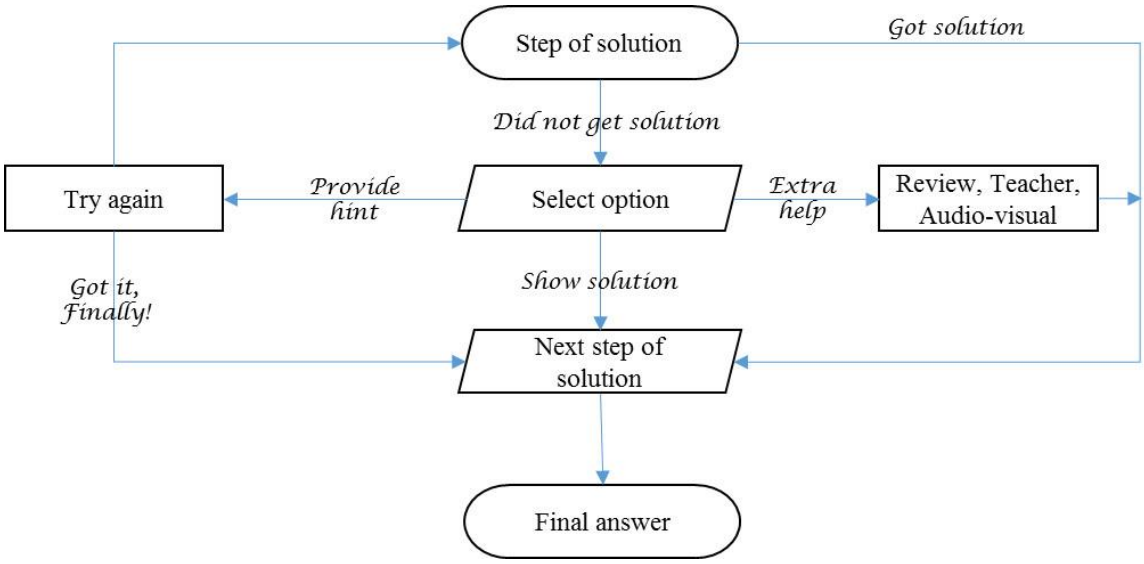

Figure 2. Flow chart for a highly interactive mathematical activity.

Interactivity

The interactivity is the coming together of the teacher, learners, and technology to facilitate the teaching and learning process. Wood and Ashfield (2008) explain that interactions between teacher, pupils, and technology necessitate more than the transmission of knowledge from either teacher or technology to learner. Figure 2 present the flow chart for supporting a highly interactive learning process in the MCIEC model. Students attempt the first step of the problem. If they get the first step, they are directed to the next step. Otherwise, they can select from three options, namely, requesting for a hint so as to try again, seeking extra help from content, using audio-visuals or teacher, and/or proceeding to the next step of the solution. Their study style will be recorded and the teacher can rely on it to provide appropriate guidance. An open platform Xerte Online Toolkits (XOT), adapted to this study, has many features that offer learners high levels of interactivity. A goal of the model MCIEC, is to create mathematical e-learning models with high interactivity, so as to stimulate the learner's own thought process, creativity, and applicability.

Dynamic Evaluation

Evaluation plays a crucial part of completing all aspects of the MCIEC model. Dynamic evaluation seeks to evaluate the learners in such a way as to cater for the learner's context, learning ability, and pace, as well innovativeness. Lui, Lo, and Yiu (2013) listed four levels of learning activities based on Bloom's taxonomy of learning domains, which are to acquire knowledge, practice and apply, explore and

evaluate, propose, and create (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). The appropriate evaluation of these activities should be based on learner context, such as assessment of learning, pace of students, ability, and group versus individual contribution to activities. E-learning platforms should be designed to provide feedback, track scores, and subsequently direct the appropriate sequencing of activities to fit the learners' context.

Connectivity

This comes at the tail end of the lesson or topic. The aim is to show how the knowledge acquired by students is connected to diverse academic and practical fields. For example, we relate the knowledge of solving simultaneous equations to diverse fields, such as linear regression, electric circuits, and garbage collection. We then request students to work in groups to formulate a system of linear equations that solves any of the problems in these or other fields. Connectivity also serves as a checkpoint for the entire lesson or topic.

The MCIEC model, in summary, does not view the theories of constructivism, realism, and connectivism as antagonistic. Instead it uniquely taps into the strength of each of the theories to build a mathematical e-learning model that offers practical guidelines of mathematical e-learning pedagogy that stimulate creativity and applicability in learners. In particular, the model asserts that intrinsic motivation in higher learners of mathematics is achieved by emphasizing the academic and practical value of the mathematics content. Based on these aspects, the MCIEC approach can make the mathematics content less abstract and more user-friendly, while allowing for the different talents that learners possess to flourish, enabling them to develop creative, innovative, and adaptable students.

Key Functional Features of the Model

In order to successfully implement the mathematics learning model, the MCIEC model emphasizes the following functional features.

Math Text and High Interactivity

One special feature of mathematics is that it has its own language and symbols distinct from other non-mathematical subjects. An effective mathematics e-learning platform must be able to accommodate mathematical language and symbols. It should also enable lecture notes taking on the system, making it a one stop e-learning system. The platform should also have features that enable teachers to set up mathematical activities and problems in such a way that students can follow step-by-step procedures in a dynamic and highly interactive way.

Figure 3 is an example to explain how we can create a highly interactive process with math text. Students are supposed to solve the problem by inserting answers in the boxes. In an interactive e-learning system, a complement should appear once the number inserted in by the student is a correct one and the student will be encouraged to go to the next step. If the answer is incorrect, a hint is provided immediately and the student can be provided with options to get extra review, audio-visual help, peer support, or teacher support. In this way, both the student and the teacher will know which steps were most challenging to the learner.

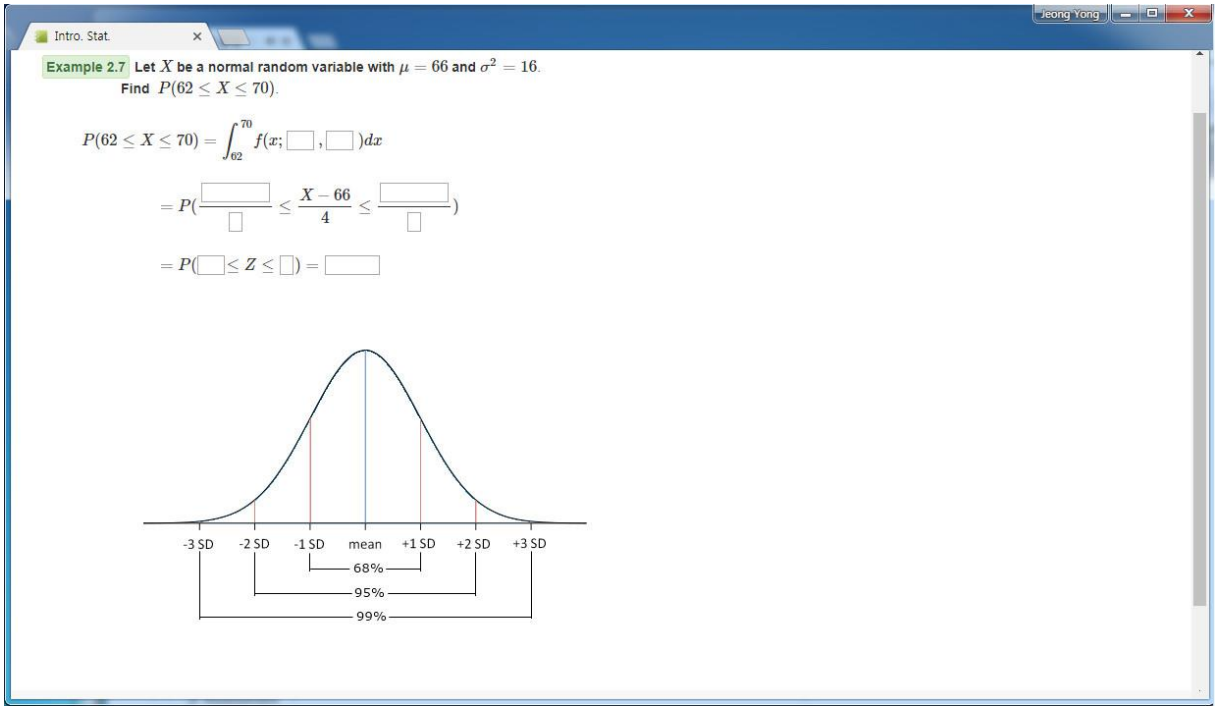

Figure 3. A highly interactive process with math text.

Enable Effective Assessment and Feedback

In both traditional and e-learning methods, assessment and feedback in the context of mathematics teaching and learning is the most effective instruction tool (Warden, 2000; Anderson et al., 2001). Assessment in mathematics needs to be well structured and sequenced. Tempelaar, Kuperus, Cuypers, Kooij, Vrie, and Heck (2012) stated that for effective mathematical assessment, all problems should produce authentic input from students arising from a carefully designed repertoire of items. It should ensure a comprehensive coverage of the domain and allow for adaptive assessment, in which the choice of a new question is based on the student's previous responses. This kind of assessment ensures that learner's capabilities and experiences are catered for and the student is asked only a small but relevant subset of questions.

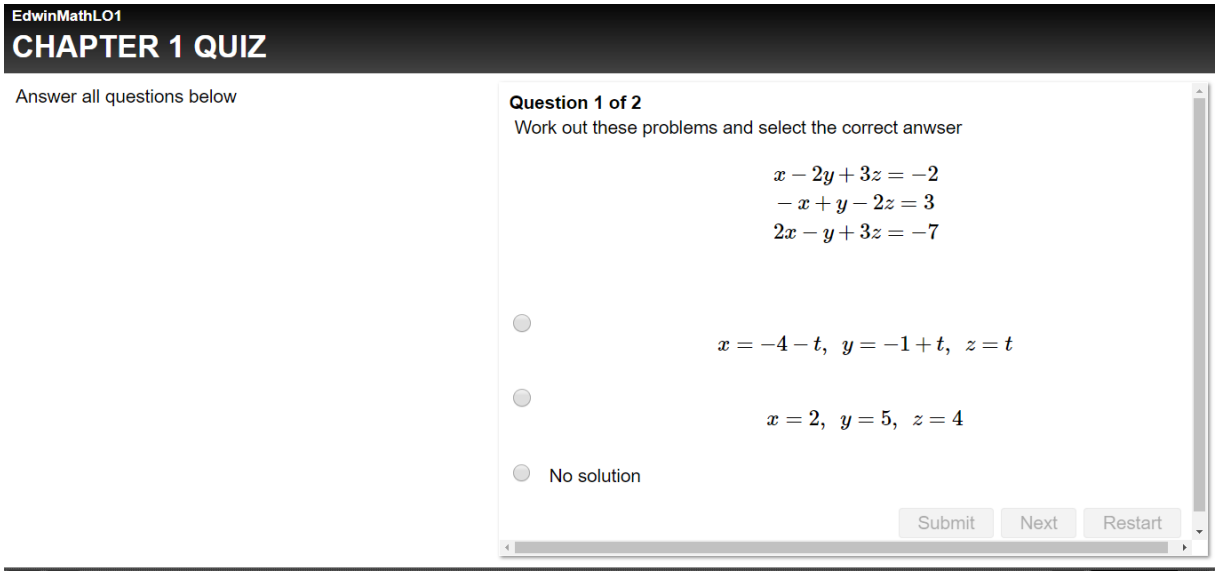

Figure 4. An example of multiple choice questions.

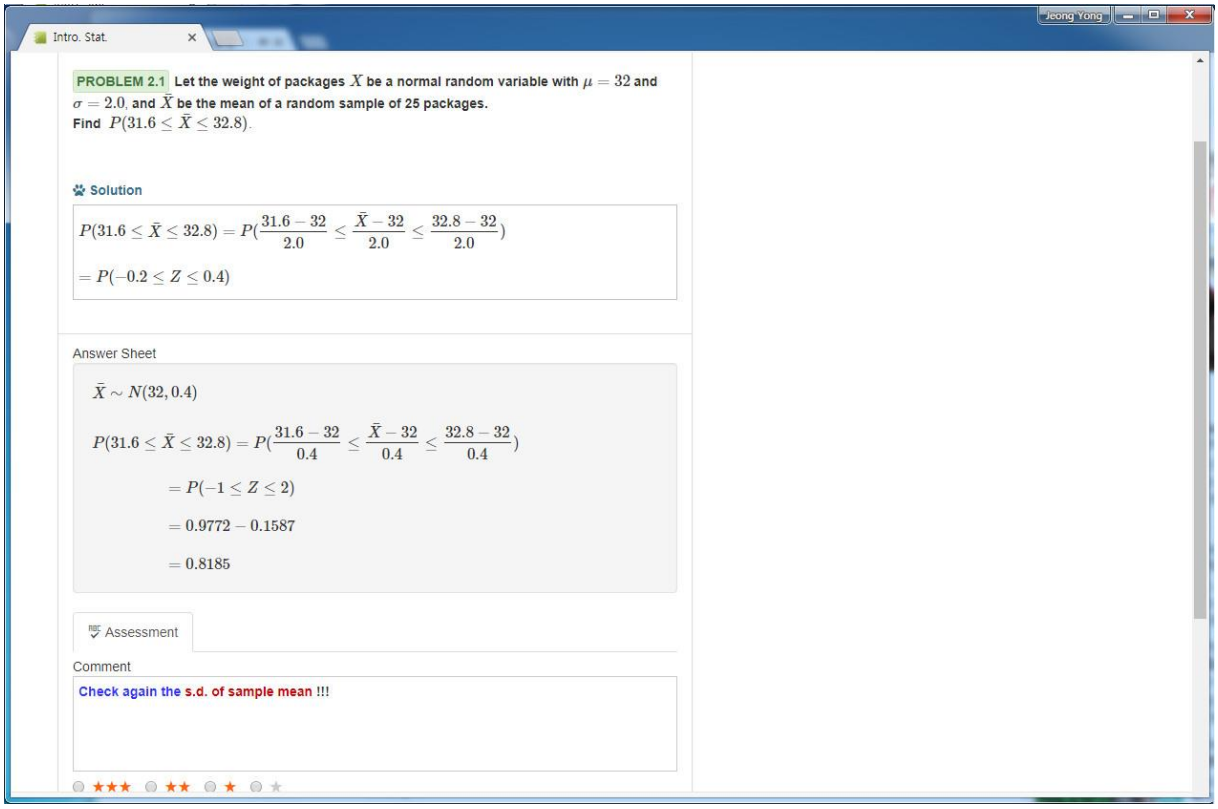

Figure 5. An example of peer-assessment and feedback.

Figure 4 is an example of the multiple choice quizzes. Student gets immediate automatic feedback and then is prompted to go to the next question. However, it is not enough for feedback to be auto-generated by a computer program. We provide a problem in which the teacher or fellow student provides the enlightened assessment and feedback. Figure 5 shows an example of peer-assessment. A student submits the full solution and gets an assessment and feedback from the instructor and/or other students. This ensures that instructor and other students are fully involved in the feedback and assessment process. In this way, students have a platform that can automatically generate hints and feedback, but also incorporate hints and feedback generated by the instructor.

Incorporate Many Offline and Online Mathematics Tools and Content

In designing effective mathematical e-learning platforms, we must be aware of and incorporate many useful offline and online mathematical tools such as tools for mathematical typesetting and generating reports such as Latex/Share latex, R-Markdown, and Shiny. Others are tools such as Maple, Mathematica, and Matlab for computations. The trend is to have a one-stop mathematical e-learning environment, which should give a learner a laboratory experience that will facilitate the independent development and testing of problem solving strategies, incorporating typical problems of mathematics, physics, and engineering science in order to prepare the student for his or her professional life (Jeschke, Richter, & Seiler, 2005).

Conclusion

In this study, we propose a mathematical e-learning model MCIEC, for making mathematical learning more interesting, meaningful, and applicable to the learners beyond the classroom knowledge. The teaching of mathematics beyond the primary level in most developing countries mainly emphasizes preparing students for high-stake national exams rather than linking the content to real life problem solving skills. The curricula are not well-aligned to the needs or abilities of the majority of learners and the failure rates for mathematics are extremely high (Namukasa et al., 2010). To overcome these challenges, the MCIEC model emphasizes a flexible approach to teaching mathematics in which motivation, context, and dynamic evaluation are the backbone of any content design or delivery. The model places greater responsibility to the teachers to be more innovative and create materials that suit the learners' abilities and environment. In addition, the model requires teachers to accord more time and effort on explaining the relevancy of the mathematics content before moving onto the mathematics in the content. It is easier for the student to put in much effort to understand the mathematics in the content once the interest, motivation, and context has been attained.

On the other hand, many developing countries do not have enough technological circumstance for constructing an e-learning environment. One way to overcome this problem is to use open source platforms. We employed the open platform XOT for instantiating the MCIEC model in this study. The platform offers several functionalities to create dynamic and interactive content that can provide students a richer learning experience. The platform can be used both online and offline, thereby overcoming the problem of limited and intermittent internet prevalent in most developing countries.

An evaluation of the trial phase of the model was carried out. The students' responses and instructors' observations show that the MCIEC model based on the XOT e-learning platform has proven to be an interesting and effective learning environment. Instructors pointed out immediate feedback about

students' understanding as their favorite functionality of the environment, and students responded that they achieve enhanced understanding. In particular, the groups of students reported using considerably less time (average = 5.2 minutes, standard deviation = 2.1 minutes) to understand and solve problems that tested application compared to groups of students that didn't use the model. Based on this, we firmly believe the environment gives both teachers and students a rich flexible learning environment to spur creativity and applicability of mathematics knowledge.

For further development of the model, materials will be developed using XOT and several Moodle plugins such as the Formulas question type so as to fully utilize all the features of the model and create an enhanced learning experience for the learners. The model will be implemented in a rural based university in Uganda and periodical surveys carried out to further evaluate the model in comparison to other previously used models. More teachers will be trained on how to fully implement the model and user guidelines will be prepared.

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