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Editorial – Volume 20, Issue 5

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Welcome to our fifth and final issue of 2019. This year has been marked by our regular high-level of activity with the publication of 58 research articles in addition to assorted notes, literature reviews, and book reviews. We even managed a special issue entitled "Open Universities: Past, Present, and Future" and gratefully acknowledge the time and leadership of our two guest editors, **Ross Paul** and **Alan Tait**.

Journal productivity aside, this year has also been marked by transitions at IRRODL. As you know, operating with minimal staff we have become inundated with ~~s~~ubmissions (600+ per year) and a lengthening publication queue. From May through August 2019, we took a break from accepting new manuscripts to allow us to catch up and establish a regularized publication schedule going forward. We intend to publish quarterly with approximately 40 research articles per annum. We have adjusted our internal processes, which should also shorten the submission to publication timeframe. We have also chosen to remove MP3s from the forthcoming issues in acknowledgment of newer and more sophisticated technology that is now available to assist with accessibility needs of our readers. Because of these changes, I want to thank both authors and reviewers for their patience as we transition to these new organizational procedures.

While we are on the topic of positive transitions, we have also had a very fortunate and timely addition to our team. It is my privilege and pleasure to welcome **Constance Blomgren** who is joining IRRODL as Associate Editor. Dr. Constance Blomgren is an Assistant Professor in the Centre for Interdisciplinary Studies, Athabasca University who researches and teaches about OER. As the project lead for the Blended and Online Learning and Teaching (BOLT) initiative, she oversaw the redesign of graduate courses into one-credit professional learning modules for K-12 teachers. This led to the creation of podcasts and videos that contribute to the current landscape of K12 OER awareness and provide opportunity for the thoughtful development of OER teaching and learning practices. She is currently researching OER as part of a Partnership Engagement Grant through Canada's Social Science and Humanities Research Council and is a director with the Open Education Consortium.

In this closing issue of 2019, our first paper draws attention to the digital divide experienced by displaced people around the globe. To address the barriers of access and participation for refugees, **Shah** and **Calonge** propose a frugally-engineered MOOC model with a focus is on adaptability and contextualized content.

In the next study, **Westine**, **Oyarzun**, **Ahlgrim-Delzell**, **Casto, Okraski**, **Park**, **Person**, and **Steele** investigate online familiarity, course design use, and professional development interest regarding universal

design for learning (UDL) guidelines. Results suggested that faculty members desire UDL training and offers possibilities for planning and implementing professional development in areas targeted to best meet their needs.

Pozzi, **Manganello**, **Passarelli**, **Persico**, **Brasher**, **Holmes**, **Whitelock**, and **Sangrà** recognize that traditional ranking of institutions do not employ characteristics of online universities and have therefore defined a set of criteria and indicators suitable to reflect the specific nature of distance education. This study used a participatory approach and ascertained that teaching and student learning experience were among the most important criteria.

Despite freedom from the restrictions of geographic location of online learning, many students still choose to study at nearby colleges. **Yoon** explores this phenomenon by using a multiple regression technique to explain the relationship between institutional factors and localized distance student enrollment patterns in the United States.

Kayaduman and **Demirel** then examine the concerns of the instructors moving from traditional to distance education in the next article. The study provides insights that can facilitate the instructors' adoption to distance education through the development of specific interventions focused on the instructors' most intense concern stages.

Microcredentials and open digital badges have become increasingly popular in education, and so this case study by **Young**, **West**, and **Nylin**, describing implementation and its benefits and effects, is both useful and timely.

In his article, **Otto** presents findings of a meta-study which critically reviewed 25 state-funded open educational resource (OER) projects located in Germany. Although the results reveal that there are many paths to OER adoption, it is certainly becoming mainstream guided by both educational research and practice.

In our *Technical Notes* section, **McGreal** (UNESCO/ICDE Chair in OER) offers us a survey of OER implementation and analysis of 13 different higher educational institutions around the globe. Organizational contexts, logistical details, as well as benefits and challenges for faculty and students are described among the different implementations with the only common thread being cost savings provided by OER.

We then provide two literature reviews. The first overview by **Fermín-González** identifies emerging trends in research on inclusive virtual education (IVE) at the higher education level and how that inclusion is conceptualized. A systematic review of a decade of scientific publications indicates the need for inclusive e-learning educational designs with greater emphasis on diversity to facilitate educational opportunity and success. The second literature review examines technology-supported peer assessment research. Through an activity theory lens, **Zheng**, **Chen**, **Cui**, and **Zhang** report on a rich variety of approaches and provide valuable analysis.

Finally, in our *Notes From the Field*, **Lim**, **Covrig**, **Freed**, **De Oliveira**, **Ongo**, and **Newman** offer us three clusters of constructive strategies for consideration to assist distance doctoral students to complete their dissertations.

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Frugal MOOCs: An Adaptable Contextualized Approach to MOOC Designs for Refugees

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Abstract

There is a growing body of literature that recognizes the role Massive Open Online Courses (MOOCs) can play in improving access to education globally, and particularly to thousands of people in developing and developed countries. There is increasing concern, however, that the millions of displaced refugee learners throughout Europe, the Middle East, and other regions are still disadvantaged when it comes to engaging in learning through MOOCs. The reasons for this disadvantage range from a lack of appropriate infrastructure or other supporting structures, to a lack of contextualized content. So far, little attention has been paid to contextualized MOOC models, which may both impact policies and be adapted to the specific needs of these learners who often do not have the means to access many education opportunities. Therefore, the purpose of this paper is to propose a frugally-engineered MOOC model that addresses the barriers of access and participation for refugees. This paper engages in an exploratory research methodology, using findings from the literature and expert opinions gathered through interviews. These findings lead to the development of what the authors call a *Frugal MOOC Model* which can be contextualized to meet the needs of refugee learners. The paper goes on to highlight the development of the Frugal MOOC Model as the first phase of an ongoing study. It concludes with recommendations for the next phase of the study: how to implement the newly developed model.

Keyword: MOOCs, Frugal MOOCs, frugal innovations, human rights, contextualized education, sustainability, cross-cultural designs, open educational resources, implementation

Introduction

The world today is facing the largest number of refugees and forcibly displaced people in history: 70.8 million and growing (United Nations High Commission for Refugees [UNHCR], 2019). Millions of these people are displaced in unfamiliar locations, often with limited access to and means to satisfy basic needs. One of these basic needs is access to education (United Nations High Commission for Refugees [UNHCR], 2016b). As the need for skilled and educated employees to support economic growth continues to rise, this education crisis will only get bigger. In the years to come, it will have significant repercussions on the global economy (Calonge & Shah, 2016). In response to this humanitarian situation, the European Commission (2016) report emphasized that a core priority for Europe is the promotion of and, thus, access to education, particularly in urgent and fragile contexts.

Refugees struggle to get access to high quality, affordable, and relevant educational content (Moser-Mercer, 2014), and this often leads to inferior educational outcomes or disengagement. More than half of all refugees globally are school-aged children and only 50% of these refugees are enrolled in primary schools. In 2016, for instance, only 30% of over 252,000 school-age Syrian refugees were enrolled at school. Among the 2.5 million refugee adolescents of secondary-school age globally, nearly 2 million did not have an opportunity to attend secondary school in 2015 (UNHCR, 2016b). It is estimated that 1 percent of refugees have access to higher education (UNHCR, 2016b). According to Lorisika, Cremonini, and Safar Jalani (2015), more than 100,000 refugees missed university classes in 2015 while residing in Lebanon, Jordan, and Turkey. There is also evidence that many in those communities, even those in urban contexts, face serious isolation because they lack opportunities to access relevant adult education, high speed internet, and professional/skills training. The lack of educational and professional development opportunities are often recognized causes of poverty. The development of contextualized and transferable knowledge using affordable learning tools is, therefore, key. Contextualized technology can provide ways to deliver distance curriculum as well as professional learning. A United Nations Committee on Economic, Social and Cultural Rights (UNCESCR) identified four critical features for education as a human right: education must be “available, accessible, acceptable and adaptable” (UNCESCR, 1999). Research has indicated that Massive Open Online Courses (MOOCs) have made access to content possible to hundreds of thousands of students in several nations (Rodriguez, 2012). However, the majority of these students already have a degree, have not been subjected to dramatic conditions of displacement, and do not live in camps that, in many instances, lack quality education opportunities (Palin, 2014). Due to the growing diversity in the types of students, both socioculturally and geographically, “simplification” and the development of “new distributed models” (Basu, Banerjee, & Sweeny, 2013), as well as other core components that are inherent to what characterizes *frugal innovations*, may be part of the solution. This could help to counterbalance the lack of existing opportunities for refugees.

Basu et al. (2013) defined frugal innovations as “appropriate, adaptable, affordable and accessible” (Basu, et al., 2013). Frugal innovations often originate in resource-poor contexts where people have to leverage resources in new and more affordable ways—in short “do more with less” (Radjou & Prabhu, 2014). Considering these factors along with the necessity to contextualize and therefore to facilitate “MOOCs without borders” for the inclusion of refugee populations and upholding the basic human right of education for all and thus, adapting from a “Contextualised MOOCs Model” (Shah, 2020), we believe there is a critical requirement for the development of what has so far been neglected: a *Frugal MOOC Model*. Considering the features for education as a human right (as defined above), the concept of frugal innovations and adaptability to the contexts of displaced learners, the aim of this paper is to investigate

and present a new, adaptable, and contextualized MOOC design, which may help tackle the needs of refugee learners in fragile contexts. In other words, this paper will examine the following research question:

> What are the elements required to design a contextualized Frugal MOOC Model for learners who are displaced?

The authors propose a Frugal MOOC Model which can be implemented in the contexts of the increasing groups of refugee learners throughout many parts of Europe, Australasia, and the Middle East. This model may subsequently play a role when examining the global need to provide contextualized education for the larger percentage of learners who are in rural areas or live in conditions of poverty and do not readily have access to educational opportunities.

As this research deals with a new concept (a Frugal MOOC Model) and is both in its early stages and exploratory in nature, the above research question will be preliminarily answered through the findings in the literature and expert opinion. For the purpose of this study, a frugally-engineered MOOC model is defined as a significantly pedagogically-rethought/needs-based design adapted to the needs of displaced populations with a specific focus on refugees.

Background Literature

Frugal Innovations

Frugality is a concept that has been in existence for centuries. It was originally associated with issues pertaining to finance and, on a larger social scale, it is seen as a means to counteract the consuming and unsustainable effects of environmental conditions (Johnson, 1978; Talwar, 2003; Fujii, 2006). In more recent years, frugality has evolved to reflect calls for sustainability in an era of globalization and the ubiquitous use of low-cost technology. The perception of "frugality" has therefore developed into the concept of frugal innovations. The need for sustainability and the socioeconomic contexts of under privileged populations and emerging markets are the core drivers of frugal innovations. The principles of frugal innovations are defined by what Basu et al. (2013) have called the "10 Core Competencies for Frugal Innovations" which further categorize the required design process for its implementation. These 10 core competencies are as follows:

- *Ruggedization* – This refers to developing frugal solutions that are designed for and can withstand conditions of "extreme environments," which in some cases may be due to remote locations.

- *Lightweight* – This refers to portability. A frugal innovation should be transportable and thus able to benefit "large groups of people" in various locations.

- *Mobile-Enabled Solutions* – The purpose of this competency is to use disruptive technology platforms, such as mobile phones, to enable greater "connectivity" while providing effective solutions.

- *Human-Centric Design* – All innovative frugal designs need to focus on the user. Ease of use and intuitive designs are essential for sustainability and must therefore require "little or no prior knowledge or training to utilize."

- *Simplification* – This competency emphasizes minimalism. The innovation must have "minimalist features and functional requirements," which can lead to higher usability and acceptability.

- *New Distribution Models* – This refers to providing frugal innovations to large populations using "non-conventional channels." The use of these channels widens the access of the product or service.

- *Adaptation* – Adaptability is a key competency. Here it is required for "leveraging existing products, inputs and services."

- *Use of Local Resources* – This reinforces the sustainability impact of frugal innovations. The use of local resources refers to "sourcing without importing equipment or materials."

- *Green Technologies* – This competency examines environmental conditions and concerns as it develops innovative frugal solutions which are "powered by renewable resources."

- *Affordability* – This final competency incorporates the financial aspect of the frugal innovation for both its users and providers. Therefore, affordability is comprised of "low input and operations costs."

MOOCs as Frugal Innovations and Education as a Human Right

The rising population in nations such as India and China and the influx of displaced learners throughout Europe, Turkey, and Canada—consequences of the Syrian conflict and ongoing crises in various parts of Africa and the Middle East—are said to be generating an "unprecedented transformation" in education systems (Pathak, Pandey, & Vashisht, 2016). 50% of the population of India, for instance, is currently under the age of 25, and many of these people are in need of education, are living in rural and remote communities, and are under the poverty bracket (Shah, Wagner, & Oztok, 2015; Pathak et al., 2016). Similar instances requiring greater access to affordable education at all levels are occurring in several other nations (Lewin & Caillods, 2001; Pityana, 2009), such as South Africa or Bangladesh. This phenomenon is only exacerbated by push factors such as the ever-increasing pace of globalization, the influx of displaced learners from war-torn areas, and the gradual increase of rural/urban migrations. As Mendenhall, Russel, and Buckner (2017) note, "more than half of the world's refugee population now live [sic.] in urban areas." This has brought about greater competitiveness for jobs and, consequently, soaring demands for improved affordable, accessible, and quality education. Pathak et al. (2016) discuss these effects when they suggest increased trade and global economic investments, as well as the necessity to work across borders, are forcing nations to reexamine their education systems in order to adapt to "changed global realities." They went on to propose the possibility of a reciprocal relationship between economic drive and affordable academic needs. This focus on adaptability and on the reexamination of education due to the displacement of learners and the greater global competition for employment highlights again the critical features of education as a human right. These features, together with cost-effective and accessible education, bring the need for frugal innovations for education into the MOOCs sphere.

The original rhetoric surrounding MOOCs was that they were producing affordable access for "whoever is interested in learning" (Yuan, Powell, & Cetis, 2013). This principle of flexibility, of being "open to all" types of learners at low cost (Yuan et al., 2013), should be the appropriate answer to providing education to displaced learners. Lane, Caird and Weller (2014) argue that open source materials could provide a potential solution when they state that "in essence open educational systems offer the potential to break the iron triangle of access, cost and quality that apply to education and create more flexible forms of provision alongside the existing more traditional but rigid forms."

However, despite their initial premise, a number of studies have shown that MOOCs were, in fact, reproducing and often aggravating existing inequalities (Kop, 2011; Palin, 2014). MOOCs have been largely designed to cater towards "knowledgeable" learners who have sufficient financial resources to afford education and, therefore, are not necessarily engaging in MOOCs as a means of gaining a livelihood and becoming employable (Palin, 2014). In many cases, MOOCs further widen existing educational divides as the education world is increasingly being separated into tiers: those who easily have access to MOOCs due to their high level of privilege in society (Perris, 2014), and those who need access to MOOCs because they are "left out" of the higher education system (Ernst & Young LLP, 2013).

As it appears that the demand for education continues to outpace its supply in growing populations, understanding education as a human right and combining the principles of frugal innovations with those of MOOCs may be effective ways to tackle the this problem. Studies have suggested this could have a knock-on effect on the dire socioeconomic conditions faced by nations dealing with displaced and rural populations, as education and frugal innovations "often offer a social benefit" (Lehner & Gausemeier, 2016). A similar sentiment is found in Pansera and Sarkar (2016), who suggest that this may aid in "poverty reduction" as well as promote inclusion for those otherwise left out of education because of other unmet needs. A study by Sen Gupta and Parekh (2009) implied that this could be a successful "universal strategy" for both "global economic viability" and the "all round development" of numerous nations.

Elements of Contextualization for a Frugal MOOC

The "critical challenge" of globalization is to gain sustainability and contextualization in several areas including education. This is crucial, particularly when nations such as the United States try to establish "internationalization strategies" for product or service deployment in nations that are dealing with different socioeconomic challenges and with "underdeveloped or absent" infrastructure (Khanna, Palepu, & Sinha, 2005). Without examining local contexts, "institutional voids" are particularly a problem for displaced learners and those in emerging markets. This creates the need to identify innovative frugal options that are useable by their local populations (Khanna et al., 2005). This context-savvy approach enables "resource-constrained" nations to allow their populations to engage with MOOCs (a product and also a service) that can help build stronger, knowledge-based societies (Zeschky, Widenmayer, & Gassmann, 2011).

In examining contextualization along with education as a human right and Frugal MOOCs, the literature identifies four key elements: *content customization*, *local stakeholders*, *technological infrastructure and green mobile-enabled technologies*, and *learners' needs*.

Content customization. Numerous studies, including those by Kop (2011), Gunawardena (2014), Palin (2014), and Knorringa, Pesa, Leliveld, and Van Beers (2016), have highlighted the overall

need for content customization in MOOCs in order to make them adaptable to and repurposable for learners' contexts. This involves incorporating content in the local official and vernacular languages used by learners, as well as providing relevant course materials by adapting the content to the participants' contexts (Gunawardena, 2014; UNHCR, 2016b).

Local stakeholders. Studies by Winkler (2014) and Jain, Gopalakrishnan, Mehra, Kennegal, Upadhyay, Pankaj, and Baxi (2014) have also indicated that local stakeholders need to be consulted on multiple occasions to ensure that their input regarding local circumstances and needs underpins appropriate (and acceptable) educational designs. The educational challenges of diverse regions along with their socioeconomic contexts are likely to require different forms of collaboration with a variety of stakeholder groups who engage in the design and development of MOOCs (Winkler, 2014). Success, and therefore sustainability, may be partly dependent on local stakeholders including academic, government, and other local support institutions (Jain et al., 2014).

Technological infrastructure and green mobile-enabled technologies. When reflecting on the element of technological infrastructure and green mobile-enabled technologies, the literature has stressed providing education through technological tools that are available to the learners as well as examining the availability of factors such as bandwidth and download speeds (Ratwatte, 2013). Research has indicated, for instance, that in remote communities people have far fewer opportunities to "engage with online technologies due to a lack of quality telecommunication services and the high cost of mobile device access and the lack of sufficient access to computer equipment, private or public" (Anthony & Keating, 2013). Providing MOOCs with contextualized technological tools and infrastructure can help in "eliminating the barriers of geography and privilege" (Wells, 2013). For displaced and rural learners, contextualization requires the use of green, mobile-friendly resources (Tyson, 2016; UNHCR, 2016a).

Learners' needs. Finally, numerous studies have also stressed the importance of contextualizing learners' needs (Hood, Littlejohn, & Milligan, 2015; Guàrdia, Maina, & Sangrà, 2013). This requires identifying intended learning outcomes, achievements, and gaps for learners, and the contexts that may influence their learning, as is the case with displaced and rural learners (UNHCR, 2016b). Users' direct involvement in culturally and ethnographically informed design, implementation, and evaluation is therefore absolutely critical to ensure interest, accessibility, "buy-in," retention, and sustainability for frugally-engineered MOOC education (Tyson, 2016).

Methodology, Methods, and Limitations

The methodology of this study was qualitative and exploratory in nature. This was because the development of the Frugal MOOC Model was based on findings in the literature and on experts' opinions. The development of the model has therefore, been viewed as an initial phase of this study. The inability to implement the Frugal MOOC Model provided an additional reason to follow an exploratory methodology. The next phase of this study intends to further examine and execute a methodology that enables the implementation of the Frugal MOOC Model that has been developed here.

Participation of MOOC Experts and Data Collection

In examining the elements required to develop a contextualized Frugal MOOC Model, MOOC experts were identified as the most appropriate participants for this study (Suri, 2011). Six experts participated in this study. They all have academic backgrounds and have more than 20 years of experience in the field of education. They are also engaged with and have a global perspective on the development, design, and nature of MOOCs in various contexts. Two experts were based in the United States; two were in South Africa and were selected based on their expertise in working in challenging socioeconomic contexts; the last two had worked directly with refugees and were affiliated with refugee resource agencies, one in Turkey, and the other designing MOOCs for refugee contexts in Jordan. The experts were therefore selected on the basis of "purposive sampling" (Groenewald, 2004). As this study is in its initial phases of exploration, six experts were considered a reasonable number and purposive sampling a pragmatic method through which to collect and manage data (Forker & Mendez, 2001).

Data were primarily collected through face-to-face and Skype interviews. In total, six interviews were undertaken between August and October 2016: three face-to-face and three via Skype. Each lasted for approximately 50 minutes each. According to Patton (2002), there are no definite or standard rules for sample size in qualitative inquiry, and "what can be done with available time and resources" needs to be taken into consideration. Using a qualitative approach based on a preliminary search of the literature, the authors of this study designed a series of open-ended interview questions. Questions were constructed in order to elicit relevant answers that would effectively shed light on MOOCs in refugee contexts. Interview questions addressed the experts general views on MOOCs in difficult contexts, the challenges (infrastructural, contextual, financial, pedagogical) faced when designing online courses in refugee contexts, the limits of the current MOOC format, and the critical elements for MOOC design that would help address the barriers to access and participation among refugees populations.

Interviews used a guided/collaborative conversation format, often used in grounded theory methods. All identifying information was stripped. The analysis of each transcribed interview followed a process of data reduction, and the drawing of conclusions outlined by Miles and Huberman (1994). Interview transcripts were manually coded by the authors of this study. The relevance of information for coding was made based on: (1) the frequency of occurrence of the concept; (2) whether the information stood out; and (3) if experts explicitly made an emphasis that it was important. Thematic categories were derived from these indicators, by using a constant cross-comparison method (Merriam, 2009). Through a constant process of comparing codes, patterns were discovered. Four emergent themes were then established: (1) content customization; (2) local stakeholders; (3) technological infrastructure and green mobile-enabled technologies; and (4) learners' needs.

Limitations

Conducting research on refugee contexts presents a distinctive set of challenges. Firstly, there is very little literature on MOOCs in fragile educational environments with refugee learners. Secondly, in this study, refugees could not be directly accessed and interviewed. Thirdly, the study was limited by being unable to gain a larger number of expert opinions, which raises concerns about a lack of representation. Findings presented in this study are drawn primarily from the interviews with the six experts, which precludes any claims of generalizability. Hence, most conclusions that can be drawn from the present analysis are tempered by these limitations and pertain primarily to the development and need for the Frugal MOOC Model and less to the immediate application of the model.

Findings

Content Customization

This element examined whether content customization was relevant to the design of a Frugal MOOC in terms of its being adaptable to and contextualized according to the needs of its intended learners. The experts all agreed that this was a most necessary element as it differentiates casual learners from those who are in need of education due to extenuating geographic and socioeconomic circumstances. The experts confirmed that previous designs of MOOCs "did not, in their actual form and shape, cater to the different needs of different learners." The experts also confirmed that MOOC content should be remixable and adaptable; this includes "resources that are going to be used in other contexts" for other learners, as they are currently not "designed to be universal." The experts firmly agreed that MOOCs would only be transformative if they were "put in the context of improving student learning," which requires adaptability of the design.

Local Stakeholders

The significance of requiring and involving diverse local stakeholders in the development of a contextualized Frugal MOOC design was examined here. All experts agreed that in order for MOOCs to be truly adaptable to diverse learners taking into account socioeconomic needs and geographical backgrounds, the MOOC stakeholders' role and function needed to be "re-conceptualized" in order to better match the educational contexts of the learners. The experts identified that current "tensions" and "power struggles" between faculty and institutions, were hindering the frugality and relevance of MOOCs for diverse learners. Local representatives, faculty, institutions, businesses, and local governments "need to bring all that together" as resource-rich and contextual stakeholders, which would enable MOOC platforms and developers to rethink "what good education would look like at scale" in fragile contexts.

Technological Infrastructure and Green Mobile-Enabled Technologies

The development of technological infrastructure, such as the provision of useable bandwidth speeds for engaging in MOOCs as well as designing the MOOC to be useable with the prevalent type of green mobile-enabled technological tools available for displaced and rural learners, were examined here. All experts confirmed the need to identify the availability of technological infrastructure for diverse learners as well as the necessity that MOOCs be adaptable to the local types of technology used. "They have access to mobiles" and this can be a primary tool for learning; this was the key, overall view of all the experts.

Learners' Needs

The focus here was to examine the requirements of the users in displaced and rural areas. Thus, any gaps in their learning needs, along with languages concerns and the availability of resources for their learning was investigated. The experts here all agreed upon the necessity to examine these needs for an adaptable Frugal MOOC Model. The experts identified "the lack of resources" relevant for learners in diverse regions, which seems to be the weakest link in current MOOC models. They agreed that the design for MOOCs needs to take into account learners' contexts, languages, and other cultural needs, and "has to be demand driven." They argued that the "personalization of the learning experience to cater to the diverse needs of the student" is critical for the sustainability and adaptability of MOOCs, and for providing an acceptable delivery of education that is contextualized according to the needs of learners.

The Frugal MOOC Model

The examination of the unquenched need for education of newly displaced learners signals the need to implement and enable education as human right by integrating frugal innovations and contextualization into MOOC designs. Therefore, initiating a Frugal MOOC Model (shown in Figure 1) to tackle the unmet education needs of these learners is absolutely critical.

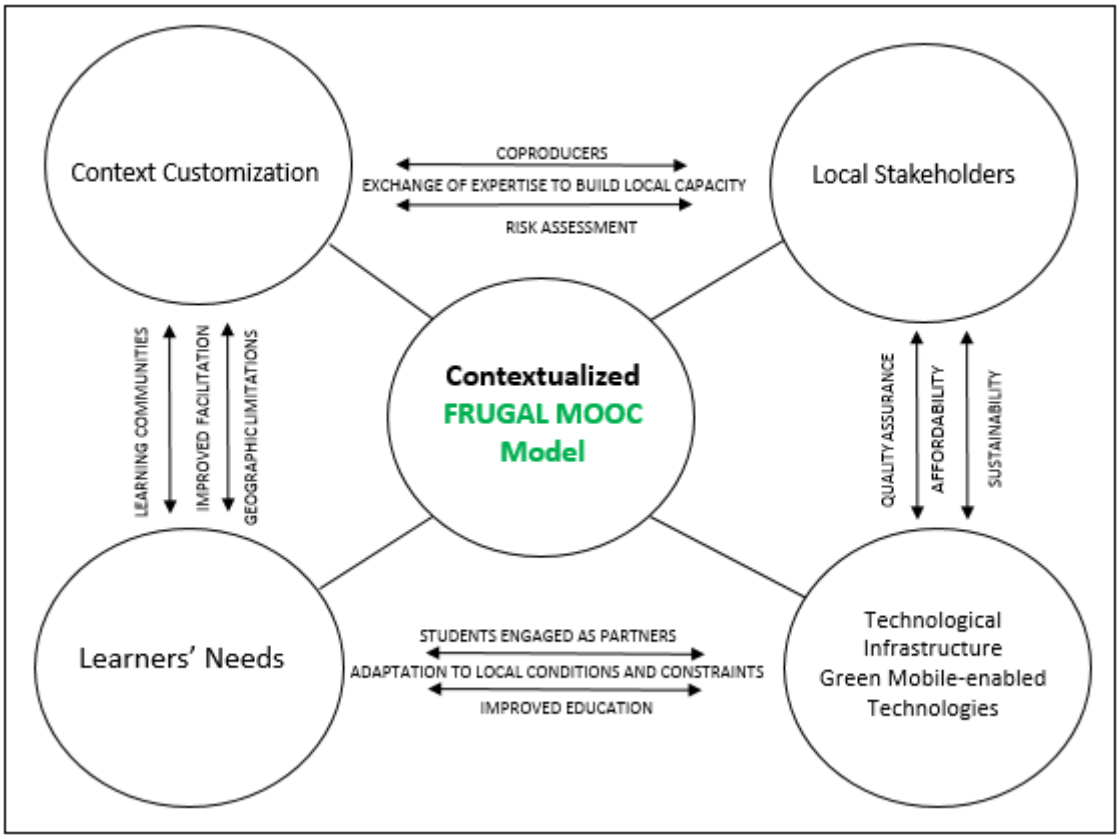

Figure 1. Frugal MOOC model.

The breakdown of the key elements of the Frugal MOOC Model in Figure 1—namely, content customization, local stakeholders, technological infrastructure and green mobile-enabled technologies, and learners' needs—and the interlaced competencies of frugal innovations and education as human right are unpacked in the following sections.

Content Customization and Learners' Needs Linked to Competencies of Frugal Innovations and Education as a Human Right

Content customization and learners' needs can safeguard *user value* providing the opportunity to disrupt struggling socioeconomic environments. This is because they can "bring products, services and systems within the reach of billions of poor and emerging middle-class consumers" (Knorringa et al., 2016).

The competencies of frugal innovations discussed above, namely ruggedization, and human-centric designs, align in the Frugal MOOC Model with geographic limitations, learning communities, and supporting local pedagogical approaches in local languages.

The features of education as a human right, namely, education being acceptable and adaptable are present in the Frugal MOOC Model through the customizability of Frugal MOOCs' content and the consideration of the needs of the learners.

Local Stakeholders and Technological Infrastructure and Green Mobile-Enabled Technologies Linked to Competencies of Frugal Innovations and Education as a Human Right

Frugal innovations are not just a strategy for sustainability; they are also associated with a "frame of mind" (Radjou & Prabhu, 2014). They have the ability to deliver "key social value" when effectively targeting "unmet needs" (Tiwari, Fischer, & Kalogerakis, 2016). This is reflected in the Frugal MOOC Model through the elements of local stakeholders, and technological infrastructure and green mobile-enabled technologies.

The frugal innovation competencies of affordability, simplification, new distribution models, lightweight technologies, and human-centric design are identified in Figure 1 as green mobile-enabled technologies and quality assurance.

The features of education as a human right (education being accessible and available) are present here through the development of Frugal MOOCs with local stakeholders in order to include learners and make them aware of MOOCs to, and to develop MOOCs through accessible technological means.

Learners' Needs and Technological Infrastructure and Green Mobile-Enabled Technologies Linked to Competencies of Frugal Innovations and Education as a Human Right

Aside from developing human-centric designs which are user friendly, MOOC functionality that identifies the "key demands" of its local uses enables greater long term growth (Fuchs, 2013). This idea correlates, in Figure 1, with learners' needs, technological infrastructure and green mobile-enabled technologies.

The frugal innovation competencies of using local resources and human-centric design are presented in the Frugal MOOC Model as the elements of adaptation to local conditions and constraints, students engaged as partners, and improved facilitation.

The features of education as a human right (education being acceptable and accessible) are present here through the contextualization and development of a structure of learning in MOOCs that is acceptable for refugee learners' needs that is contextualized through accessible technological means.

Content Customization and Local Stakeholders Linked to Competencies of Frugal Innovations and Education as a Human Right

The concept that MOOCs need to be well conceptualized and "tailor-made" (Mukerjee, 2012) for their target users is identified here through the correlation between "Content and Customization" and "Stakeholders." The emphasis in the Frugal MOOC Model is placed on satisfying the "fundamental needs" of the targeted learners.

The Frugal Innovation competencies of human-centric design and adaptation are presented in Figure 1 as the elements of co-producers and risk assessment, and the exchange of expertise to build local capacity.

The features of education as a human right (education being adaptable and available) are present here through the customization of Frugal MOOCs to learners' contexts and the development of Frugal MOOCs with local stakeholders to provide inclusion in and awareness of educational infrastructures.

Discussion

Countless studies have shown that increased levels of participation in higher education are significantly correlated with greater levels of socioeconomic development (Blanden & Machin, 2004). MOOCs as they are currently designed, however, seem to contribute to the increase of unequal opportunities that pose insurmountable challenges to underprivileged learners in developing countiries and to refugees who are forced into displacement throughout Europe, the Middle East, and Asia. With this focus, this exploratory study has aimed at developing a new appoach to MOOC designs. Thus, it has examined how the concepts of frugal innovations and the right to education, may be applied to MOOC designs.

In doing this, this study has examined the question: "What are the elements required to design a contextualized Frugal MOOC Model for learners who are displaced?"

To tackle this question we argued for the indispensable need to customize content, to engage all local stakeholders in the design process, to design mobile-enabled content according to the availability of local technological infrastructure and the prevalence and types of digital capabilities that learners have, and to identify the specific needs of learners who are often in complicated socioeconomic and educational environments. Through identifying these elements with the backing of literature and experts opinions, this study has endeavored to provide ways forward to a more adaptable and contextualized approach to MOOC designs for underprivligered learners, which could help improve the accessibility and usability of online learning content.

The opinions of the six experts led to the development of the interconnected elements of our Frugal MOOC Model. Their perspectives demonstrated the need for MOOC designs to be contextualized for learners and to incorporate frugality in order to become more inclusive and accessible to underprivileged learners such as refugees. Along with this, the expert opinions highlighted the need for a differentiation in the design of MOOCs for refugee learners, which may allow learners access to the (human) right to education. This, in turn, may have a greater impact on developing a knowledge-based society.

Discussing the Key Elements of the Frugal MOOC Model

The need for content customization emphasized current MOOC content design is often complex and comes laden with cultural values. MOOCs are in many instances irrelevant for, incomprehensible to, and inappropriate for refugees' and their circumstances. Attention to cultural differences, sensitivities, and nuances is extremely important when introducing online content and MOOCs into new challenging contexts. Unless the content and medium of instruction are aligned with the learners' background, language levels, digital capabilities, and culture, the impact MOOCs have for those displaced will be very limited. To mitigate such negative impacts, it is recommended that content is repurposed, discussed, and co-produced in direct and close consultation with local schools, instructors, and students.

Local Stakeholders demonstrated the need for diversified investments in order for MOOCs to have greater accountability to the communities they serve, and to have greater societal impact through

providing awareness of and access to MOOCs to these communities. Exchange of expertise between MOOC developers and local stakeholders is paramount. This will help build local capacity and create valuable content with risk assessment procedures put in place to ensure tailored content, monitoring of online engagement, and assessment practices, as well as achievement of learning outcomes. These suggestions may help palliate the shortage of qualified local teachers by inciting graduate students, alumni, educated elders and overseas global mentors to become facilitators and learning coaches in, for instance, WhatsApp learning communities. Involving local teachers in content development, writing of discussion guides in the local language(s), and facilitation will also encourage the creation of local communities of enquiry, support, learning, and practice, which are often the missing link in disadvantaged educational contexts. Close collaboration as *equal* partners may also help attenuate traditional and often ancestral hierarchies of authority or superiority. Take, for example, the Teachers for Teachers initiative in Kakuma Refugee Camp, Kenya, which was launched by Columbia University in partnership with UNHCR, Finn Church Aid, and the Lutheran World Federation with the goal of supporting refugee and Kenyan teachers in their efforts to improve their own teaching practices. In short, all stakeholders must be included from the outset.

Technological infrastructure and green mobile-enabled technology issues and their costs are vital to MOOCs as they can limit access to course content. Lack of connectivity and engagement can have serious consequences and may further decrease the betterment of "life chances, and social inclusion" (Clark, 2003). Despite rapid technological advances and the launch in many developing countries of affordable mobile devices, there is often inadequate or insufficient technological infrastructure such as steady electricity supply or high bandwidth Internet access to make appropriate use of such devices. It is therefore recommended that MOOC developers make use of frugal, cost-effective, power efficient, low-bandwidth hardware such as Raspberry Pi, and preloaded content on memory sticks coupled with hard copies, compressed video formats, and light-weight apps such as Binu, which could either be preloaded in low-end devices or easily downloadable in slow networks to access content. Locally-developed, portable, rechargeable (solar/wind), user-friendly Wi-Fi hotspot technological tools that support multiple devices with long-lasting battery backup such as BRCK are advocated for refugee communities.

When examining Learners' Needs, through our expert views and the literature, it can been seen that MOOCs are not considered suitable in their current form, shape, and design for the needs of refugee populations. A combination of factors such as poverty, remote geographical location, and sometimes ethnicity or gender put people at a significant disadvantage to gain an education, even at primary level. We therefore recommend through the Frugal MOOC Model the development of locally-relevant digital capabilities training programs as well as thorough needs' evaluations. These would help design relevant content, as well as appropriate diagnosis, tracking, intervention, and support structures drawn from evidence-based on on-the-ground expertise.

How Can This Model be Implemented? The Future Applications of the Model

The implementation of the Frugal MOOC Model is complex as it requires multiple parties to be actively involved in coordinated action—but it is feasible. On a wide scale it will require an active, multisector, multilevel, and systematic outreach with key international and local actors to ensure ownership and participation. It will also involve clear identification of key local contexts (i.e., cultural, ethno-linguistic, etc.) and issues (risk assessment) to contextualize content and delivery, as curricula in host countries that are taught in foreign languages are often unfamiliar to and difficult for many refugees. This will

necessitate establishing strong partnerships with key local influencers: ministers, municipal authorities and community leaders, social workers, refugee associations (which played a key role in the Calais "jungle" and the migration crisis in 2016, for example), UN agencies such as the UNHCR offices, NGOs, or language peer support programs such as the English Language Fellow Program. Partnership initiatives such as the Jamiya Project, Kiron, or Chatterbox are encouraging as they address learners' needs: they help refugees (1) get access to higher education; (2) credentialize or upgrade their vocational skills; (3) connect to other people in search of their skills; and (4) be remunerated. To maximize sustainability and durability, key structural barriers such as legal frameworks that allow refugees to obtain work permits or visas in their host country (special economic zones for refugees outside Zaatari camp in Jordan have shown promising results) and financial support (loan schemes or microfinancing to encourage entrepreneurship and help offset school burden as there is a lack of public schools and private school fees are too high) need to be addressed, and quality assurance processes need to be put in place.

All of these aspects and parties mentioned above contribute elements to the Frugal MOOC Model; however, their application and the development of MOOCs for refugees remains disjointed, as many, perhaps apart from Edraak (the Arabic MOOC platform), do not directly engage in the building and implementation of MOOCs in fragile contexts. One of the purposes of the Frugal MOOC Model is to address this by presenting a succinct approach to the provision, development, and future application of MOOCs for refugees. Therefore, on a more concise and implementable scale, two elements need to be defined for future application of the Frugal MOOC Model: (1) a *Frugal MOOC Platform* that can host and deliver refugee-led contextualized Frugal MOOCs; and (2) *Frugal MOOC Curriculum Experts*. Frugal MOOC Curriculum Experts would require knowledge and expertise in both the contexts of refugee learners from the perspectives of their socioeconomic environments and the necessity of involving various stakeholders. They would also require knowledge of online pedagogy and design for the development of contextualized Frugal MOOCs in vulnerable learning conditions. This would enable all the relevant parties to come together, including refugees as partners as advocated by Betts, Bloom, Kaplan and Omata (2017), and work in unison, effectively and coherently, to deliver contextualized MOOCs for refugees and others in fragile contexts.

Conclusion

With the increasing number of refugees and forcibly displaced people around the world, there is remarkably little scholarly research on how online learning, and MOOCs in particular, could be used in these fragile and difficult contexts. The authors of this article have therefore proposed a contextualized Frugal MOOC Model to cater to the educational needs of those in complex and difficult refugee contexts. The "first digital divide" refers to the gap between those who had access to computers and the Internet and those who did not. A "second-level digital divide" was identified by Hargittai (2001), which separates "those with the competencies and skills to benefit from computer use from those without" (Trucano, 2014). We argue that the inability to access contextualized MOOC content is creating a *third* digital divide. MOOCs in their current form, shape and design do not socially empower those who most need it in remote, rural communities and refugee contexts. Current online learning policies still stratify people by creating a meritocratic system, with those who have the means and capabilities to access and those who do not. MOOCs therefore still help in perpetuating (and increasing) educational divides as the best students get even better after taking MOOCs while many, from underprivileged or difficult

backgrounds, seem to still be denied these opportunities and the basic human right to education. They remain excluded, distanced, and even more globalized as they face increased hurdles to catching up with knowledge economies (Santandreu, 2017). It is only through a reconceptualization of MOOCs design, through taking on a frugal approach that is adaptable and contextualized, that the existing barriers of online education can be opened.

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Familiarity, Current Use, and Interest in Universal Design for Learning Among Online University Instructors

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Abstract

This study investigated online faculty familiarity, course design use, and professional development interest regarding universal design for learning (UDL) guidelines. The researchers surveyed all 2017 to 2018 online faculty at a large university in the southeastern United States. Findings included 71.6% of faculty reporting familiarity with at least one UDL guideline, with most respondents indicating familiarity with guidelines relating to perception, expression, and communication. Faculty reported the highest implementation of UDL guidelines was for those suggesting options for comprehension as well as expression and communication; the lowest implementation was for those suggesting options for physical action as well as language and support. Survey results also indicated high to moderate interest in learning more about all UDL guidelines, with emphasis on comprehension, persistence, and expression. This study suggests that faculty members desire UDL training and offers possibilities for planning and implementing such professional development in areas targeted to best meet the needs of online faculty.

Keywords: universal design for learning, online teaching, faculty development, higher education

Introduction and Overview

Expanding the delivery of courses online presents an ongoing challenge to universities that aim to provide all students with comparable high-quality experiences that transcend all delivery modalities. Typically, universities react to the changing needs of online students as they arise, but this increasingly places them in the precarious position of being able to react fast enough to the evolving environment. Universities must find new ways to adapt to the changing culture and needs of students while continuing to grow and virtually reach students.

Universal design for learning (UDL) is a framework designed to optimize learning for all, based on scientific evidence of how learning occurs (CAST, 2018). This framework has been widely used in the field of special education for learners with differing abilities (Keeler & Horney, 2007; Rao, Ok, & Bryant, 2014). While the UDL framework is less well-known in other disciplines, it may be useful to guide learning for all, given the new opportunities and challenges information technologies have presented to educational institutions. Because it has not received as much attention in online contexts, the framework presents a radical shift to one of proactivity for course designers, where planning online courses is executed to optimize the learning environment for all students prior to delivery.

As universities align their missions to promote a culture of equity, it is important to explore the viability of UDL as a framework to promote accessibility and achieve success, particularly in response to expanding course delivery options. In this study we report on a survey of faculty perspectives of UDL as a first step in a broader needs assessment of UDL for online teaching at a university with an equity-focused mission. The online faculty knowledge of and interest in the application of UDL guidelines in online course design was assessed to help document the current state of UDL guidelines application in online course design.

Universal Design for Learning

UDL is a conceptual framework that examines how to provide instruction that meets the learning needs of all students. UDL forces educators to proactively reflect on learning needs for learners with and without disabilities. Within the UDL framework there are three primary principles: (a) multiple means of representation, (b) multiple means of engagement, and (c) multiple means of expression. First, representation speaks to using a variety of strategies, methods, and tools that present class information and content in different forms to proactively meet students' needs and learning preferences. Next, expression and action provide students multiple means of demonstrating their learning. Finally, engagement looks at strategies such as offering student choice to increase the level of active learning for students, and encourages the use of self-reflection and self-monitoring for students. As seen in Table 1, each UDL principle has three guidelines (CAST, 2018).

The benefits of using UDL are well documented in the face-to-face classroom. For example, Al-Azawei, Serenelli, and Lundqvist (2016) conducted a content analysis of 12 studies regarding the adoption of UDL principles from 2012 to 2015. Ten of the studies were conducted in traditional or blended classrooms, and only two studies were online. Nearly all yielded positive results from implementing UDL principles. The authors suggested that material designed with UDL principles could effectively reach a large variety of learners with different levels of prior knowledge, abilities, and education from various cultural backgrounds.

Capp (2017) pointed to similar benefits in a meta-analysis of 18 studies between 2013 and 2016 for students across varying abilities. In both the Al-Azawei et al. (2016) and Capp (2017) syntheses, the positive findings spanned multiple disciplines. There were also benefits for teachers. Specifically, Katz (2012) identified a reduction in stress, while Kumar and Wideman (2014) found there to be better preparation through reduced workload. Additionally, Capp (2017) emphasized the role of teacher preparation programs which demonstrate both the student and teacher perspective as a critical juncture for introducing UDL principles, for example through lesson planning.

Table 1

A Description of UDL Principles and Guidelines

Principles	Guidelines	Description
Principle 1: Providing multiple means of representation	1: Perception	Alternatives for auditory and visual information or offer ways of customizing the display of information
	2: Language, mathematical expressions, and symbols	Clarify vocabulary, symbols, syntax, and structure; promote understanding across languages
	3: Comprehension	Activate or supply background knowledge; highlight patterns, critical features, big ideas, and relationships; guide information processing and visualization
Principle 2: Providing multiple means of action and expression	4: Physical action	Vary the methods for response and navigation; optimize access to tools and assistive technologies
	5: Expression and communication	Use multiple media for communication; use multiple tools for construction and composition; build fluencies with graduated levels of support for practice
	6: Executive functions	Guide appropriate goal setting; support planning and strategy development; facilitate the management of information and resources; enhance capacity for monitoring progress
Principle 3: Providing multiple means of engagement	7: Recruiting interest	Optimize individual choice, autonomy, relevance, value, and authenticity; minimize threats and distractions
	8: Sustaining effort and persistence	Heighten salience of goals and objectives; vary demands and resources to optimize challenge; foster collaboration and community; increase mastery-oriented feedback
	9: Self-regulation	Promote expectations and beliefs that optimize motivation; facilitate personal coping skills; develop self-assessment and reflection

Note. Adapted from "Universal design for learning guidelines version 2.2," by CAST, 2018 (http://udlguidelines.cast.org).

Unfortunately, much less is known about the use of UDL in an online environment where the delivery modality can have differing impacts on experiences for students, depending on their needs. Specifically, some higher education students may find online courses eliminate the need to address a visible disability, possibly enhancing their experiences (Barnard-Brak & Sulak, 2010). Other students with disabilities may be more discouraged by having to ask for accommodations in an online environment than in a face-to-face

setting (Ryan, 2007). When an online course is designed to meet UDL, it eliminates the need for retrofitting courses to accommodate the needs of specific subpopulations including students with disabilities, which further delays mastery (Casper & Leuichovious, 2005). Instead, UDL provides flexibility to all students to engage in a course in a way that is optimal for them, whether needing an accommodation or not. Hence, UDL is applicable to all learners, and in all settings—even online.

While the topic of UDL is not new, its application to online environments is still rare. A study conducted by He (2014) identified increased confidence in the content as well as self-efficacy tied to future teaching, particularly online. Additionally, Hall, Cohen, Vue, and Ganley (2015) noted positive effects on reading processes.

Furthermore, although not empirical, Tobin (2014) argued that applying UDL principles would help increase retention rates and ease technical problems with accessing materials, given the rise in use of various devices to access course content. Students value multiple options to access content and multiple options to demonstrate mastery of content throughout courses (Rao & Tanners, 2011). For example, if a student is traveling, and has limited Wi-Fi connection and only a mobile device, s/he could opt to access the text version of the content instead of a lecture video that may not be readily accessible given the circumstances.

One possible reason for the lack of empirical research is limited guidance on how to implement UDL in the online environment, and how it differs from existing, more commonly used quality frameworks such as Quality Matters (QM; Quality Matters, 2018). Indeed, while there are similarities between UDL and the QM standards, the interpretation or application of the QM standards can be different. For example, an instructor may apply the use of a variety of instructional materials by using different instructional materials in each module (e.g., a lecture video in module 1, a research article in module 2). Although similar, UDL recommends providing various methods to access the content. This suggests having the same content represented in multiple ways which differs from having a variety of instructional materials in various modules.

Research does emphasize an incremental approach to adoption, highlighting feasible avenues for practitioners to consider as they explore the use of UDL in their online courses. Recently, Robinson and Wizer (2016) integrated the QM and UDL frameworks to create a set of guidelines for the development of quality online courses. Their recommendations focused on taking small steps to develop content, and then design the course with the students' success in mind: (a) begin with a small amount of content, (b) recruit students to make change decisions, (c) provide various methods to access the content, (d) provide choices for students to demonstrate understanding, and (e) provide multiple content engagement methods. Relatedly, Dell, Dell, and Blackwell (2015) drew off a University of Arkansas recipe for developing online UDL courses to also highlight starting small and utilizing backward design. Backward design prioritizes tailoring the course content to established course objectives (Wiggins & McTighe, 2005). Finally, Tobin (2014) also recommended five strategies for faculty to apply UDL principles to online course design: (a) build the text foundation, (b) create video and audio alternatives, (c) allow students to express their understanding of material in their own way, (d) break content into chunks, and (e) use tools that are user-friendly. While the collective recommendations span the UDL principles, they also specify generating content alternatives for perception and adding flexibility for expression as starting points for UDL adoption.

Unquestionably, more research and evaluation will be needed to provide empirical guidance on the topic of UDL adoption in an online context.

The Need for Universal Design for Learning in an Equity-Focused Institution

An equity-focused mission. While UDL can provide benefits to all students and even teachers, it is unique in its emphasis on designing for equity, and therefore it may be a better option for institutions of higher education that are equity focused. According to the Americans With Disabilities Act of 1990 (1991), all American universities are prohibited from discrimination against students with disabilities. Adherence to ADA can be accomplished in multiple ways, depending on perspective, namely reactive or proactive. Providing accommodations such as closed captions for an instructional video after the course is in progress, for example, is reactive rather than proactive. The UDL framework can assist with ADA compliance proactively, in addition to being culturally responsive.

In addition to ADA compliance, some university mission statements include equity-focused language. Below are several statements quoted from a university mission that characterizes this equitable focus:

- An accessible and affordable quality education that equips students with intellectual and professional skills, ethical principles, and an international perspective;
- A robust intellectual environment that values social and cultural diversity, free expression, collegiality, integrity, and mutual respect;
- A safe, diverse, team-oriented, ethically responsible, and respectful workplace environment that develops the professional capacities of our faculty and staff (The University of North Carolina at Charlotte, 2014, “University Vision and Values Section,” para. 1).

Some ways that universities can meet this mission is through delivery of high-quality online courses, and the opportunity for faculty who teach online to obtain QM online course certification using the higher education rubric standards (Quality Matters, 2018). This is a proactive approach for designing high-quality online courses, but the interpretation of the QM standards may not be ADA compliant. Incorporating the UDL guidelines, in addition to the QM rubric, may result in an online course that is more culturally responsive to diverse audiences.

According to Eberle and Childress (2006), in the design of online courses it is imperative to consider the culturally diverse audience they will reach; however, the values of “social and cultural diversity, free expression, collegiality, integrity, and mutual respect” (The University of North Carolina at Charlotte, 2014, “University Vision and Values Section,” para. 1) are not explicitly represented in the quality rubric adopted by the university at which this study took place. The UDL principles were created to ensure that all individuals have equal opportunities to learn (CAST, 2018) and could be beneficial in guiding the design of online courses to support this part of the university’s mission statement. Therefore, UDL provides an appropriate framework by which to consider online course design given an equity-focused mission.

Growth of online courses. Aligning online course design with an institution’s goal to provide equitable access to a diverse body of students is increasingly important given the growth of online offerings

as a share of the total course offerings at institutions in the past two decades. According to Allen and Seaman (2016), more than a quarter of higher education students are now enrolled in at least one online course. This trend has also occurred at the university where this study took place, where the number of fully online courses has doubled in five years (see Figure 1).

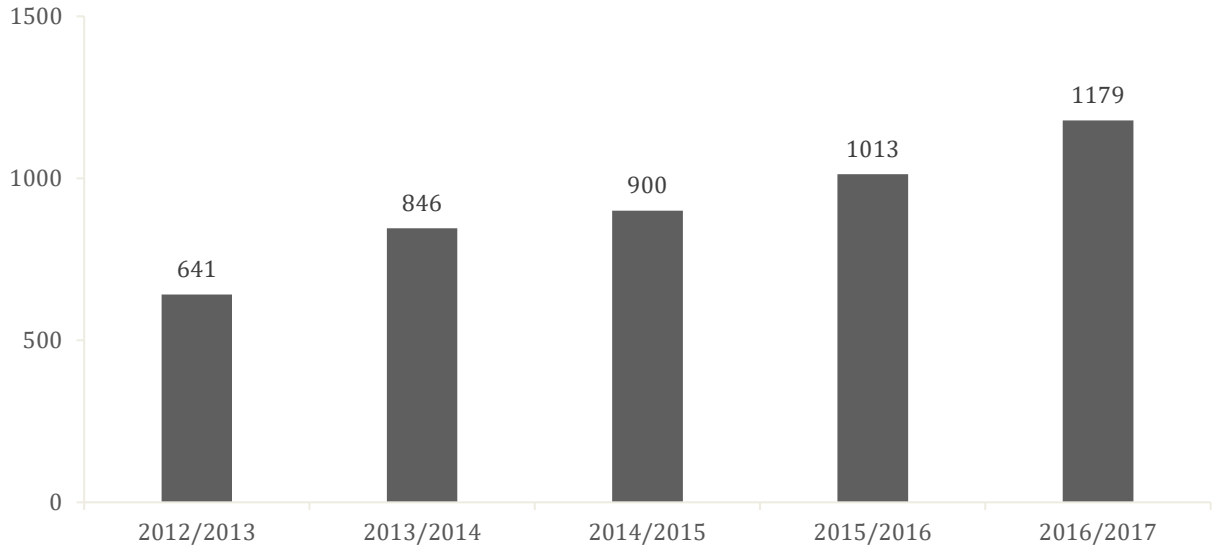

Figure 1. Rapid increase in the number of fully online course sections across time.

Research Purpose

Given the growth of online offerings, and a mission of providing equitable access to a diverse body of students, the purpose of this research was to explore faculty familiarity, use, and interest in learning more about the UDL guidelines in the online learning environments. We conducted a survey of online faculty at a large southeastern university in the United States who had taught a fully online course during the 2017-2018 academic year, in order to document their practice, as well as identify knowledge gaps and interest in professional development opportunities with respect to UDL. Specifically, we were interested in answering the following research questions:

1. To what extent are online faculty familiar with UDL guidelines?
2. To what extent do online faculty use UDL guidelines in course designs?
3. What are online faculty interests and priorities with respect to learning more about UDL guidelines for course design?

Method

This survey research study was guided by the social exchange theory and tailored design method (Dillman, Smyth, & Christian, 2014). This theory and design method are used in order to embed reciprocity, credibility, and trustworthiness in survey design and dissemination, in an effort to obtain representative

response rates, recognizing the importance of knowing the audience. Survey administration took place in spring 2018.

Sampling Frame

The sampling frame consisted of 425 university employees who had taught at least one fully online course during the 2017-2018 academic year (i.e., three semesters; summer, fall, spring). Names and emails were provided to the researchers by the university's Office of Distance Education. The university is a public institution offering undergraduate, graduate, and professional programs affiliated with the state system located in an urban area of the southeastern United States. The frame was narrowed to 355 faculty members after removing individuals who were no longer university employees.

Instrumentation

A questionnaire was developed specifically for this study and was guided by recent articles about UDL and online instruction (Bauder & Simmons, 2017; Eberle & Childress, 2006; Tobin, 2014). The instrument was designed to collect the necessary information to describe faculty familiarity with, use of, and interest in UDL. The instrument also included several demographics questions to describe the sample. Question options included interval scales, select all that apply, and ranking. Options labelled other were provided as a space for writing individual responses.

The survey was piloted with six university faculty members who were not included in the sampling frame. Three used a think aloud method. The other half tested skip patterns and determined the time needed to complete the questionnaire, finally set at 15 to 20 minutes.

Administration Procedure

The survey was administered using SurveyShare, an online survey program, between March 22, 2018 and April 12, 2018. Personalized e-mail invitations described the study and linked to a consent form and online survey. Two reminder e-mails were sent to non-responders, approximately one week apart on different days and times. A single lottery-based incentive valued at $100.00 was offered to participants.

Results

The survey had three distinct sections aligning to the research questions to identify familiarity with UDL, use of UDL in a particular context, and interest in learning more about UDL. Below, we present descriptive information about the respondents, and then subsequently address each of the three sections.

Respondents

Response rates. In total, we received 150 responses, a 42.2% response rate. This is slightly lower than the targeted 186 responses required to maintain a confidence level of 95% and a margin of error of 5% in order to be considered representative of the sampling frame (Krejcie & Morgan, 1970). However, given the lack of research in this area we felt these results still contribute to the knowledge base.

Figure 2 summarizes the response rates and attrition for each section of the survey. Of the 150 responses, nine did not respond to any of the questions and were not included in the analyses. Of the 141 respondents who completed the first section, there were 101 (71.6%) respondents who indicated familiarity with at least one UDL guideline. Beyond the opening questions, some attrition appears to have taken place. Our sampling frame of instructors was based on a registry of online courses during this time period, but only 124 (87.9%) indicated they taught an online course between summer 2017 and spring 2018. Additionally, not all respondents who taught a course during the year contributed to the course design. Just 107 (86.3%) of the 124 indicated designing at least some aspect of the course; 83 (67%) of these were the sole designer.

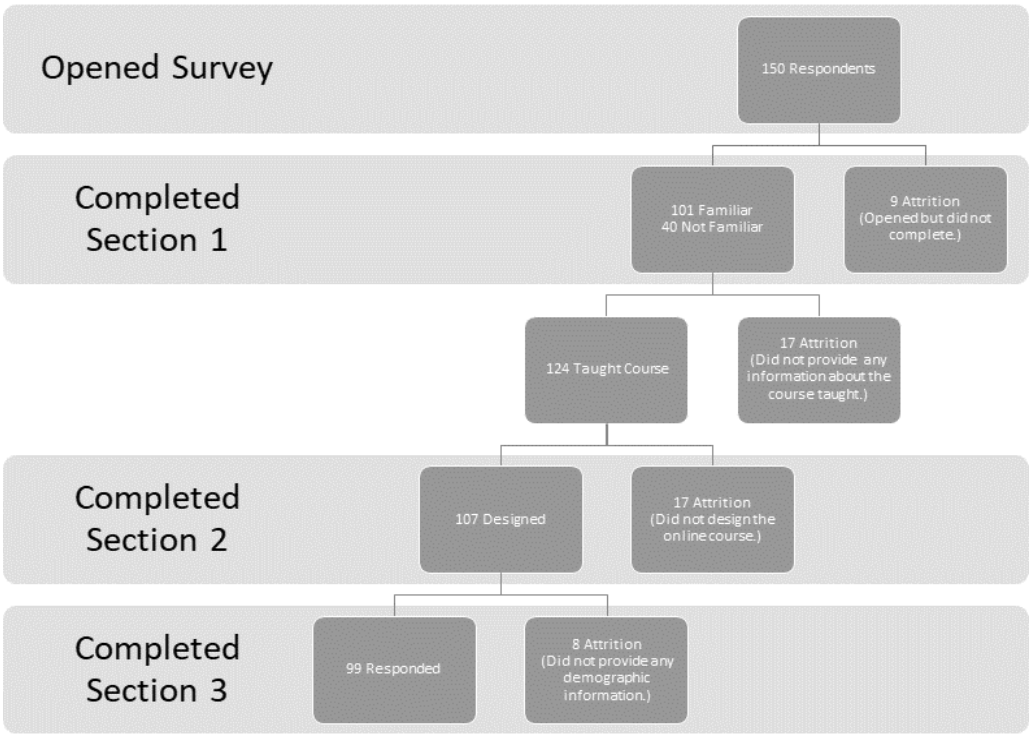

Figure 2. Response rates and attrition points for each of the three survey sections.

Given the observed attrition, there is a potential bias towards familiarity with UDL in the results of the final survey sections. We compared the groups of respondents who dropped out of the study after indicating UDL familiarity with those who stayed in and found respondents for the remaining questions were more likely to be familiar with at least one of the UDL guidelines, $\chi^2(2, N=141) = 8.38$, $p=.0038$.

Demographics. Respondents self-reported their faculty role or rank, typical online student audience, years of experience teaching online, number of online courses taught, and information on specialized training for online teaching (see Table 2). Tenured and tenure-track faculty represented approximately one-third of the respondents (33.7%). Faculty reported their online classes predominantly served undergraduate students (62.6%). Additionally, the respondents were relatively new to online teaching. Typical online teaching experience was one to five years (42.4%), but 21.2% of respondents reported having less than one year of experience. Consequently, the breadth of courses taught was also limited; about two-thirds (61.5%) of faculty taught one to three online courses, and the median was two on

a range from one to twenty courses. Half (55.4%) of the faculty received training in QM, but few (12%) in UDL.

Table 2

Characteristics of the Survey Respondents

Characteristic	*n*	%
Role or rank		
Lecturer	28	28.6
Clinical	25	25.5
Tenured	24	24.5
Tenure track	9	9.2
Adjunct	9	9.2
Other	3	3.1
Online course audience(s)		
Undergraduate	62	62.6
Graduate	47	47.5
Post baccalaureate or certificate	14	14.1
Years of online teaching experience		
Less than 1 year	21	21.2
1 to 5 years	42	42.4
6 to 10 years	20	20.2
11 to 15 years	12	12.1
More than 15 years	4	4.0
Number of online courses taught		
1 to 3 courses	59	61.5
4 to 6 courses	20	20.8
7 to 9 courses	8	8.3
10 to 12 courses	7	7.3
13 or more courses	2	2.1
Training for online teaching		
Canvas	76	82.6
Quality Matters	51	55.4
Universal design for learning	11	12.0
Other	18	19.6

Note. Characteristic sample sizes vary due to missing data or participants having selected multiple response options.

Since we were interested in describing online course design practices, the questions about use of UDL in a particular context were only asked of those 107 who identified as contributing to the course design. The final set of questions regarding interest in learning more about UDL and demographic information was available to everyone, but only 99 responses were provided.

Familiarity with UDL

Respondents were asked about their familiarity with the nine UDL guidelines (see Table 3). Forty respondents (28.4%) reported that they were not familiar with any of the nine UDL guidelines. Among the remaining 101 online instructors, the median number of guidelines the faculty were familiar with was four.

The two guidelines that faculty were most familiar were Guideline 1: Perception (59.6%) and Guideline 5: Expression and Communication (60.3%). When qualitatively asked to describe how they learned about UDL, responses fell into two main categories: professional development (e.g., workshops, conferences, coursework) and self-study (e.g., reading online or textbooks, personal experience.)

Table 3

Faculty Familiarity With Specific UDL Guidelines

Guidelines	Familiarity	
	n	%
1: Perception	84	59.6
2: Language, mathematical expressions, and symbols	53	37.6
3: Comprehension	71	50.4
4: Physical action	61	43.3
5: Expression and communication	85	60.3
6: Executive function	55	39.0
7: Recruiting interest	57	40.4
8: Sustaining effort and persistence	56	39.7
9: Self-regulation	67	47.5
Not familiar with any guidelines	40	28.4

Note. Guidelines 1-3 represent the principle of multiple means for representation, guidelines 4-6 represent the principle of multiple means for action and expression and guidelines 7-9 represent the principle for multiple means for engagement.

Current Status of UDL Online Practices

The 107 respondents who indicated they designed an online course were asked to identify a specific online course for the purposes of this study. Table 4 details the reference courses faculty identified, by college. The courses reported span six of the seven colleges within the university. The colleges of liberal arts and sciences, education, and health and human services had the highest representation.

Table 4

Faculty-Identified Reference Courses: Home College Within the University

College	*n*	*%*
Computing and informatics	9	8.4
Education	23	21.5
Engineering	3	2.8
Health and human services	19	17.8
Liberal arts and sciences	34	31.8
Interdisciplinary	1	0.9
University college (i.e., freshman experience)	9	8.4
Not specified	9	8.4
Total	107	

Table 5 displays the frequency and percent of use of UDL guidelines in the design of an online course. It also shows users' familiarity with the respective UDL guidelines. The guidelines used most frequently were Guideline 3: Comprehension (69.8%) and Guideline 5: Expression and Communication (64.9%). The guideline used least was Guideline 2: Language, Mathematical Expressions, and Symbols (38.8%). Interestingly, familiarity was not a requirement for faculty use, as up to 15% of faculty who reported using a guideline were also unfamiliar with it.

In follow-up to using the guidelines, respondents were asked to report their level of implementation for each guideline. Table 6 displays the level of implementation for each guideline. A majority of online instructors reported a high to moderate level of implementation across the nine guidelines. In addition to being the most frequently used, Guidelines 3 and 5 regarding options for comprehension, expression, and communication were rated with the highest levels of implementation.

Table 5

Faculty Use of UDL Guidelines in Online Course Design

Guideline	*n*	%[a]	% familiar with the UDL guideline[b]	% not familiar with the UDL guideline[b]
1: Perception	55	55.0	85.5	14.5
2: Language, mathematical expressions, and symbols	38	38.8	94.7	5.3
3: Comprehension	67	69.8	85.1	14.9
4: Physical action	40	42.1	87.5	12.5
5: Expression and communication	61	64.9	86.9	13.1
6: Executive function	42	46.2	90.5	9.5
7: Recruiting interest	44	48.4	93.2	6.8
8: Sustaining effort and persistence	45	50.6	95.6	4.4
9: Self-regulation	48	53.9	93.8	6.3

Notes. Guidelines 1-3 represent the principle of multiple means for representation, guidelines 4-6 represent the principle of multiple means for action and expression and guidelines 7-9 represent the principle for multiple means for engagement.

[a]Only faculty who designed some aspect of the online course were asked about using the UDL guidelines, and of the 107 individuals asked about their use of each guideline, responses were provided by 89 to 100 individuals, depending on the specific guideline.

[b]Percentage denominator is the number of faculty who indicated use of the specific UDL guideline.

Table 6

Respondents' Self-Reported Level of Implementation of UDL Guidelines in Their Course Design

Guideline	*n*	Very high	High	Moderate	Low	Very low
1: Perception	55	10.9	40.0	43.6	5.5	0
2: Language, mathematical expressions, and symbols	37	13.5	35.1	43.2	5.4	2.7
3: Comprehension	66	9.1	47.0	37.9	6.1	0
4: Physical action	40	15.0	25.0	47.5	10.0	2.5
5: Expression and communication	60	16.7	43.3	40.0	0	0
6: Executive function	42	9.5	45.2	40.5	4.8	0
7: Recruiting interest	43	13.9	34.9	41.9	9.3	0
8: Sustaining effort and persistence	47	17.0	48.9	21.3	10.6	2.1
9: Self-regulation	48	8.3	47.9	39.6	2.1	2.1

Note. Guidelines 1-3 represent the principle of multiple means for representation, guidelines 4-6 represent the principle of multiple means for action and expression and guidelines 7-9 represent the principle for multiple means for engagement.

Another follow-up question regarding use of the guidelines addressed respondents' level of comfort in applying the guidelines to online courses; Table 7 displays the results. Response options included: (a) I am comfortable mentoring others in the application of this UDL guideline, (b) I am comfortable applying this UDL guideline in my course without assistance, (c) I am comfortable applying this UDL guideline in my course with assistance, and (d) I am not comfortable applying this UDL guideline. Most respondents reported being able to implement the nine UDL guidelines without assistance. About 30% of respondents indicated they needed assistance applying six guidelines to their courses.

Table 7

Respondents' Self-Reported Level of Comfort in Applying the UDL Guidelines They Implement

Guideline	*n*	Mentoring others with application (%)	Applying without assistance (%)	Applying with assistance (%)	Not comfortable applying (%)
1: Perception	55	14.6	49.1	30.9	5.5
2: Language, mathematical expressions, and symbols	37	2.7	56.8	37.8	2.7
3: Comprehension	66	13.6	56.1	27.3	3.0
4: Physical action	40	17.5	37.5	37.5	7.5
5: Expression and communication	60	20.0	58.3	18.3	3.3
6: Executive function	42	21.4	57.1	19.1	2.4
7: Recruiting interest	43	23.3	37.2	37.2	2.3
8: Sustaining effort and persistence	47	17.0	55.3	23.4	4.3
9: Self-regulation	48	14.6	52.1	31.3	2.1

Note. Guidelines 1-3 represent the principle of multiple means for representation, guidelines 4-6 represent the principle of multiple means for action and expression and guidelines 7-9 represent the principle for multiple means for engagement.

Respondents were asked about the variety of ways in which they present information (Principle 1), assess student learning (Principle 2), and engage students (Principle 3) across different units or tasks within the online course. Few online instructors offer a variety of ways simultaneously across all units or tasks for presentation of information, assessment of student learning, or student engagement. Most online instructors offer a variety of ways within most or some of the units or tasks in the course for presentation, assessment, and engagement.

Table 8

Frequency (Percent) of Overall Use of UDL Principles Within the Course

Use of UDL principles	Presentation	Assessment	Engagement
Variety of ways simultaneously within each unit or task for ALL units/tasks	12 (14.3)	14 (16.7)	13 (15.7)
Variety of ways simultaneously within each unit or task for MOST units/tasks (more than half)	30 (35.7)	25 (29.8)	31 (37.4)
Variety of ways simultaneously within each unit or task for SOME units/tasks (less than half)	21 (25.0)	18 (21.4)	15 (18.1)
Variety of ways ACROSS the units or tasks of the course	16 (19.1)	19 (22.6)	19 (22.9)
One way within all the units or tasks of the course	5 (6.0)	8 (9.5)	5 (6.1)

Interest in Applying UDL to Online Courses

The final section of the survey concerned faculty interest in learning about applying the guidelines to online courses. Moderate to high interest exists for learning more about each guideline (see Table 9), but concentrated interest lies with Guideline 8: Sustaining Effort and Persistence (45.5%), Guideline 3: Comprehension (47.5%), and Guideline 5: Expression and Communication (44.9%).

Table 9

Faculty Interest in Learning About Applying UDL to Their Course Design

Guideline	*n*	Interest level			
		High	Moderate	Low	None
1: Perception	97	33.0	40.2	17.5	9.3
2: Language, mathematical expressions, and symbols	98	31.6	39.8	18.4	10.2
3: Comprehension	99	47.5	35.4	9.1	8.1
4: Physical action	98	28.6	41.8	20.4	9.2
5: Expression and communication	98	44.9	33.7	13.3	8.2
6: Executive function	99	36.4	37.4	15.2	11.1
7: Recruiting interest	99	33.3	38.4	15.2	13.1
8: Sustaining effort and persistence	99	45.5	31.3	15.2	8.1
9: Self-regulation	96	36.5	39.6	14.6	9.4

Note. Guidelines 1-3 represent the principle of multiple means for representation, guidelines 4-6 represent the principle of multiple means for action and expression and guidelines 7-9 represent the principle for multiple means for engagement.

Next, respondents rated the top three most valuable guidelines when designing an online course. In Table 10, the guidelines selected most often as first most valuable were Guideline 3: Comprehension (33.0%) and Guideline 1: Perception (19.6%). Guidelines selected most often as second most valuable were Guideline 3 (26.6%) and Guideline 5: Expression and Communication (18.1%). Guideline 5 (20.9%) and Guideline 9: Self-Regulation (17.6%) were most often selected as third most valuable. The guidelines most frequently selected among the top three were Guideline 3 (67.0%) and Guideline 5 (51.5%).

Table 10

Faculty Ranking of the Top Three Most Valuable UDL Guidelines

Guideline	% selecting first most valuable (*n*=97)	% selecting second most valuable (*n*=94)	% selecting third most valuable (*n*=91)	% within top 3 (*n*=97)
1: Perception	19.6	11.7	8.8	39.2
2: Language, mathematical expressions, and symbols	4.1	3.2	1.1	8.2
3: Comprehension	33.0	26.6	8.8	67.0
4: Physical action	11.3	10.6	9.9	30.9
5: Expression and communication	15.5	18.1	19.8	51.5
6: Executive function	5.2	6.4	14.3	24.7
7: Recruiting interest	5.2	1.1	7.7	13.4
8: Sustaining effort and persistence	2.1	13.8	12.1	26.8
9: Self-regulation	4.1	8.5	17.6	28.9

Note. Guidelines 1-3 represent the principle of multiple means for representation, guidelines 4-6 represent the principle of multiple means for action and expression and guidelines 7-9 represent the principle for multiple means for engagement.

Discussion

The purpose of this study was to identify and prioritize instructors' needs for successful application of UDL principles in online course design. The first research question guiding this study pertained to instructor familiarity regarding UDL principles and guidelines. Sixty-two percent of the respondents reported that they were familiar with at least one UDL guideline. This provides evidence that there are opportunities for faculty professional development to increase familiarity and raise awareness of UDL guidelines for online course development. The UDL framework provides principles and guidelines to assist faculty in creating an inclusive culture which supports the mission of the university to promote equity and accessibility to a high-quality education. Capp (2018) suggests that professional development in UDL should not be a general workshop examining the broader underlying principles, but instead aim to target on-demand resources addressing specific UDL principles and guidelines to increase confidence in implementing the UDL framework.

Importantly, respondents were most familiar with guidelines aligned with perception, expression, and communication. These guidelines are similar to quality rubric design standards such as QM's standards for assessments that "are sequenced, varied, and suited to the level of the course" (Quality Matters, 2018, p. 1). Participants often indicated they learned about UDL through professional development, which suggests prior coursework of potential new faculty should be considered as an important resource for advancing

UDL adherence. Additionally, existing QM workshops given on campus may be serving to propagate certain UDL concepts, particularly related to raising awareness. Given the emphasis of QM on applying standards to instructional materials, future professional development should encourage additional technical steps toward the creation of accessible electronic materials.

The second research question examined the current status of UDL practice. The guidelines used most frequently in course design were Guideline 3 (69.8%) which suggests that options be provided for comprehension and Guideline 5 (64.9%), which suggests that options should be provided for expression and communication. Interestingly, the existing research seems to prioritize Guideline 1, providing options for perception, as a necessary introductory step to implement UDL online (Dell et al., 2015; Robinson & Wizer, 2016; Tobin, 2014). While Guideline 1 was still mentioned by about half of the respondents, opportunities to support faculty in generating multiple content alternatives exist.

The level of practice for Guideline 3 is also worth noting. In addition to being the most frequently used, Guidelines 3 and 5 were rated at the highest levels of implementation with the ability to use them without assistance. This suggests a field-initiated strategy for adoption aligned with Guideline 3 that many instructors find practical and feasible. Still, relatively few reported they allowed students options on how to represent their mastery of the content. This is consistent with Capp's (2018) findings indicating that faculty were more confident in providing various instructional materials than they were letting students create different products to show mastery. Student choices should provide multiple options for how students engage with the material and how they participate in assessments. An example would be to provide options for how to produce a product that shows students have mastered an objective such as writing a paper, producing a video, or creating a presentation. Detailed examples of how to apply UDL principles with student choices centered on student interests, motivations, and needs were provided by Morra and Reynolds (2010).

Tobin (2014) suggested starting with text by writing out content, then creating audio and video alternatives, and finally allowing students to "let 'em do it their way" (p. 16). Of course, it is important to recognize that providing options may create additional work for faculty. This may explain why faculty are in favor of providing some options—when it is convenient—but hesitate to do so in all circumstances. However, as Tobin has noted, expressive options can also create more engaging grading sessions for faculty. Since only about one-third of the respondents indicate that they need assistance to apply most of the guidelines, further support is still needed. Additionally, more research is needed to elucidate the types of courses and skills being taught for which faculty need assistance providing various types of presentation, assessment, and engagement options.

The least used guidelines were Guideline 2 (38.8%) suggesting that options be provided for language and support, and Guideline 4 (42.1%) suggesting options be varied for physical action. These guidelines were also two of the lowest rated in terms of faculty comfort with implementation. While these may in fact be more difficult to implement, one reason could be a lack of clarity as to what each guideline really means in practice. Since UDL guidelines were established before the mainstreaming of online courses, the ideas of physical action and language support are not immediately apparent. Online courses may seem like unlikely venues to promote physical action, but the lack of application is evidence of unfamiliarity of this specific guideline in online learning contexts. Physical action may mean how the student is physically interacting

with the technology in the online learning environment such as a touch screen or an image scavenger hunt. Only 2.7% of faculty rated their comfort in applying Guideline 4: Physical Action at the highest level, that of mentoring others. As UDL migrates to the online context, it is important to clearly translate the meaning of each guideline, and provide faculty with good, operationalized examples of their application (Rao, et al., 2014).

The third research question examined interest in learning more about UDL for online courses. While there was moderate to high interest in learning more about all of the guidelines, the highest interest lies with Guideline 3: Comprehension (47.5%), Guideline 8: Sustaining Effort and Persistence (45.5%), and Guideline 5: Expression and Communication (44.9%). Guidelines 3 and 5 were also ranked highly by faculty in terms of importance. On the contrary, Guideline 8 was rated as one of the lowest in terms of importance, but one of the highest in terms of interest. Further research is needed to understand the dichotomy in this case, as well as to clarify the reasons why certain guidelines were not viewed as important, including the three guidelines that comprise the engagement principle. Recent research has highlighted the importance of engagement in the online context. For example, Cho and Shen's (2013) recent study of self-regulation (see Guideline 9) in online learning showed students' intrinsic goal orientation and self-efficacy were important for academic achievement.

Finally, we showed that similarities exist between familiarity and interest in the guidelines, pointing to the importance of future professional development on UDL. If faculty learn to apply the options that UDL prescribes, we would expect to see interest in UDL grow as well. An important consideration for professional development may be digital tools. Although not explicitly detailed in the Results section due to the lack of an explicit connection of digital tools with UDL, our study found a lack of training to use digital tools. Instructors' awareness of digital tools and their abilities to support UDL guideline implementation could have a significant impact on the success of online course design. The UDL guidelines offer many instructional best practices to differentiate for diverse learners; therefore, the research team suggests promoting professional development on UDL guidelines in conjunction with digital tools for online instructors.

Conclusion

The results from this survey point to a need for higher education practitioners, researchers, and administrators to further allocate resources for effective training on the application of UDL guidelines in online course design. Many online instructors who took this survey admitted a lack of knowledge about UDL. However, there are also many online instructors who have been trained or have extensive practice implementing UDL guidelines in their online teaching, and may be consulted to offer training for their colleagues or identify the best practices for online course design. Yet, even those with familiarity and high implementation of some UDL guidelines express a need for and interest in learning about other UDL guidelines. For the adoption of the guidelines to be widespread in the online learning context, investigating the faculty decision-making and adoption process is warranted. Exploratory research that identifies concrete examples of best practices in all disciplines would be beneficial. This would help designers and faculty connect the guidelines to current online course design practices.

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Ranking Meets Distance Education: Defining Relevant Criteria and Indicators for Online Universities

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Abstract

University ranking systems are being implemented with the aim of assessing and comparing higher education institutions at a global level. Despite their being increasingly used, rankings are often strongly criticized for their social and economic implications, as well as for limitations in their technical implementation. One of these limitations is that they do not consider the specific characteristics of online education. This study used a participatory approach to define a set of criteria and indicators suitable to reflect the specific nature of distance education. This endeavour will help evaluate and rank online higher education institutions more appropriately than in current practice, where indicators are devised for traditional universities. To this end, several stakeholders and informants were involved in a Delphi study in an attempt to reach the broader higher education institutions (HEI) community. According to the study participants, apart from students' achievements and general quantitative measures of HEI performance, which are quite common in traditional ranking systems, teaching and student learning experience turned out to be the most important criteria. Student support, teacher support, technological infrastructure, research and organization were deemed middle ground criteria, while sustainability and reputation were regarded as the least important criteria.

Keywords: university ranking, online education, quality in higher education, institutional reputation, Delphi study, performance indicators

Introduction

In an increasingly internationalized and globally connected scenario, the higher education arena is becoming an ever more competitive market, with universities under constant pressure to secure student numbers and research funding. As part of this phenomenon, the component of distance education is constantly growing in the framework of higher education, even though some providers of traditional education question its quality.

In such a context, university rankings—such as Academic Ranking of World University (ARWU) and Times Higher Education World University Rankings—have become powerful tools enabling universities, potential students, policy-makers and funders to measure and compare universities at a global level (Brasher, Holmes, & Whitelock, 2017). Despite their increasingly widespread use, university rankings have been strongly criticized for their social and economic implications, as well as for their technical implementation (Amsler & Bolsmann, 2012; Bougnol & Dulà, 2015; Lynch, 2015).

One such limitation is that, despite the crucial role distance higher education and online education providers (such as online universities) are known to play at the European level and worldwide (Li, 2018; High Level Group on the Modernisation of Higher Education, 2013), at present, existing university ranking systems do not consider their specific characteristics (Brasher et al., 2017; King, 2012). This issue has already been recognized by research in the fields of evaluation and assessment of the quality of online education, leading to the development of several benchmarking tools specifically tailored to evaluate the quality of online programmes or courses. However, since those instruments are not designed with the aim of ranking, they cannot be used to compare online higher education institutions (HEIs). There is a risk that current rankings of online universities misrepresent their actual quality, when compared to traditional universities.

It should be noted that the problem of evaluating online education, in general, can be tackled at different levels (from institution level to course level) and in different contexts (pure online versus blended). For example, one can consider the object of the evaluation to be online institutions (such as the open universities), traditional universities running only a few courses, entire programmes through the Internet, or, perhaps, MOOC providers and so on. Defining criteria and indicators for all of these situations (or any possible variant thereof) is an extremely delicate matter, thus each study needs to clearly state its target context. In this study, we focus on evaluation of online HEIs, rather than on individual online courses or programmes.

In order to develop a ranking tool tailored to capture the quality of online HEIs, we first need to understand what criteria and indicators are the most appropriate for measuring the specificities of online universities. In this paper, we present the approach we adopted to address this need and the results obtained, in an attempt to contribute to the debate about how we should valorize online HEIs within existing ranking systems. We seek to address the following research questions:

1. What criteria shall we consider for ranking online HEIs?

2. What indicators (and weights) shall we consider for ranking online HEIs?

To answer these research questions, we took a participatory approach to defining the criteria and indicators (i.e., the definition process involved several stakeholders and informants in an attempt to cover the broader HEI community). This was done on the assumption that taking into consideration the points of view of all relevant informant bodies and individuals is crucial for the criteria and indicators to be understood, recognized, accepted and ultimately used (Usher & Savino, 2006). Furthermore, this approach should lead to a comprehensive set of criteria and indicators that capture and evaluate all the aspects and variants at play.

Our purpose was to identify the features that reflect the peculiarities of distance institutions specifically; thus, we let aside from our study some criteria and indicators which can apply to any HEI (traditional or online), as these can be easily drawn from existing ranking systems, as will be further explained in the following sections.

Setting the Scene

The higher education world is becoming more and more complex, with a growing number of universities and education providers acting as commercial enterprises competing within a global market. According to Leo, Manganello, & Chen (2010), universities have to compete as well as consolidate or improve their reputation. In such a competitive environment, there are rapidly emerging tools that aim to represent the prestige and reputation of universities, generally in terms of perceived quality, by means of qualitative and quantitative indexes. These tools include internal and external quality assurance processes and procedures, accreditation, evaluation, benchmarking, accountability systems and university rankings.

Rankings are an established technique for displaying the comparative position of universities in terms of performance scales. These have become quite popular and are seen as a useful instrument for public information and quality improvement (Vlăsceanu, Grünberg, & Pârlea, 2007). Since 2003, when the ARWU was born, university rankings have been used by HEIs at global level as a means of becoming more visible, reputable and marketable. The most significant university ranking systems include global rankings (e.g., ARWU, Quacquarelli Symonds World University Rankings, Centre for Science and Technology Studies Leiden Ranking, U-Multirank), national rankings (e.g., Centre for Higher Education University Rankings, Guardian, United States News & World Report Best Colleges), and global discipline-focused rankings (e.g., Financial Times Master of Business Administration rankings). All these ranking systems periodically issue lists of ranked universities, based on criteria and indicators that are assessed, measured and then usually aggregated into one (or more) composite measure(s). Criteria and indicators vary from system to system, but they all share the same underpinning philosophy. Typically, the systems rely on self-reported data, provided by the institutions themselves, as well as surveys, bibliometric and patent data, and so on.

According to Bowman and Bastedo (2011), university rankings are said to influence HEIs on different levels, such as institutional aspects (organizational mission, strategy, personnel, recruitment and public relations), reputation, student behaviour, tuition fees and resource supply from external providers. Furthermore,

rankings are also increasingly being used as a policy instrument to assess the performance of institutions by governmental agencies (Salmi & Saroyan, 2007; Sponsler, 2009).

Most of the existing ranking systems are criticized for several methodological shortcomings (Amsler & Bolsmann, 2012; Barron, 2017; Bougnol & Dulà, 2015; Çakır, Acartürk, Alaşehir, & Çilingir, 2015; Lynch, 2015). Among the main weaknesses mentioned, many say rankings are not robust enough, especially as far as validity of indicators, methodological soundness, transparency of sources of information and algorithms, reliability, and so on (Billaut, Bouyssou, & Vincke, 2009; Bonaccorsi & Cicero, 2016; Kroth & Daniel, 2008; Turner, 2013). Furthermore, university ranking systems have been criticized for equity concerns (Cremonini, Westerheijden, Benneworth, & Dauncey, 2014).

Another key limitation of current ranking systems is that the dimension of online education is not represented. That is, most of the criteria and indicators used do not consider online education, so online universities are ranked according to the same indicators used for traditional universities (King, 2012). This shortcoming affects the representation and visibility of online universities, especially in terms of quality; they have quite specific features that set them apart from traditional universities, even though they share many of their goals. Thus, the need to have tools specifically designed to measure and compare the quality of the online services offered by HEIs is emerging with a certain urgency (Kurre, Ladd, Foster, Monahan, & Romano, 2012; Marginson, 2007).

Even if there are no rankings for online universities at present, there are several benchmarking initiatives in the field of online education, emerging from the need to tailor indicators to the specific context of online education. Examples include the Quality Scorecard Suite by the Online Learning Consortium (formerly Sloan Five Pillars), European Foundation for Quality in e-Learning, Quality Matters, and E-xcellence (European Association of Distance Teaching Universities). These tools are designed to assess quality at module and course or programme levels. Therefore, it may prove useful to look at their indicators and guidelines, as these may provide hints about crucial dimensions to focus on for measuring the quality of HEIs. However, since these instruments were not designed with the aim of ranking, they cannot be used to compare online HEIs.

Despite their recognised limitations, university rankings continue to be widely used, especially due to their increasing influence and to the fact that they "satisfy a public demand for transparency and information that institutions and governments have not been able to meet on their own" (Usher & Savino, 2006, p. 38).

Therefore, there is definitely a need to implement a ranking system able to reflect the specific nature of online education, in such a way that online universities are not evaluated by means of inappropriate indicators devised for traditional universities. This, however, presents a number of challenging aspects, not least of which is the need to identify the most suitable criteria and indicators for representing and measuring the nature of online universities.

Context of the Study

This study was undertaken in the context of CODUR Project, a European Erasmus+ project that ended in October 2018. The project aimed to generate a set of quality criteria and indicators for the measurement of

the worldwide online education dimension, and guidelines for integrating these online education quality indicators within other current ranking systems.

In accordance with the above-mentioned objectives, the partnership has dedicated considerable effort to defining a set of criteria and indicators that can be used to rank online HEIs. To this end, the partnership took a participatory approach through a Delphi study, involving informed experts in an effort to cover the broader online HEIs community.

Method

The Delphi method, first proposed by Dalkey and Helmer (1963), is a research technique based on consultation with a panel of experts through multiple questionnaire rounds. In Delphi studies, the results of previous rounds are usually used to prepare questionnaires for subsequent rounds, and participants remain anonymous and work independently.

The CODUR Project's Delphi study remotely involved a worldwide sample of experts, with the aim of defining the criteria and observable indicators for assessing the quality of online HEIs. Moreover, the Delphi study structure also allowed participants to suggest criteria and indicators that were not initially considered. More specifically, the Delphi aimed to:

- identify the criteria relevant for online educational institutions (Round 1);
- determine a non-ambiguous, agreed-upon definition for each criterion (Round 1);
- operationalize each criterion, by identifying multiple observable indicators (Round 2); and
- assign a relative weight to each indicator (Round 2).

The Delphi study research design is represented in Figure 1. In our case, since we started with a solid knowledge base, two rounds were deemed sufficient for the Delphi study (Iqbal & Pipon-Young, 2007), considering that a session of discussion using the Metaplan technique (http://www.metaplan.com/en/) laid the foundation for the first round with the experts (Jones & Hunter, 1995).

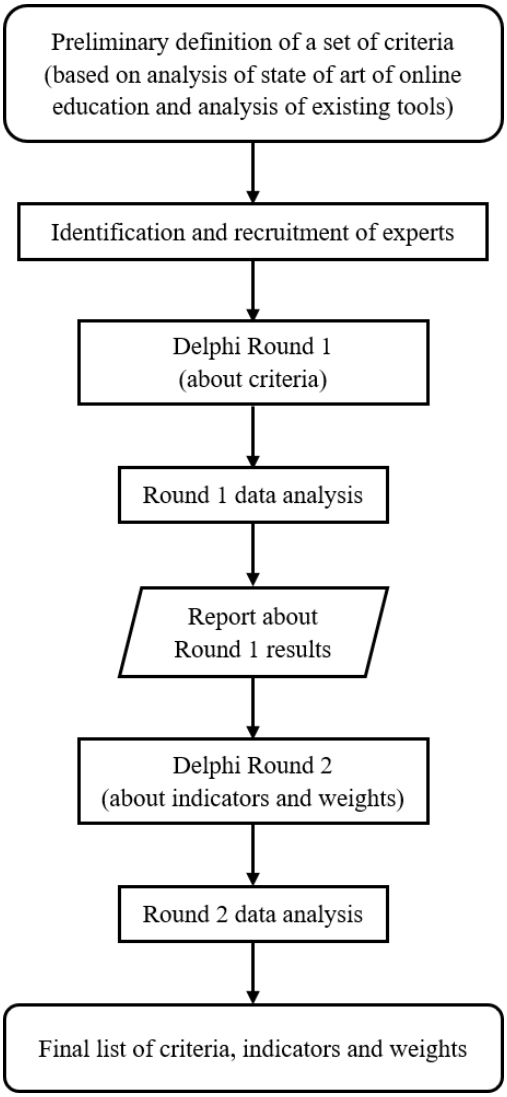

Figure 1. Delphi study research design.

In preparation for Round 1 of the Delphi study, a comprehensive analysis of the state of art in online education across the globe (Giardina, Guitert, & Sangrà, 2017) and a parallel study on the existing ranking systems and benchmarking tools (Brasher et al., 2017) were conducted. Presenting the results of these two analyses is outside the scope of this study. However, it is important to stress that the former analysis pointed out that online education is a global trend, growing at an accelerating rate; this confirmed the need for tools capable of evaluating and comparing the quality of the services offered. At the same time, the latter study, focusing on the indicators used in the existing ranking systems and in some of the most commonly used benchmarking tools, pointed out that we are far from having a unique or standardized way to measure quality and rank universities. On the contrary, the existing systems are heterogeneous, and the indicators adopted are very different and not always clearly defined and/or transparent. As a consequence, the results of these two analyses, which consisted of a huge set of heterogeneous indicators, were not directly usable as input proposal for the Delphi study, but the project partners needed to carry out an intermediate step aimed

at creating a more homogenous and limited set of indicators. To do so, the Metaplan technique was used as a collaborative method for the partners to define a more coherent and smaller set of indicators (Pozzi, Manganello, Passarelli, & Persico, 2017). As represented in Figure 1, the results of this initial phase led to the identification of preliminary criteria and indicators for the quality assessment of online HEIs which was then used as the starting point for the Delphi study. A questionnaire was prepared for Round 1 which, starting from the preliminary set put forward by the project, aimed to collect the experts' opinions regarding the proposed criteria and their definitions.

A panel of experts was recruited (details about the experts and related recruitment follow below) and each one was asked to individually fill in the first questionnaire. After Round 1, the experts were presented with an anonymized summary of the results and a second questionnaire, to trigger Round 2 (see Figure 1).

Both Round 1 and 2 of the Delphi study were carried out using LimeSurvey. The order of presentation of criteria and of indicators within each criterion was fully randomized for each participant.

Participants

The experts involved in the Delphi study consisted of a group of informed stakeholders including (a) researchers on online education; (b) educators working in online HEIs; (c) cross-faculty heads of e-learning; and (d) quality assurance (QA) professionals in traditional, hybrid and online HEIs. The list of experts to be contacted was drawn from the professional networks of the project partners, which include two reputable online HEIs, and great care was taken to include high-profile informants. The list included 140 well-known researchers and teachers—at international level—with expertise in the field of online education and/or HEI policy.

The process of recruiting experts was managed in two steps. A first e-mail was sent to formally invite each expert to participate to the Delphi study; a second e-mail was sent only to the experts who had agreed to participate, in order to provide them with all the information and the link to the questionnaire.

There were 40 participants in Round 1 of the Delphi study. Of these, there were 17 females, 19 males and 4 undisclosed. Participants' ages ranged from 35 to 72 (M = 53.95, SD = 9.47). Most of the participants (31) were from European countries, while 6 were from Australia, 1 from Israel, 1 from Canada and 1 undisclosed.

Fifteen participants reported being both researchers and educators; 12 were educators, but not researchers, and 8 were researchers, but not educators. The remaining 5 reported being either cross-faculty heads of e-learning or QA professionals in HEIs (see Figure 2). When asked how much they considered themselves informed about University ranking systems, 13 participants reported being slightly informed, 15 stated they were well informed and 11 were very well informed. No participant reported being not at all informed about ranking systems.

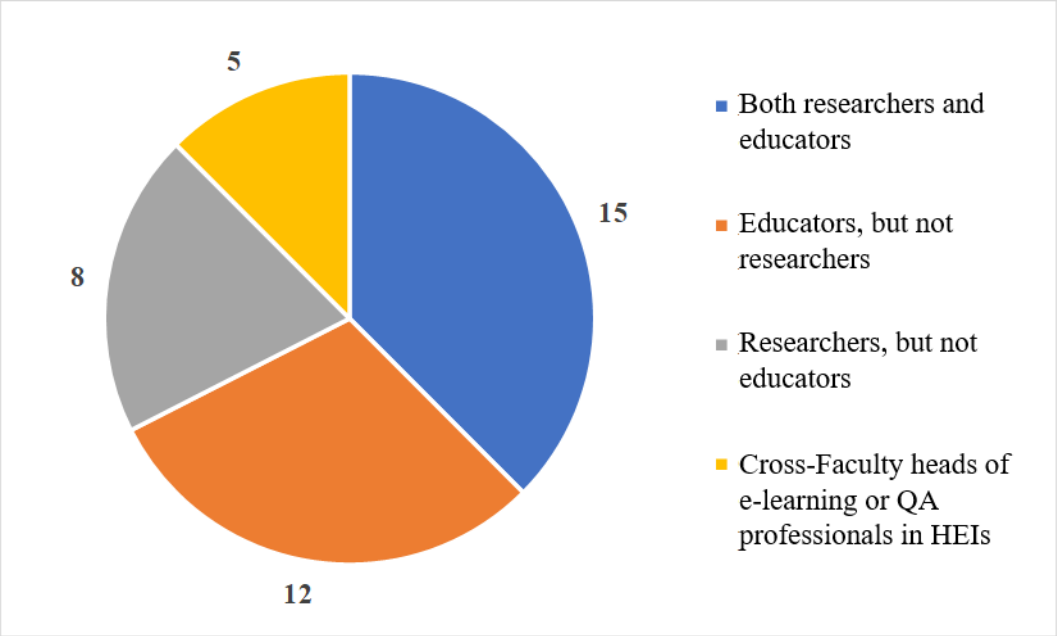

Figure 2. Round 1 Delphi study's experts' background.

All the experts who took part in Round 1 of the Delphi were invited to participate in Round 2. Of the 40 Round 1 participants, 21 took part in Round 2. A retention rate of 46.7% can be considered satisfactory for the scope of this study, and it is aligned with what is reported in literature (Hall, Smith, Heffernan, & Fackrell, 2018).

Results

At the beginning of the Delphi (Round 1) we proposed to the experts a set of nine initial criteria, along with their definitions, for the assessment of quality of online HEIs. The initial proposed criteria, as they came out from our analysis of the literature and existing tools, included:

- quality of learning experience,
- quality of teaching,
- quality of student support,
- quality of teacher support,
- reputation/impact,
- quality of research,
- quality of organization,

- sustainability of the institution, and
- quality of the technological infrastructure.

It should be noted that we intentionally avoided considering the performance of the HEI in terms of student achievement. Such criterion is usually present in the ranking systems we analysed, with indicators such as drop outs, student graduation rate, number of students graduated on time and so on. These indicators are outside the scope of this study, because they are not particular to online HEIs only and should be considered fundamental in any ranking system. Other criteria, such as quality of research, quality of organization, sustainability of the institution, and reputation/impact, which are also in principle applicable to traditional HEIs, it was decided these should be investigated in the study because the very nature of online institutions might change the related indicators.

Participants were asked to rank the criteria in order of importance and provide feedback on the suggested definitions. Moreover, they were asked to give suggestions regarding possible indicators for each criterion.

The resulting rankings were analyzed using Thurstone Case V Scaling (Thurstone, 1927), leading to a relative estimate of importance on an arbitrary scale (Round 1 data analysis). Criteria importance ratings are reported in Figure 3, with associated 95% bootstrapped confidence intervals. Asking participants to rank criteria, instead of judging the importance of each one separately, avoided the possibility that all criteria would be ranked as very important.

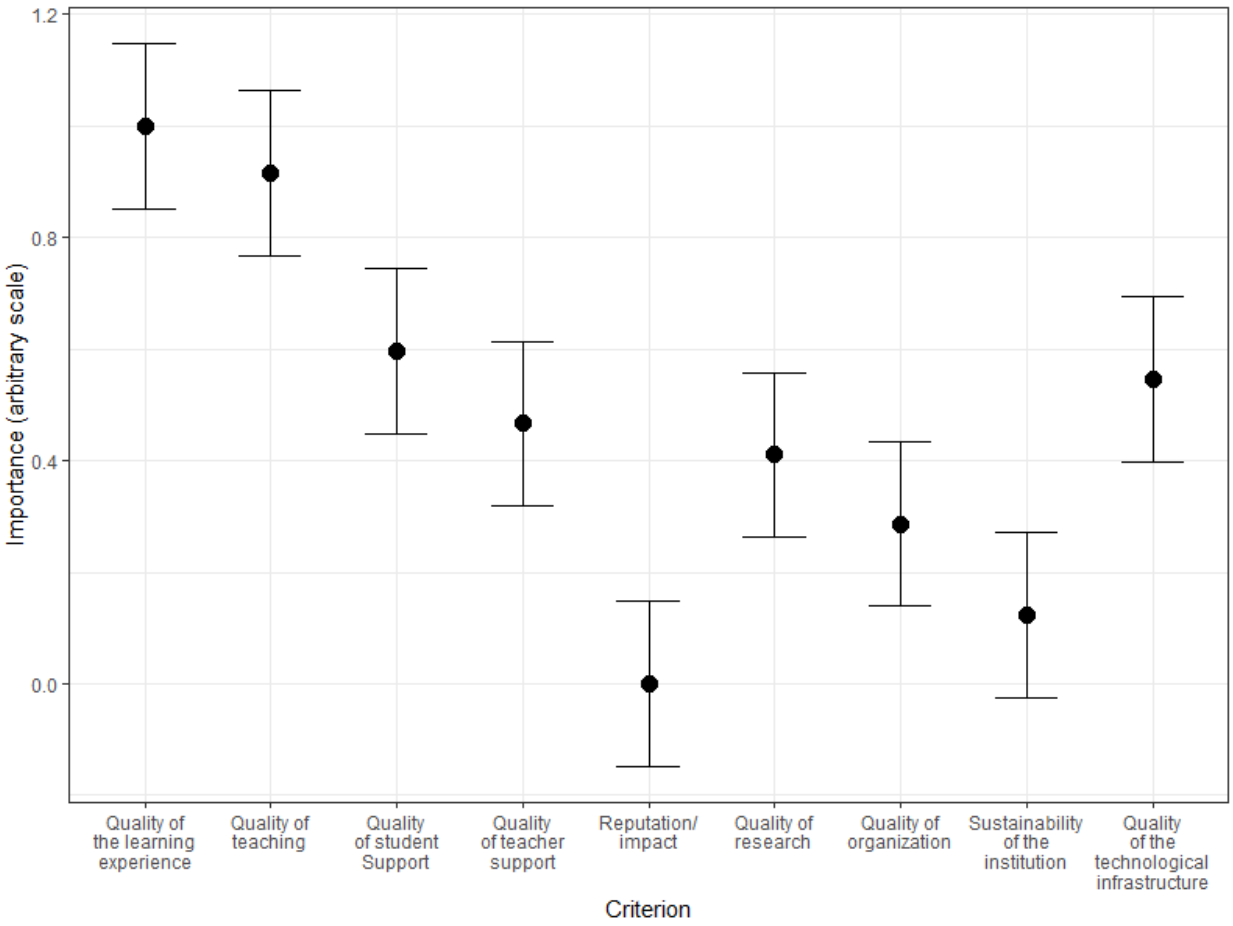

Figure 3. Delphi Round 1 data analysis. Relative importance of criteria with 95% confidence intervals, as estimated by Thurstone Case V Scaling.

According to the results reported in Figure 3, quality of teaching and quality of learning experience were the most important criteria; quality of student support, quality of teacher support, quality of the technological infrastructure, quality of research and quality of organization were deemed middle ground criteria. Sustainability of the institution and reputation/impact were regarded as the least important criteria.

Participants could also suggest adding or deleting criteria. While no deletions were proposed, participants suggested merging the criteria quality of teaching and quality of learning experience, which were perceived as highly overlapping.

This suggestion was accepted (see Table 1), and Round 2 of the Delphi was based on eight—rather than nine—criteria. Minor suggestions on rephrasing criteria definitions were also used to inform Round 2 of the Delphi. Table 1 contains the list of criteria and agreed definitions as they resulted from Round 1.

Table 1

List of Agreed Criteria and Their Definitions (Outcome of Round 1)

Criteria	Definitions
Quality of teaching and learning	The ability of the online HEI to offer effective learning experiences, in terms of sound design, delivery, adopted methods, learning materials, assessment means, and so on.
Quality of student support	The ability of the online HEI to provide support to learners in different areas (e.g., learning, orientation, socializing with peers, organisational issues, and use of technology).
Quality of teacher support	The ability of the online HEI to provide support to teachers and lectures in terms of training provision, organisational issues, use of technology, and so on.
Reputation/Impact	Impact on job market, institutional image, communication strategies, and so on.
Quality of research	The ability of the online HEI to carry out research initiatives and innovation projects.
Quality of organization	Availability of service's structures, efficiency of bureaucracy, and so on.
Sustainability of the institution	Sustainability includes aspects such as the size of the institution, availability of standardised procedures and strategic plans, resources, and so on.
Quality of the technological infrastructure	The ability of the online HEI to offer a sound technological platform, in terms of usability, accessibility, flexibility, types of features offered, and so on.

In preparation for the second round of the Delphi, we addressed the extensive list of observable indicators (75 in total) deemed relevant by Round 1 participants. The goal of the second round was to reduce this list to a manageable number of indicators (roughly half), selecting only those indicators considered most important by the experts we surveyed. We asked participants to choose at most half of the proposed indicators for each criterion. The number of experts who selected each indicator was used both to guide indicator selection and to obtain an estimate of the weight to be applied.

Table 2 reports the final list of 38 indicators chosen by participants as being most important, along with their associated weight. The final indicators we obtained rely on differentiated data sources. These include: (a) student and/or teacher and/or institutional surveys; (b) institutional self-reported data; (c) data coming from the review by an external panel of experts; and (d) bibliometric data.

Table 2

Complete List of Criteria, Observable Indicators, and Weights (Outcome of Round 2)

Criteria	Observable indicators	Weight
Quality of teaching and learning	Student satisfaction of the overall learning experience (through student survey).	16.5%
	Student satisfaction regarding adequacy of the adopted pedagogical approaches to the learning objectives (through student survey).	16.5%
	Institutional support for learning design, in terms of tools, formats, and so on (data provided by the institution).	15.2%
	Percentage of courses that propose personalized paths to reach the learning objectives (e.g., offering different materials or activities depending on culture, learning style, background; data provided by the institution or review by external panel).	11.4%
	Student satisfaction regarding learning materials (through student survey).	15.2%
	Percentage of courses and examinations that make use of diverse forms of assessment (e.g., quantitative and qualitative approaches, human-based and technology-based tools; data provided by the institution or review by external panel).	13.9%
	Student and teacher satisfaction regarding performance reports (through student and teacher survey).	11.4%
Quality of student support	Student satisfaction regarding interactions with teachers and tutors (through student survey).	55.6%
	Student satisfaction with technology support (including helpdesk, FAQ, wizards, support material and initial training; through student survey).	44.4%
Quality of teacher support	Teacher/tutor satisfaction with technology support (including helpdesk, FAQ, wizards, support material and initial training; through teacher survey).	34.7%
	Number of hours of training per year devoted to teaching staff about online learning (data provided by the institution).	22.4%
	Teacher and tutor satisfaction of training opportunities (through teacher survey).	24.5%
	Teacher and tutor satisfaction with feedback on their courses derived from students' surveys (through teacher survey).	18.4%

Criteria	Observable indicators	Weight
Reputation/Impact	Percentage of credits given in service-learning activities, in relation to total number of credits. (Service learning involves students in community service activities and applies the experience to personal and academic development; it takes place outside the HEI; data provided by the institution).	11.0%
	Number of clicks/likes/shares/comments/followers/impressions on academic social networks, such as Academia.edu, ResearchGate, and so on (data provided by the institution).	8.2%
	Percentage of post-graduates actively engaged after graduation (data provided by the institution).	11.0%
	Percentage of former students employed in job sectors matching their degree (data provided by the institution).	19.2%
	A composite measure taking into account the existence of joint/dual degree programmes, the inclusion of study periods abroad, the percentage of international (degree and exchange) students, the percentage of international academic staff (data provided by the institution).	16.4%
	The number of student internships (total per year; data provided by the institution).	8.2%
	The number of student mobility (total per year; data provided by the institution).	13.7%
	The proportion of external research revenues, apart from government or local authority core/recurrent grants, that comes from regional sources (i.e., industry, private organisations, charities; data provided by the institution).	12.3%
Quality of research	Internal budget devoted to research on online learning and teaching per full-time equivalent (FTE) academic staff (data provided by the institution).	16.5%
	Percentage of FTE staff involved in research on online learning and teaching (data provided by the institution).	17.7%
	Yearly average number of publications on online teaching and learning per FTE academic staff (WoS or Scopus publications; data provided by the institution or review by external panel).	17.7%
	Yearly average number of publications with authors from other countries per FTE academic staff (WoS or Scopus publications; data provided by the institution or review by external panel).	10.1%
	Internal budget devoted to disciplinary research per FTE academic staff.	10.1%
	External research income concerning disciplinary projects per FTE academic staff.	11.4%

Criteria	Observable indicators	Weight
	Yearly average number of publications per FTE academic staff (WoS or Scopus publications; data provided by the institution or review by external panel).	16.5%
Quality of organization	Percentage of student complaints or appeals solved or closed (data provided by the institution).	23.8%
	Number of FTEs employed for non-instructional, non-technical support services (e.g., providing assistance for admission, financial issues, registration, enrolment) weighted by student satisfaction for the service (data provided by the institution + student survey).	28.6%
	Student satisfaction with rooms, laboratory and library facilities (through student survey).	23.8%
	Student satisfaction with organization (through student survey).	23.8%
Sustainability of the institution	Availability of an Institutional Strategic Plan for Online Learning (online vision statement, online mission statement, online learning goals and action steps; data provided by the institution).	47.2%
	Percentage of curriculum changes resulting from an assessment of student learning (either formal or informal) within a fiscal year; measures increased flexibility within the curriculum development process to better respond to a rapidly changing world; data provided by the institution).	27.7%
	Percentage of total institutional expenditure dedicated to online programmes (data provided by the institution).	25.0%
Quality of the technological infrastructure	Student satisfaction with the overall learning platform (through student survey).	38.9%
	Measure of compliance with the accessibility guidelines WCAG 2.0 (through technical institutional survey).	36.1%
	Measure of interoperability, for example: (a) with external open sites (e.g., social media, DropBox, Google Drive); (b) between learning management systems; (c) information and teaching/learning materials exchange (e.g., LTI, SCORM); (d) single sign-on access control (data provided by the institution).	25.0%

Discussion

Evaluation, accreditation and ranking are critical aspects within the higher education community. However, even if evaluation, accreditation and ranking are somehow all facets of the same question, it is important not to mix them, as they point to different actions, each one with different aims. In this study, we have decided to focus on the ranking area.

The lack of specific indicators for ranking the quality of online education is seen as an urgent gap the higher education community needs to fill. Currently, the rank attributed to online universities is derived from criteria and indicators that were originally conceived to evaluate traditional HEIs; the risk of misinterpreting the actual quality of distance HEIs is very high, especially when they are compared to traditional universities.

In this paper, we have described the participatory approach we took, in order to fill in this gap, with the final aim of contributing to the debate about how we should valorize online HEs within existing ranking systems. In the following, starting from the data coming from the Delphi, we discuss the two research questions presented at the beginning of the paper.

Research Question One: What Criteria Shall We Consider for Ranking Online HEIs?

As a result of the overall process conducted, we came up with a set of 8 criteria and a total of 38 observable indicators deemed by our experts as able to well represent the peculiarities of distance education institutions (see Table 2). To these, we should add all kinds of indicators typically included in any ranking systems and not peculiar of online institutions, such as student performance indicators.

Regarding the eight criteria which the Delphi participants agreed on, we see that the quality of teaching and learning was considered highly important for evaluating online institutions (see Figure 3). Wächter et al. (2015) recommended focusing particular research effort on “adequate and internationally comparable indicators for the quality of teaching” (p. 78), something which seems to be missing or unsatisfactory in most existing ranking systems. This recommendation is reflected in our results, as the experts felt these criteria were the most important ones for measuring the quality of online HEIs.

Within this quality of teaching and learning criterion, our Delphi experts pointed out the importance of the learning design phase, as this should guarantee that effective pedagogical approaches are adopted and aligned with the learning objectives, and that adequate assessment procedures are put in place (see Table 2). In addition, our Delphi study pointed out the significance of teachers’ and students’ experience; this is also a crucial point that should be considered in any ranking system, possibly by collecting their opinions through surveys. Moreover, the ability of an online institution to offer personalized learning paths has been considered as deserving valorization, as this represents a distinctive element in respect to traditional universities, where personalization can be harder to achieve.

Quality of teacher support and quality of student support were both considered of medium importance (Figure 3). Regarding quality of teacher support, the experts pointed out the importance of measuring the online institution’s ability to provide continuous training opportunities for teachers especially in online

learning, as well as the importance of collecting their opinions on the adequacy of the support being offered (see Table 2).

The quality of the technological infrastructure is important in an online institution and should be measured, according to our experts, in terms of students' satisfaction, compliance with accessibility standards and interoperability.

As far as the quality of research is concerned, this was mainly valorized in terms of publications and budget (see Table 2), while it is the authors' opinion that these should be compounded also by measurements of the level of innovation and impact of research, which are hard to capture if we only look at publications and budget devoted to research.

Organization is measured in terms of efficiency of bureaucracy and adequacy of provided facilities (see Table 2). Reputation/impact, and sustainability of the institution, were positioned in the last places (Figure 3); this might be due to the fact that they are the result of all the other criteria.

The results contained in Figure 3, which represents the relative importance of criteria, can be used as preliminary weights, but in order to use them in practice they should be linearly transformed so that the lowest-ranked criterion (reputation) has a weight higher than 0. Ultimately, this is a matter of choosing how much impact the less important criterion should have on the overall ranking (e.g., should it be dropped? Should it matter at least 1%? Or 2%? Or 5%?). This choice cannot be made just by examining data, but requires careful consideration of the potential practical impact of assigning very different—or very similar—weights to the criteria.

It should be noted that some of the criteria are very much intertwined and the boundaries between them are often blurred. For example, quality of student support, quality of teacher support and quality of teaching and learning probably overlap or are strongly correlated. In addition, some of the interviewed experts raised the objection that the criteria should be independent variables. However, if we accept this position, it may become very difficult to find even two orthogonal criteria.

Research Question Two: What Indicators (and Weights) Shall we Consider for Ranking Online HEIs?

One of the most challenging and often questioned aspects of rankings is their ability to capture and measure the complexity of reality with a reasonable number of indicators. Even U-Multirank, which was an attempt to propose a reasonable number of transparent and easy-to-read indicators, has received recommendations to scale down and simplify its indicators (Wächter et al., 2015). With this in mind, in this study we tried to keep the number of indicators as low as possible, and ended up proposing, on average, four to five indicators per criterion.

Interestingly, the observable indicators proposed by participants for the teaching and learning criterion emphasised the (a) pedagogical approaches adopted, (b) learning design phase, (c) personalization opportunities, and (d) kinds of assessment available. These observable indicators seem particularly reasonable and in contrast with some of the indicators adopted by other existing ranking systems (such as U-Multirank), which focus on indicators of outcome (e.g., the percentages of graduations achieved on time

or the number of academic staff members with doctorates), or on other aspects (e.g., library or laboratory facilities), which deal with organizational and infrastructural aspects. Overall, we think the observable indicators proposed by our Delphi study for the teaching and learning criterion are so significant that we recommend their inclusion in other existing ranking systems addressing online or traditional universities. Similarly, we can identify some criteria for which the indicators suggested by our participants clash with those used in peculiar national contexts. For example, in Italy, sustainability is mainly conceptualized in terms of economic resources alone (Ministry of Education, University and Research, 2016). Among the indicators we selected the greatest weight was given to the availability of strategic plan detailing a vision of the place of online learning in the institution, clearly-stated goals and a plan to attain them—all intangible, but crucial, resources. On the other hand, some of the indicators we suggest are already monitored in some national contexts, and therefore adoption of our proposed list of indicators could be easier for some countries. For example, the UK's National Student Survey already collects several indicators related to student satisfaction, which is present, though in different facets, in several of our proposed criteria. In any case, a phase of adaptation to each national context would be necessary in the interest of optimizing resources for data collection, as well as identifying potential issues related to each country's educational infrastructure. More details on national adaptation of CODUR Project's indicators are presented in Pozzi et al. (2017).

As far as the indicators identified for reputation/impact, quality of research, quality of organization and sustainability of the institution, obviously in principle they can be applied to both online and traditional HEIs, but it is interesting to note that the very nature of online institutions often orients the focus of our indicators differently from those in existing ranking systems. For example, while the internal budget devoted to research is an indicator commonly found in other ranking systems (under the quality of research criterion), in our list of indicators it becomes internal budget devoted to research on online learning and teaching. So, even if the criterion might seem the same as those included in other ranking systems, deeper analysis of its internal indicators highlight that there are peculiarities for online HEIs that should be considered.

By contrast, the indicators for student support, teacher support and technological infrastructure concern aspects of stronger importance for online HEIs than for traditional ones. Nevertheless, we believe these latter dimensions should also be considered nowadays by face-to-face institutions, given that blended approaches are becoming increasingly common and important in traditional contexts as well.

Lastly, the observable indicators have been kept as simple, operative and raw as possible. We have tried to avoid complex or aggregated indicators, to support readability and ease of use for the final user. This does not prevent some being subsequently aggregated, in case one wants to provide a synthetic view of data.

In order to address the issue of transparency of indicators, which is often questioned for existing ranking systems, we have provided the weighting for each indicator, to make explicit the relative importance of each one in relation to the dimension under the lens. It should also be noted that these weightings, too, were assigned based on opinions expressed by the experts in the Delphi study.

Conclusions

Given the lack of ranking systems for distance education, the study presented in this paper aimed to devise a set of criteria and indicators reflecting the specific nature of online HEIs that could be integrated with existing ranking systems. Specifically, this study deals with the idea of defining criteria and indicators to be used for a university ranking system through a participatory approach, based on the iterative contribution of a number of expert stakeholders. This study contributes to the development, testing and refinement of representative quality indicators for online education based on consensus at three different levels: (a) the criteria that should be considered when assessing and ranking online HEIs, (b) the observable indicators that should be adopted for each criterion, and (c) the relative weight that should be applied to each observable indicator. The set of criteria and indicators presented in this paper could be considered both as a stand-alone set for a new ranking system, or, probably more wisely, as a sub-set to be integrated within already existing ranking systems, with the purpose of valorizing the online component of the considered institutions. Integrating our criteria and indicators into an existing ranking system would of course call for an additional step of identifying and deleting possible (partial or total) repetitions. This is something the CODUR Project has already started working on, by exploring in collaboration with U-Multirank the feasibility of integration.

Among the main conclusions of this research is the finding that teaching and student learning experience turned out to be of greater importance than all other criteria. Organization, student and teacher support, research and technological infrastructure were found to be middle ground criteria, while sustainability and reputation were deemed the least important.

The study took a participatory approach to the definition of the criteria and indicators; the design phase was not confined within the project boundaries but involved several stakeholders and informants and the broader higher education community, through the Delphi study, as advocated by Usher and Savino (2006). This led to a comprehensive, easy-to-accept set of criteria and indicators able to capture and evaluate all the aspects at play. Among the limitations of this study, we should note that we run the risk of having excluded stakeholders whose point of view should have been considered; for example, our initial list of proposed indicators included several technical indicators for measuring the quality of the technological infrastructure (e.g., server error rates, average response times). These indicators were among those least selected by our participants, and as such, they were not retained in our final indicators list. However, our participant selection and recruitment may have biased the selection of indicators, for example by not including the professionals charged to run and maintain the technological infrastructure of an online HEI.

Another challenge we faced during the study regarded terminology, which is not always uniquely defined, and can lead to misinterpretation. Providing definitions for terms at the beginning of each survey item was the best solution we found to mitigate the risk of misunderstandings, but we cannot guarantee that all the participants interpreted the definitions we provided in the same way.

Future work should focus on testing the indicators, evaluating their validity as well as the effort required to collect them, as this can become a significant barrier to adoption. Additionally, as argued in the discussion, application of the indicators to specific HEI contexts (e.g., countries) could require their fine-tuning and adaptation, to better reflect characteristics specific to each context.

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An Online College Near Me: Exploring the Institutional Factors of E-Learners' Local Orientation

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Abstract

One advantage of online learning settings relative to conventional classrooms is their anytime, anywhere accessibility. While online education programs provide students with flexible learning opportunities free from the restrictions of geographic location, a consistently growing number of students who prefer to learn exclusively online still choose nearby colleges. The choice to attend a local college by exclusively online learners is an interesting phenomenon, because most of these students rarely visit campus at any point in the process of obtaining their degrees. This study aims to explain this localized distance student enrollment pattern using Integrated Postsecondary Education Data System data and Homeland Infrastructure Foundation-Level Data from the fall of 2016. This research uses a multiple regression technique to explain the relationship between institutional factors and localized distance student enrollment patterns in the US. This study utilizes the C^2Q (cost, convenience, and quality) model to explain the local orientation of e-learners. The findings show that convenience and quality of education are significantly associated with each local institution's share of exclusively online learners in the same state.

Keywords: proximity, online education, college choice, human capital theory

Introduction

Numerous college students prefer to study locally for a variety of reasons. Staying close to home may have both financial and academic benefits. Studying at a nearby college has become a more attractive choice than ever before due to the continuously rising costs of attending college (Hillman, 2016), particularly among low-income students (Griffith & Rothstein, 2009; Ovink, Kalogrides, Nanney, & Delaney, 2018). Students and their parents may potentially save a considerable amount of the cost of attendance by living at home, decreasing expenditures on on-campus housing, food, and transportation.

The location of colleges in relation to students has been a key assumption in increasing the accessibility of the American higher education system and equal access to education for all at the policy level. For the past two decades, however, the system has shifted from using the face-to-face classroom as the primary means of course-delivery to using online formats. Between 2015 and 2016, among about 20 million American students (17 million undergraduates and 3 million graduates), 6 million students took more than one distance course, and approximately half (2.2 million undergraduates and 0.8 million graduates) were exclusively online learners (McFarland et al., 2018; Seaman, Allen, & Seaman, 2018).

Hypothetically, the 3 million exclusively online learners (e-learners) are less constrained by geographic limitations than are traditional college students. In 2014, 58% of high school graduates attended a college within 100 miles of their home, and 72% stayed in-state (Chokshi, 2014). Interestingly, nearly three-quarters of online students reported that they were enrolled at an institution located within 100 miles of their home (Clinefelter & Aslanian, 2017) and more than half of e-learners remained in the same state in 2016 (Seaman et al., 2018). This calls into question the assumption that e-learners tend to be free from geographic limitations when choosing to enroll in a college. Considering the geographically unlimited possibilities of e-learners' college choices, this persistent proximity effect is an interesting phenomenon. Moreover, the proportion of American in-state e-learners has been continuously growing since 2012 (Seaman et al., 2018).

At the individual level, online students tend to be nontraditional students who work full-time, support family members, are older, and are female (Kramarae, 2001; Ortagus, 2017; Radford, 2011). Nontraditional students tend to maintain social relationships with their families, workplaces, and communities, so they might choose one of the nearest and most affordable colleges due to convenience and budget restrictions (Kim & Rury, 2011; Perna, 2010). Although factors specific to the individual e-learner may explain why a group of students prefer in-state colleges, the reasons why some local institutions have a relatively larger number of in-state e-learners remain under-examined.

Understanding how institutional characteristics affect e-learners' decision-making processes would assist higher education administrators in developing more effective student recruitment and marketing strategies. What local e-learners expect from their nearby institutions is an important yet underexamined issue in online college education literature. In this respect, this study addressed the following research questions. Which local institutions tend to have a relatively larger number of in-state e-learners compared to other institutions in the same state? Which institutional factors influence e-learners' choice to enroll at nearby colleges? To answer these questions, a multiple regression analysis was conducted with the Integrated

Postsecondary Education Data System (IPEDS) data and Homeland Infrastructure Foundation-Level Data (HIFLD) from the 2016 academic year.

Literature Review and Theoretical Frameworks

Literature Review

The existing literature discusses college choice with a focus on traditional students' individual developmental process during their senior year of high school (Paulsen & St John, 2002; Perna, 2006). College choice studies have been guided by the three-stage model of predisposition, search, and choice (Hossler & Gallagher, 1987; Hossler, Schmit, & Vesper, 1999; Perna, 2006). All three stages are regarded as corresponding to the childhood and adolescence periods, with a focus on the 10th through 12th grades in general. However, the traditional college choice model has many limitations regarding the analysis of online learners' behavior for two reasons.

First, the characteristics of e-learners, in general, do not align with young high school graduates' decision-making processes, because e-learners tend to be nontraditional students. In general, seven characteristics represent the traits of the heterogeneous group of nontraditional students: (a) delayed enrollment; (b) part-time enrollment; (c) 35 or more working hours per week; (d) financial independence; (e) caregiver who has children or dependents other than their partner; (f) single parent; and (g) no high school diploma, general education diploma, or any other type of equivalent certificate (Radford, Cominole, & Skomsvold, 2015). Over the last few decades, there has been no shortage of higher education research on college choice; however, little is known about the college choices of nontraditional students (Perna, 2010) and that of distance students (Lansing, 2017).

Second, previous distance education studies have commonly reported that convenience and flexibility were key characteristics of online student college attendance. According to a recent qualitative explorative study on the online learning experience of students at community colleges, most students preferred to choose online options for relatively easy academic subjects, whereas they chose to take the course face-to-face when it dealt with difficult or more important academic subjects (Jaggars, 2014). The assumption that many distance students are seeking convenient and flexible options to allow them to carry out adult responsibilities during their college years has been accepted in most studies of distance students (Lansing, 2017). In the traditional college choice literature, the time at which a student becomes predisposed to attend college has been regarded as very important. The earlier a student makes this decision, the more time he or she is likely to have to prepare for college. However, for many adult students, spending significant time searching and preparing for college could have different implications, because the time spent on college choice could limit the time available for their many other adult responsibilities. In other words, adult students are more likely to spend a shorter amount of time on college choice than are younger students, due to their life circumstances. In fact, 60% of online college students submitted college applications within four weeks or less after beginning their search process, and almost 90% applied within three months (Clinefelter & Aslanian, 2017). These facts suggest that online students prioritize convenience in their college choice process.

Perceived convenience as a significant factor in college decision-making has been only partially discussed in the college proximity literature. According to Dache-Gerbino (2016), geographic inquiry in college access studies is categorized as proximity research, which focuses on the influence of spatial location on youths' enrollment in college. College proximity researchers (Hillman, 2016; Tate, 2008; Turley, 2009) employed geography of opportunity as a key concept, which originated in the literature on housing (de Souza Briggs, 2005; Rosenbaum, 1995). They predicted that a student's residential location in proximity to colleges might affect her social and economic opportunities and life outcomes.

Turley (2009) argued that the residential location of students may influence every stage of college access and choice phases. She hypothesized that students' proximity to more colleges and universities helped them to develop higher educational aspirations, consequently resulting in a higher likelihood of participation in the actual college admission process. Turley's (2009) empirical study showed that an increase in the number of nearby colleges was significantly associated with an increase in the number of college applicants and college-goers, and nearby four-year college influences were especially distinctive. According to Turley's (2009) theoretical framework, local college orientation is explained by two interrelated mechanisms: the convenience mechanism and the predisposition mechanism. The convenience mechanism refers to a greater likelihood of obtaining convenient access to a college logistically, financially, emotionally, and socially. For instance, it is far easier to visit a local campus and talk to its staff than to do so at faraway colleges. Also, financially, in-state tuition, the possibility of local scholarships, and other tuition-saving strategies will likely be more widely available for those who choose a local campus than for those choosing a distant college. The predisposition mechanism refers to the possibility of increasing the educational aspirations of local youth due to frequent interactions between colleges and community members. For instance, the community outreach program of a large public university will likely impact the postsecondary level educational aspirations of local youths (Turley, 2009). Hillman (2016) used the term spillover effects to comprehensively explain proximity college effects by encompassing the two mechanisms of Turley (2009) and other possibilities (e.g., collective consciousness, civic engagement).

According to the IPEDS college enrollment statistics, the number and percentage of e-learners varied greatly depending on the type of institution and degree level sought, especially between public and private institutions. As shown in Figure 1, public institutions have much higher numbers and percentages of in-state e-learners than do private institutions. Specifically, public two-year institutions have the highest percentage of in-state e-learners, and private institutions have much smaller percentages; in particular, for-profit institutions have the highest percentage of out-of-state e-learners.

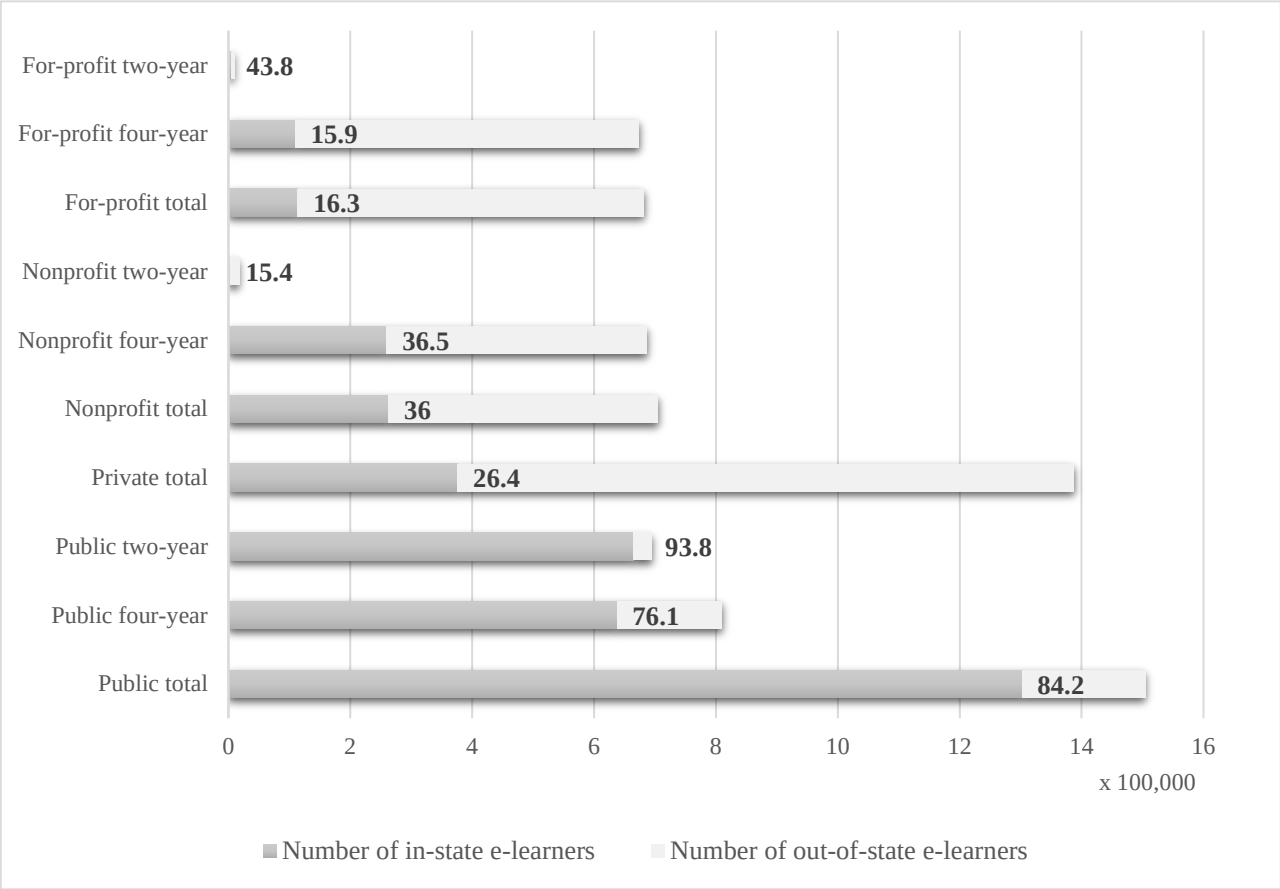

Figure 1. Number and percentage of e-learners by institutional type and location of students in fall 2016. Adapted from "Table 311.15. Number and percentage of students enrolled in degree-granting postsecondary institutions, by distance education participation, location of student, level of enrollment, and control and level of institution: Fall 2015 and fall 2016," by U.S. Department of Education, National Center for Education Statistics, 2018 (https://nces.ed.gov/programs/digest/d17/tables/dt17_311.15.asp). In the public domain.

In sum, current college choice theories of traditional students' individual developmental process during their senior high school year may not explain online students' local orientation, because it is difficult to accommodate (a) nontraditional student characteristics and their different college choice process, (b) proximity effect, and (c) different institutional type. Therefore, an alternative theoretical framework will be proposed in the following section, with four hypotheses addressing the different characteristics of e-learners' college choice.

Theoretical Frameworks

Both local colleges and distance education options promise flexibility, convenience, and affordability, which are especially preferred by nontraditional students. Levine (2001) found that the nontraditional college student's attitude toward college resembles that of a consumer:

> older, part-time, and working students, especially those with children, often said in a national study I conducted (1998) that they wanted a very different type of relationship with their college than students have historically had. They preferred relationships like those they already had with their bank, the electric company, and the grocery. Today's older adult students are bringing precisely the same consumer attitudes to higher education. They are looking for just four things from their colleges—convenience, service, quality, and low cost. (p. 256)

Also, in a recent survey, when online students were asked to select the three most important factors of college choice, tuition and convenience were among the top three (Clinefelter & Aslanian, 2017). In this respect, three theoretical perspectives were applied to explain the underlying factors of local college orientation regarding low cost, quality of education, convenience, and available student services: (a) human capital theory, (b) college proximity theory, and (c) relational marketing theory. Based on these theories, this study proposed the C^2Q model, which suggests that the various factors of the local orientation of e-learners might fall into three categories: cost, convenience, and quality of education and service.

First, economic factors have been discussed in postsecondary research literature mainly based on human capital theory (Becker, 1964; Mincer, 1958; Toutkoushian & Paulsen, 2016). While other types of investments also improve human capital, education is among the most worthwhile of human capital investments. The rational model of human capital investment predicts that individuals decide to invest in additional education based on a comparison of the expected lifetime benefits and the expected costs. Based on human capital theory, e-learners might assume that additional years of online education will raise their productivity, and thus future earnings. In addition to the substantial benefit of an increase in earnings, other long-term benefits, including a more fulfilling work environment, better health, and lower probabilities of unemployment might be expected by e-learners. Hypothetically, if colleges in the same state provide the same quality of education, a local e-learner would likely choose the most affordable college among them to minimize the cost of attending. Therefore, this study hypothesized that in-state tuition will predict the college choice of in-state e-learners.

The role of lower in-state tuition. Hypothesis One states that for the same state, an institution with lower in-state tuition will have a relatively larger number of in-state e-learners. The total costs of attending incurred by e-learners might be minimized by choosing the lowest tuition, but the benefits of the cheapest college choice could vary depending on various institutional factors because e-learners might consider convenience, and quality of education and service as much as low cost. In recent surveys of 1,500 online students conducted by Aslanian Market Research and Learning House, about 25% of students reported that they were willing to pay more for a higher quality program (Clinefelter & Aslanian, 2016, 2017; Magda & Aslanian, 2018).

Quality of education has been operationalized differently by researchers with different data sources (Shin, Toutkoushian, & Teichler, 2011). For instance, *Barron's Profiles of American Colleges* (Thomas & Zhang, 2005), *U.S News and World Report* college rankings (Bastedo & Bowman, 2010), and institutional expenditure for students and the average SAT scores of first-year students in IPEDS (Toutkoushian & Smart, 2001) have all been used by past researchers. This study employed IPEDS data because most institutions offering online programs have often been excluded from other college ranking data sets. In addition, college major choice and institutional prestige have been widely accepted as the two major predictors of economic

benefits after graduation. College graduates from more prestigious and more selective colleges gained small but consistently significant wage premiums relative to peers graduating from lower-quality institutions (Thomas & Zhang, 2005). Based on human capital theory, individuals might be willing to take a huge financial risk to attend prestigious colleges that promise greater economic rewards (e.g., earnings), but the same investment mechanisms might be rare in the case of students who attend less prestigious institutions. In fact, numerous online education researchers have accepted that concern over the quality of online education is growing, especially with regard to student attrition (Lee & Choi, 2011). The average attrition rates of online college students are at least 10% higher than those of students matriculating in conventional classrooms (Carr, 2000; Jenkins, 2011; Patterson & McFadden, 2009; Xu & Jaggars, 2011). Given the low completion rate of e-learners, it might be necessary to examine several hypotheses in terms of the selectivity and expenditure of institutions in conjunction with the graduation rate of the institution:

Association of college choice and quality of education. Hypothesis Two states that the quality of education with regard to admission selectivity, graduation rate, and expenditure of institutions will be associated with the college choice of in-state e-learners. Additionally, this study acknowledged the effect of a college's geographic location on convenience (as perceived by students), as shown by the college proximity literature. Hypothetically, if colleges in the same state provide the same quality of education for the same price, a local e-learner will likely choose one of the nearest colleges, because it is the most convenient and comfortable choice for her due to the spillover effects of college proximity. Based on proximity theory, this study examined a third hypothesis.

The effect of an institution's population base. Hypothesis Three states that an institution located in a more populous area will have a relatively large number of in-state e-learners. Despite the growing popularity of online education, top tier universities provide online options exclusively for continuing education programs and Massive Open Online Courses (MOOCs) (Hanover Research, 2014). Also, "a marked stigma attached to online degrees throughout the hiring process" is prevalent in many workplaces (Columbaro & Monaghan, 2009, para. 32.; see Kizilcec, Davis, & Wang, 2019). *The Chronicle of Higher Education* conducted a survey of 50,000 employers who hire recent college graduates in order to understand employer perceptions, and found a consistent pattern of negative employer responses to online degrees (Chronicle of Higher Education, 2012). Unlike the few prestigious schools, which serve the highest achieving traditional-age students, none of the less prestigious institutions that offer online degree programs have sufficient prestige to recruit on that basis. For the less prestigious institutions, student recruiting or marketing consists of identifying and targeting potential customers (prospective e-learners), wooing them, and developing strong relationships. In this respect, although human capital theory and proximity theory both informed the study as to why some local colleges might be more attractive to e-learners than others due to their affordable tuition and accessible locations, this study employed relational marketing theory to examine the influence of quality of service on local college orientation.

Non-prestige-based alternative strategies might aim to satisfy customers by improving service quality. In fact, according to Clinefelter and Aslanian's (2017) survey, the number of transferrable credits and institutional responsiveness influenced e-learners' college choice significantly. In this respect, this research assumed that the quality of service tends to follow relational marketing strategies. Helgesen (2008) identified four factors of relational marketing in the context of higher education: (a) service quality, (b)

available facilities, (c) information technology, and (d) social activities. Helgesen's (2008) survey results showed that service quality and information technology were the two most influential factors for improved student value.

The role of quality of student service. Hypothesis Four states that the quality of student service will be associated with the college choice of in-state e-learners. In this study, available student services such as alternative tuition plans, prior-learning assessments, and career counseling services were used to examine the quality of service.

Summarizing the theoretical framework. The proposed theoretical framework for this study predicted that cheaper and more populous areas near colleges would have a relatively larger number of in-state e-learners because students might choose the most affordable, convenient, accessible, and familiar institution. Also, the framework suggested that the quality of education, as well as the quality of student service, will explain the college choice of e-learners. The various factors fell into the three main categories of institutional factors, namely cost, convenience, and quality of education and student service.

Methods

Data Collection

The main data source for this research came from the IPEDS, for which the National Center for Education Statistics gathered various data from annual mandatory surveys of US postsecondary institutions. The colleges and universities section in the HIFLD provided multiple geospatial data for the postsecondary institutions in the IPEDS for the 2016–2017 school year. Data were retrieved for e-learner enrollment, tuition and fees, population, admission selectivity, graduation rates, institutional expenditure, and service for fall 2016.

Enrollment. The IPEDS offers enrollment data for distance students, including students who have been enrolled exclusively in distance education courses since 2012. This research uses the number of an institution's e-learners who reside in the same state. This research modified the original enrollment variables by calculating the percentages within local institutions from the same state to reflect differences in the number of e-learners and institutions across specific states.

Cost. The IPEDS reports comprehensive data on tuition, fees, and other costs of attendance for each institution every year. This research creates a new tuition variable by calculating the difference between the average in-state tuition and the tuition of each institution in the same state to reflect differences in the amount of in-state tuition and fees across each state.

Proximity. The HIFLD offers the total number of the population around each institution's geographic location. This research modified the original variable by calculating the shares of institutions in the same state to minimize the impact of differences in population across each state.

Selectivity and graduation rate. This study categorized all institutions into three groups: (a) non-selective (admission rate of 100%); (b) selective (admission rate lower than 100% and higher than the average of 35.33%); and (c) highly selective (admission rate lower than the average), because the distribution of the admission rate was left-skewed due to the large number of institutions offering open admission policies. The average admission rate was calculated before assigning a 100% admission rate to those institutions with open admission policies but lacking a reported admission rate. Otherwise, the original graduation rate variable in the IPEDS was employed without modification because its distribution was not skewed.

Expenditure. Toutkoushian and Smart (2001) examined institutional expenditure as one of the indicators of quality of education and used expenditure for instruction, academic support, and institutional support data. The present study used the same categories in Toutkoushian and Smart to examine the effect of institutional expenditures used primarily for students. In the regression model, the percentage of the three categories of the expenditure for students was employed. The total amount of expenditure was not selected because public, private, and for-profit institutions employed different accounting standards (e.g., the Financial Accounting Standards Board [FASB] and the Governmental Accounting Standards Board [GASB]).

Service. To examine the effect of student service quality on e-learner enrollment, this research collected data from the several items in the IPEDS institutional characteristics survey data, such as (a) academic/career counseling service; (b) employment service; (c) placement service; (d) on-campus daycare for students' children; (e) alternative tuition plans; (f) non-traditional credits; and (g) services and programs for service members and veterans. To dichotomize the categorical variables, three values of no, not reported, and not applicable in the original data were converted to 0, and only all yes responses were assigned 1.

Table 1 provides information on the average number (mean), standard deviation, minimums, and maximums for each variable. The cost variable, which refers to the difference in in-state tuition and fees between each institution and the average, has a relatively higher value than the other independent variables due to their unit of measurement, which is the US dollar.

Table 1

Descriptive Statistics

Variable	Mean	SD	Min.	Max.
Dependent variable	1.97	0.09	0	73.78
Independent variables				
Cost	0	211.32	-21250.66	43018.42
Proximity	1.97	0.08	0	59.87
Selectivity	0.79	0.02	0	2
Graduation rate	38.32	0.42	0	100
Expenditure for student				
% instruction	41.05	0.22	0	79
% academic support	10.64	0.14	0	62
% institutional support	20.29	0.22	0	84
Service for student				
Military member friendly	0.03	0	0	1
Dual credit	0.92	0.01	0	1
AP credit	0.96	0	0	1
Remedial	0.84	0.01	0	1
Academic counseling	0.99	0	0	1
Employment	0.90	0.01	0	1
Placement	0.82	0.01	0	1
Daycare	0.31	0.01	0	1
Alternative tuition plan	0.90	0.01	0	1

Table 2 describes the correlation coefficients of independent variables with the dependent variable. Pearson's product-moment correlation coefficient, which is a measure of the strength of a linear association between two variables, was measured to explore the potential for bias since many indicators of institutional characteristics were not included in the model. Mostly weak associations between the dependent variable and independent variables were identified, except in the case of the proximity variable. Any potential multicollinearity among predictors was not identified; the Variance Inflation Factors (VIFs) of the variables were less than 2, except that of the selectivity (2.76) and cost (2.06) variables.

Table 2

Correlations of Dependent Variable With Other Measures

Measures	Correlation
Cost	-0.1193
Proximity	0.6697
Selectivity	-0.0543
Graduation rate	-0.0743
% Instruction	0.0346
% Academic support	0.0321
% Institutional support	-0.1160
Military member friendly	-0.0647
Dual credit	0.0683
AP credit	0.0588
Remedial	-0.0017
Academic counseling	0.0307
Employment	-0.0007
Placement	0.0072
Daycare	0.0855
Alternative tuition plan	0.0489

Data Analysis

The primary goal of this study was to determine whether the e-learner shares of local institutions in the same state are affected by the cost, convenience, and quality of education and service. As a multiple regression analysis, this study used the following explicit functional forms for an explanation of various variables by grouping them into six different categories:

$$E_{ij} = \alpha + \beta_1 T_{ij} + \beta_2 P_{ij} + \beta_3 S_i + \beta_4 G_i + \beta_5 X_i + \beta_6 V_i + \epsilon_i$$

On the left side of the equation, E_{ij} represented the estimated proportion of the in-state e-learners at *i* institution relative to the total number of e-learners in *j* state. On the right side, T_{ij} represented the tuition difference of *i* institution in *j* state, P_{ij} referred to the proportion of the population of nearby institution *i* in *j* state that indicates proximity. S_i represented selectivity, which encompassed the admission rate and open admission policy; G_i referred to the graduation rate; X_i indicated institutional expenditures for student; V_i

encompassed multiple variables related to student services. The six coefficients β_k represented the partial effects of the independent variables described in the above section.

Results

To assess whether institutional factors affect the college choice of local e-learners in the US, this study estimated multiple regressions for in-state e-learner enrollment. As shown in Table 3, models (1), (2), (3), and (5) were nested in the full model (4) because they represented special cases of model (4), which contained all predictor variables. In multiple regression, the coefficient of determination (R-squared) represented the percentage of deviation in the dependent variable explained by all independent variables together. The first three nested models showed relatively smaller R-squared values than the full model, but model (5) reported nearly the same R-squared value as the full model. To obtain model (5), this study used the *step* function, which is one of the built-in functions in R software for stepwise model selection (R Core Team, 2016). The step function is used for stepwise variable selection process which helps to find a nested model with the lowest value of Akaike's information criterion (AIC) by repeatedly adding or dropping variables among all predictors in the full model, and AIC is one of the most widely used criterions in regression variable selection (Fox, 2016; Gujarati & Porter, 2009). This study used the Stargazer package in R (Hlavac, 2018) to print multiple regression results in a single table.

Table 3

Multiple Regression Models Explaining In-State E-Learner Enrollment

	Dependent variable				
	A proportion of local e-learners at an institution in the same sate				
	(1)	(2)	(3)	(4)	(5)
Private four-year	-1.963***			0.580**	0.342
	(0.231)			(0.280)	(0.208)
For-profit four-year	-1.860***			-0.573	-0.726**
	(0.332)			(0.365)	(0.331)
Public two-year	-0.969***			-0.435*	-0.471**
	(0.227)			(0.227)	(0.224)
Private two-year	-3.058***			-0.899	-1.114
	(1.074)			(0.819)	(0.802)
For-profit two-year	-2.904***			-0.733	-0.804
	(0.636)			(0.585)	(0.515)
Tuition		-0.00001		-0.00001	
		(0.00001)		(0.00001)	
Proximity		0.751***		0.784***	0.783***
		(0.016)		(0.017)	(0.016)
Selective		-0.806***		-0.758***	-0.805***

		(0.186)		(0.230)	(0.227)
Highly selective		-1.139***		-1.064***	-1.159***
		(0.179)		(0.242)	(0.232)
Graduation rate			-0.021***	-0.033***	-0.035***
			(0.004)	(0.004)	(0.004)
% of instruction			-0.005	0.023***	0.023***
			(0.009)	(0.007)	(0.007)
% of academic support			0.019	0.038***	0.038***
			(0.014)	(0.010)	(0.010)
% of institutional support			-0.040***	0.013*	0.014*
			(0.009)	(0.008)	(0.008)
Military member friendly			-1.149**	-0.633	-0.580
			(0.539)	(0.398)	(0.391)
Dual credit			0.933**	0.665**	0.630**
			(0.365)	(0.275)	(0.262)
AP credit			0.408	-0.232	
			(0.461)	(0.376)	
Remedial			-0.589**	0.004	
			(0.252)	(0.186)	
Academic counseling			0.697	1.034	
			(1.148)	(0.842)	
Employment			-0.426	-0.163	
			(0.351)	(0.257)	
Placement			0.083	-0.190	-0.243
			(0.256)	(0.188)	(0.170)
Daycare			0.539***	-0.407***	-0.402***
			(0.199)	(0.154)	(0.153)
Alternative tuition plan			0.807***	0.715***	0.736***
			(0.288)	(0.212)	(0.210)
Constant	3.124***	0.986***	1.593	-1.046	-0.146
	(0.170)	(0.100)	(1.301)	(0.992)	(0.570)
Observations	2,593	2,593	2,593	2,593	2,593
R^2	0.034	0.467	0.035	0.497	0.496
Adjusted R^2	0.032	0.466	0.031	0.493	0.493
Residual std. error	4.373 (df = 2587)	3.250 (df = 2588)	4.377 (df = 2579)	3.166 (df = 2570)	3.166 (df = 2575)
F statistic	18.350*** (df = 5; 2587)	565.867*** (df = 4; 2588)	7.296*** (df = 13; 2579)	115.479*** (df = 22; 2570)	149.301*** (df = 17; 2575)

*p<0.1. **p<0.05. ***p<0.01.

Among the four main hypotheses, the hypotheses about quality of education and proximity were strongly supported; the effect of quality of service was partially supported, but the first hypothesis about cost was not supported by the regression results. The selected model (5) suggested the following findings. First, the cost was not a decisive factor of each local institution's share of e-learners within the same state. Given the larger number of in-state e-learners attending public colleges (Figure 1), the impact of tuition benefits for public institutions would diminish when e-learners select a specific local college to attend.

Otherwise, the effect of proximity was apparent, which strongly supported the main assumption of this study about the local orientation of e-learners. Based on the literature review, this study predicted that proximity theory would facilitate an understanding of why some local colleges would be more attractive for e-learners than others, due to their accessible location. The findings of the study suggested that the college choice mechanisms of convenience and predisposition in Turley's (2009) study should be applied in order to understand the relationship between college proximity and perceived convenience regarding the local college choice of e-learners.

Next, the overall negative effects of selectivity and graduation rate were statistically significant. These results required more detailed interpretations of the effect of quality of education, because selective and highly selective institutions with higher graduation rates would have a smaller proportion of e-learners, compared to institutions that offered an open admission policy, which was regarded as a reference category in the regression process. The research results supported the hypothesis of quality of education, but in a problematic way: low-quality institutions tend to have a larger share of in-state e-learners. The negative effect of quality of education would mean the strong preference for convenience among e-learners allows them to sacrifice quality education for the sake of quick and easy access. This result corresponded to widespread concerns about higher attrition rates, because, as Engstrom and Tinto (2008) addressed, the open-door policy common at the bottom of the college pyramid turns out to be more of a so-called revolving door, since it does not guarantee degree completion, especially for many underprivileged students. This, in turn, can impact later social mobility for this population.

Last, the negative effect of on-campus daycare services and the positive effects of dual credit and alternative tuition plan services were identified. When considering this inconsistent effect of service factors alongside the consistent positive effect of expenditure together, one possible interpretation that emerged is that an institution can expect a larger number of local e-learners when it increases its budget and targets improving the quality of academic services that do not require a campus visit. Regarding the fact that the academic support expense category includes information technology expenses related to academic support activities, the considerable effects of the quality of both education and service partially explain the distribution of local e-learners.

Conclusion and Discussion

This study began with the question of which institutional factors of local postsecondary institutions explain e-learners' college choice. Based on a literature review of online student characteristics, college choice theory, and college proximity theory, the four main hypotheses were suggested and examined by multiple

regression analysis. Research findings showed that specific types of institutions tend to attract a larger share of local e-learners, and the features of such institutions include: (a) located in a more populous area; (b) larger proportion of expenditure spent on academic support; (c) open admission policy, dual credit services, and alternative tuition plans; and (d) lower reported graduation rates. Because this study was based on the human capital theory, it predicted that a larger number of local e-learners would prefer to attend more affordable in-state institutions, but this insignificant effect of the cost was sorted out in the regression model.

American e-learners' strong preference for low-graduation schools showed that they prioritize convenience in their college choice process while taking a huge risk of attrition. This finding is related to the growing public concern over the credibility of an online college education. The reputation of online college education came under siege due to fraud in student recruitment and marketing strategies, resulting in enormous accrued student debt at a few for-profit colleges specializing in online education (Cottom, 2017; Wessel, 2015). For decades, distance student enrollment has been highly concentrated in a few institutions, especially in the private for-profit sector. Accordingly, a common misconception regarding e-learners is that they attend private for-profit distance-only institutions that lack any brick-and-mortar campus (Seaman et al., 2018). The Century Foundation analyzed all 98,868 allegations of fraud submitted to the US Department of Education by students and found that for-profit colleges generated almost 99% of the allegations; the most-accused institution, Corinthian Colleges, accounted for approximately three-fourths (75,343) of the claims and closed after a series of legal challenges by the government in April 2015 (Cao & Habash, 2017).

Unfortunately, these instances of fraud did not cease but were instead mirrored in public and private non-profit colleges. Graduate students at George Washington University filed a lawsuit against their college because of the relatively inferior quality of the online master's program compared to the on-campus degree program (McMurtrie, 2017). These problems could be a transitional phenomenon or a side effect, but the situation requires careful monitoring. Moreover, only seven percent of all distance students were enrolled in a private for-profit institution in 2016, and the total number of distance-only schools (140) accounted for a much smaller proportion of e-learners than did public schools (Seaman et al., 2018). In other words, it is time to turn back to the online courses and programs offered by dual-mode local colleges, rather than focus exclusively on the relatively low numbers of students enrolled in single-mode online colleges.

According to a recent national survey, an increasing number of American people showed a loyal preference for local colleges and universities, compared to their tenuous distrust toward the higher education system in general (Fishman, Ezeugo, & Nguyen, 2018). Local colleges and universities have long been regarded as engines for local economic development, and they are expected to increase the local supply of human capital through the production of a skilled labor force (Abel & Deitz, 2012). Most online learners are nontraditional students, so they might be relatively less mobile than traditional-age students. As a result, the economic and social spillover effects of local colleges could perhaps be maximized by improving the quality of online education and providing unwavering support to nontraditional learners. They may not want to spend time on campus, but they still want to be connected to their colleges and communities, albeit in ways different from traditional young students. The existing tuition gap between in-state and out-of-state costs is likely a strong incentive for students' choosing in-state colleges. However, these results suggest special attention to

convenience and quality of education is needed to fully understand local college preference among e-learners.

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Investigating the Concerns of First-Time Distance Education Instructors

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Abstract

The purpose of the study is to investigate the concern developments of first-time distance education instructors using the concerns-based adoption model (CBAM). This study used stages of concern (SoC), a component of CBAM, as its theoretical framework. A descriptive case study was implemented, which focused on the adaptation processes of nine instructors lecturing for the first time via distance education. The instructors attended a two-day training, which was designed based on their initial concerns. Then instructors implemented their courses for four weeks via distance education. While the informational and personal stages (self-concerns) decreased compared to the initial findings, the consequence stage increased in intensity. However, self-concerns remained predominant in the process despite the reduction in self-concerns and increase in the consequence stage. Based on the findings, the implications for distance education and recommendations for addressing the instructors' concerns are discussed. Recommendations for alleviating the concerns of first-time distance education instructors include: the provision of ongoing concern-based interventions that incorporate technological, pedagogical, and content knowledge; providing working examples related to distance education from which instructors can learn vicariously; and encouraging collaboration among instructors.

Keywords: concerns-based adoption model, stages of concern, distance education, distance education adoption, instructors' concerns

Introduction

Rapid advancements in technology are driving dynamic innovations across the higher education landscape. When educational institutions innovate, so too must their educators. Since people are typically resistant to change (Casey & Rakes, 2002; Rogers, 2003), the move to Web-based education is often met with discomfort and concern from instructors asked to adapt to the changing tide.

Moving from face-to-face to distance education can be a strenuous process for instructors, as they learn unfamiliar technologies and face new pedagogical challenges (Conrad, 2004). As such, it's essential that institutions understand their instructors' concerns as they transition into new realms and provide the appropriate support necessary to facilitate this process (Evans & Myrick, 2015; Lochner, Conrad, & Graham, 2015; Menchaca & Bekele, 2008). This notion is supported by Berigel (2013), who posits that instructors who receive proper support from their institutions are more likely to be successful in adopting distance education than those who do not.

As institutions moving to distance education models design their support programs, they must not simply consider the technical knowledge necessary to conduct distance education courses, but also the wider range of concerns faced by instructors as they move from an in-person to a Web-based teaching format. Having a clear understanding of the concerns that emerge throughout the distance education process and designing a support program around those concerns is likely to not only facilitate a smoother adaptation process for the instructor, but also likely to yield a more successful and sustainable implementation of distance education for institutions at large.

Literature Review

Distance education instructors should possess a wide range of skills in order to carry out their courses effectively (Dabbagh & Bannan-Ritland, 2005). They must be subject matter and pedagogy experts; skilled evaluators, researchers, and advisors; and possess technological savvy (Bawane & Spector, 2009; Beaudoin, 1990; Egan & Akdere, 2005). As such, much of the responsibility for the course depends on how adeptly they can wear multiple hats (Berge, 1995).

Considering the myriad responsibilities resting on the instructors (Bawane & Spector, 2009; Beaudoin, 1990; Berge, 1995; Egan & Akdere, 2005), first time distance education instructors are quite likely to have a set of concerns related to the implementation process (Hall & Hord, 2014). These concerns can influence people's decisions in structuring the course and the overall quality of their performance (Hall, 1976). Hall and George (1979) define concern as "the composite representations of feelings, preoccupations, thoughts, and considerations given to a particular issue or task" (p. 8). Ghaith and Shaaban (1999) expressed that concerns influence one's sense of self-efficacy; Wexler (2003) stated that the instructors' concerns impact their ability to successfully adapt to new educational settings. Therefore, it is critical to have a nuanced understanding of the concerns of instructors moving from face-to-face to distance education, as their concerns might have a significant impact on the overall implementation of the course.

Many factors might have an impact on the concerns of instructors switching from face-to-face to distance education. First, technological literacy is likely to be a concern for many first time distance education instructors. Specifically, instructors may have concerns around their ability to create and

deliver content, monitor students' participation, manage virtual live classes, and assess learning outcomes online (Almarashdeh, 2016; Berigel, 2013; Carr-Chellman & Duchastel, 2000; Erlich, Erlich-Philip, & Gal-Ezer, 2005; Hardy, 1999; Menchaca & Bekele, 2008). Secondly, the pedagogical knowledge of the instructors could be another critical factor influencing their concerns. Thieman (2008) stated that the indifference of students and their low participation in the course activities can cause concerns for instructors. Since the successful implementation of instruction relies primarily on an instructor's pedagogical knowledge (Berigel, 2013; Menchaca & Bekele, 2008; Shamoail, 2005), lack of understanding about the instructional methods and strategies that might be implemented in distance education can raise concerns for the instructors. Finally, instructors might also be concerned about the support that will be provided by their respective institutions. Directors and support staff within an organizational structure can have a positive impact on the adaptation process for the instructors (Berigel, 2013; Evans & Myrick, 2015; Lochner et al., 2015; Menchaca & Bekele, 2008; Weaver, Spratt, & Nair, 2008). Although the concern factors influencing instructors' adaptation to Web-based technologies and distance education is well documented in the literature (Almarashdeh, 2016; Berigel, 2013; Carr-Chellman & Duchastel, 2000; Erlich et al., 2005; Evans & Myrick, 2015; Hardy, 1999; Lochner et al., 2015; Menchaca & Bekele, 2008; Shamoail, 2005; Thieman, 2008; Weaver et al., 2008), very little is known about what the initial concerns of instructors switching from face-to-face to distance education are and how these concerns evolve in the process. To discover what these concerns are, it is necessary to investigate the instructors' adaptation to distance education from their perspective.

Theoretical Framework

The current study is based on the Stages of Concern (SoC) component of the Concerns Based Adoption Model (CBAM) (Hall, George, & Rutherford, 1977). Many research studies use CBAM in education to understand the adaptation of people to an innovation (Borgerding, Sadler, & Koroly, 2013; Khoboli & O'toole, 2012). Hall and Hord (2014) describe SoC as the personal side of change and define it as a developmental pattern of emotions to an innovation. This theoretical framework divides developing concerns into "stages," as to enable an understanding of how individuals move from one concern to another: while one concern decreases, another concern increases. The stages in the model are: Unconcerned, Informational, Personal, Management, Consequence, Collaboration, and Refocusing (George, Hall, & Stiegelbauer, 2006). In the Unconcerned stage or Stage 0, individuals indicate little or no concern toward using innovation. In the Informational stage or Stage 1, individuals indicate general understandings and ask for more information about using the innovation. In the Personal stage or Stage 2, individuals are more concerned about their abilities and adequacies to fulfill the innovation's demands. In the Management stage or Stage 3, individuals focus on the issues related to managerial problems such as time and efficiency, and in the Consequence stage or Stage 4, individuals consider the learning outcomes as a result of innovation's implementation. In the Collaboration stage or Stage 5, individuals seek collaboration to enhance the effectiveness of using innovation. Lastly, in the Refocusing stage or Stage 6, individuals are concerned about revising the way they use the innovation in order to increase its effectiveness or to replace it with an alternative.

The instructors in the current study started to lecture their courses via distance education for the first time due to a decision made by their university's senate. Determining the instructors' concerns and addressing their needs in order to facilitate their change process was thus a crucial consideration to ensure that the new courses were implemented successfully.

Purpose of the Study

The purpose of the present study is to investigate the initial concerns of the instructors switching from face-to-face to distance education and assess how their concerns evolve throughout the process of implementation. The following research questions guided the study:

1. What are the initial concerns of the instructors switching from face-to-face to distance education?

2. How did the concerns of the instructors evolve in the process of implementation after a concerns-based intervention?

Method

This is a mixed methods case study (Merriam, 1998), which focuses on the adaptation processes of nine instructors lecturing for the first time via distance education. The reason for selecting a mixed methods case study is to provide a rich analysis of the topic. We collected both quantitative and qualitative data using interviews and questionnaires to ensure that the study encompassed a broad perspective.

Participants

The participants in the study at hand are instructors from the same university in Turkey who have no previous experience lecturing via distance education. Four of the instructors teach English Language courses, three teach History of the Revolution of the Turkish Republic, and two teach Turkish Philology courses. Teaching these courses is the main responsibility of these instructors, all of whom hold permanent positions at the university. Seven instructors have their master's degree and four instructors are still in pursuit of their postgraduate education in their fields. Their face-to-face teaching experiences range from 2 to 32 years. Up to now, they have managed all their courses successfully. These instructor characteristics are illustrated in Table 1. The instructors have previously implemented their courses face-to-face and their switch to distance education was a result of a senate decision. We, as the director and deputy director of Distance Education Research and Application Center, who hold PhDs in Educational Technology, had no relationship to the courses and participants before the senate decision. All instructors have computers and smartphones connected to the Internet and know how to use them. While they generally use computers for their jobs, they mostly use smartphones for personal purposes. The instructors' self-reported competence of using technology for their courses is illustrated in Table 2.

Table 1

The Characteristics of Instructors

Field	*n*	Age	Teaching experience
English language	4	31(M), 32(F), 42(M), 46(M)	2, 9, 18, 20
The history of the revolution of the Turkish Republic	3	38(F), 39(M), 57(M)	13, 10, 32
Turkish Philology	2	38(M), 44(M)	8, 22

Note. n = Number of instructors. Age and teaching experience represented in years. F = female, M = male.

Table 2

The Competence of Instructors for Using Technology in Their Courses

	n	%
Creating videos	1	11
Creating PowerPoint presentations	6	67
Creating Pdf files	5	56
Creating Word documents	8	89
Creating Excel files	3	33
Creating audio files	1	11
Editing image files	3	33
Attending online forums	3	33
Attending webinars	1	11
Uploading files to the Internet	5	55
Sending and receiving e-mails	9	100

Note. n = Number of instructors.

Procedure

The university senate issued a mandate that the English Language, History of the Revolution of the Turkish Republic, and Turkish Philology courses are to be implemented via distance education across the university. The distance education format allows students to access the course materials and archive records anytime and anywhere on a learning management system (LMS). Recently, most of the universities in Turkey have switched to the distance education format for these courses and successfully implemented them. Due to the increasing number of students taking these courses and the limited number of instructors, the senate of the developing Turkish university, from which study participants were selected for the study at hand, decided to move to distance education for these courses. There were no mandatory courses implemented via distance education in the university before the senate decision. Although some faculty members were used to using different LMSs for their classes, there was no common LMS used across the university. Following the senate's decision, all departments and impacted instructors were informed about the decision and a support center was established for the instructors.

Training should be designed parallel with the developing concerns of the individuals in order to address and support their needs (Hall & Hord, 2014). Accordingly, the present study used the SoC (Hall & Hord, 2014) and the ADDIE model (Driscoll, 2002) to design the training based on the concerns of the instructors, differentiating our training from traditional training designs which do not incorporate instructor concerns. In order to design the training, we initially analyzed the needs of instructors using a questionnaire and an open-ended question form. We first prepared an online form to ask open-ended questions about the instructors' concerns and then administered the questionnaire as a pretest which included demographic, level of use (LoU), and stages of concern (SoC) questions to reveal instructor concerns about lecturing online. Based on the initial findings, we then designed a two-day training program consisting of two parts. The first part covered the fundamentals of distance education, the implementation process at the university, and the responsibilities of instructors and students. It also outlined the technical and pedagogical support that would be provided to instructors and students and explained the university's technological resources. The second part covered the details of using the Learning Management System (LMS) and virtual classroom. In the second training session, the instructors practiced activities related to the various facets of distance education instruction: interface, communication, uploading lesson materials, creating an assignment, forum and poll, broadcasting virtual live class, using the interactive board, and making an online test on LMS. Although the demographic questions revealed that the instructors needed to learn more about creating online materials for their lessons, we did not include it in the training since the instructors' concerns were mostly around the implementation process and technical details. While direct instruction and discussion methods were used in the first part, hands-on practices were done in the second part. Following the training, we conducted semi-structured interviews to assess the effectiveness of the training. The instructors then designed their courses and implemented the classes for four weeks on the LMS. In order to evaluate the process, we administered an online survey as a posttest and conducted semi-structured interviews again. The reason we administered the surveys and interviews after the fourth week was to relate the instructors' experiences with the training. All procedures of the study are illustrated in Figure 1.

Figure 1. All procedures of the study.

Instruments

Open-ended question. We asked to the instructors to respond to an open-ended question in order to facilitate the SoC interpretations. Newlove and Hall (1976) suggest that using an open-ended question is one of the simplest and effective ways to understand people' concerns. They recommended asking this question: "When you think about (the innovation), what are you concerned about?" (Newlove & Hall, 1976, p. 1). We asked the same question to the instructors via an online form.

Questionnaire. The questionnaire administered in the study consists of three parts. While the first part includes demographic questions, the second part contains level of use (LoU) questions to understand the adaptation level for distance education. In the LoU section, participants select the appropriate level from the categories of Nonuse, Orientation, Preparation, Mechanical Use, Routine, Refinement, Integration, and Renewal to indicate their adaptation levels to distance education. The last part of the questionnaire involves the Turkish version of the Stages of Concern Questionnaire (SoCQ) (Baltacı-Göktalay, 2006) to measure the instructors' stages of concern toward distance education. Baltacı-Göktalay (2006) adapted the questionnaire based on the original SoCQ (George et al., 2006) and the participants were required to choose the level to which they agree on a variety of statements using a 7-point Likert scale. The overall Cronbach's Alpha coefficient of SoCQ is .87 (Baltacı-Göktalay, 2006), which is an indication of the reliability of the questionnaire.

Interviews. We designed two interviews. While we implemented the first interview right after the training to understand its effectiveness, and conducted the second interview after the four weeks of implementation to see how the instructors' concerns and level of use changed. All instructors participated in the interviews. Two experts with a doctorate degree in the College of Education examined the appropriateness of the questions and finalized the interviews.

Data Analysis

While the researchers used descriptive statistic measures to analyze the quantitative data collected via questionnaire, they followed the content analysis procedures (Miles & Huberman, 1994; Yıldırım & Şimşek, 2013) to analyze the qualitative data. Firstly, we transcribed the data verbatim and then followed the data reduction, data display, and conclusion drawing/verification phases. Two experts with a doctorate degree in the College of Education checked the code and themes and found the inter-coder reliability score appropriate (90%) (Miles & Huberman, 1994).

Validity and Reliability

We employed different strategies to ensure the validity and reliability of the study. First, we used the triangulation strategy (Patton, 2001) to constitute the credibility. We collected both qualitative and quantitative data at different times to enable a broad perspective. Second, as for the transferability of the study, we explained the characteristics of participants, why we used the mixed methods case study and how we selected the participants as a sample. Third, while we kept the data for confirmability, the experts from the College of Education reviewed the data to certify the consistency of the study. Finally, the study was based on voluntary participation, thus helping to ensure its credibility.

Findings

Research Question 1

We first analyzed the data gathered from the pretest to reveal the instructors' initial needs by calculating the group percentile scores (George et al., 2006) of Stages of Concern (SoC) to reveal the intensity and diversity of concerns within the group.

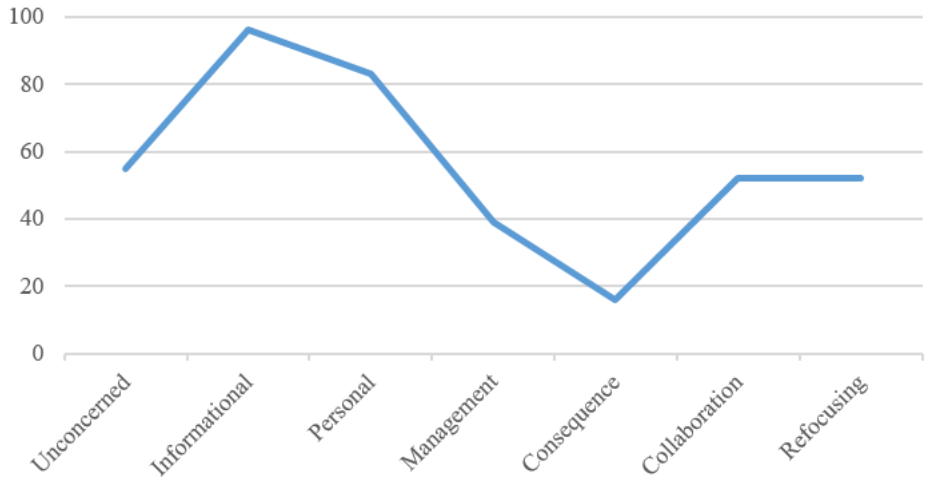

Figure 2. Group profiles of instructors in pretest.

The results suggested that, as illustrated in Figure 2, the Informational and then Personal stages were the most intense concerns among the instructors. Conversely, the Consequence stage was the least intense concern. In other words, while the instructors had considerable concerns about their ability to handle the distance education courses and displayed a strong desire to know more about distance education, they rarely thought about the effects of the distance education courses on their students.

We also analyzed the instructors' level of use (LoU) for the distance education to measure their adaptation levels. The results indicated that there were four instructors in the Orientation level, four instructors in the Preparation level, and one instructor in the Mechanical level. In other words, the instructors are mostly in the non-user category (Nonuse, Orientation, Preparation).

In order to interpret initial findings listed above on a deeper level, we also asked an open-ended question ("when you think about the implementation of your course via distance education, what are you concerned about?") and analyzed the data. The findings are illustrated in Table 3.

Table 3

The Descriptive Information of SoC From an Open-Ended Question

Stages of concern	*n*	*f*
Unconcerned	0	0
Informational	5	9
Personal	2	2
Management	3	3
Consequence	3	3
Collaboration	0	0
Refocusing	0	0

Note. n = Number of instructors, f = frequency of data excerpts.

As displayed in Table 3, the instructors mostly stated concerns related to the Informational stage. Moreover, they wanted to know more about the implementations that will be carried out across the university and the technical details. For example, one of the instructors expressed her concerns as follows:

> We used to share a room with other instructors before. How will we carry out our courses now? Is it possible to do them at home? ... I have no experience with distance education. Will the experts advise instructors like me who will be lecturing for the first-time about the implementation process?

Another instructor stated concerns related to the use of the LMS and virtual classroom by stating "there may be problems related to the system. The instructors or students may experience issues during the lesson. We need to be fully trained about taking a video, uploading it, etc."

All in all, one can conclude that while the instructors were especially concerned with understanding the fundamentals of distance education and how the process would be implemented at the university, they were also concerned about their ability to navigate the technological challenges. Considering the findings, we designed a two-day training which covered the fundamentals of distance education, the implementation process at the university, and the details of using the LMS and virtual classroom.

Research Question 2

After carrying out the training, we conducted interviews to determine the instructors' thoughts about the effectiveness of the training. Table 4 illustrates the findings of the interview.

Table 4

The Instructors' Thoughts About the Effectiveness of the Training

Effectiveness of the training	*N*	*f*
Benefits of the training	8	15
Unnecessary details in hands-on practices	6	6
Providing the training earlier	3	3
Demanding more training	4	5

Note. n = Number of instructors, f = frequency of data excerpts.

According to the findings, most of the instructors (n=8, f=15) found the training to be effective in addressing their concerns. Moreover, they stated that they better understood not only how the process of switching face-to-face courses to distance education courses would be implemented at the university, but also how to use the LMS and virtual classroom via hands-on practices. For example, one of the instructors noted: "The first part of the training helped us to understand the whole process. In the second part, we got enough knowledge about how to use the system. I think I could say that my concerns decreased."

Additionally, the instructors emphasized the importance of not being given too much detail in hands-on practices (n=6, f=6) and of providing the training a few months before the semester (n=3, f=3). They also recommended ongoing training to supplement the initial training (n=4, f=5). One instructor articulated: "I think some of the parts were complicated for me at the beginning. It was not necessary to learn everything at this stage; maybe some additional things could be addressed over time in the future." Another instructor said "My only suggestion is that it would be more beneficial for us, if it is possible, to provide ongoing training."

All in all, while the instructors found the training helpful for lowering their concerns about using the system and helping them to understand the implementation process at the university, they wanted ongoing training that was more specific to their needs.

After the four weeks of implementation, we administered a questionnaire as a posttest to see how their concerns changed in the process of instructing courses. The group percentile scores (George et al., 2006) of SoC were calculated and represented as comparative results in Figure 3.

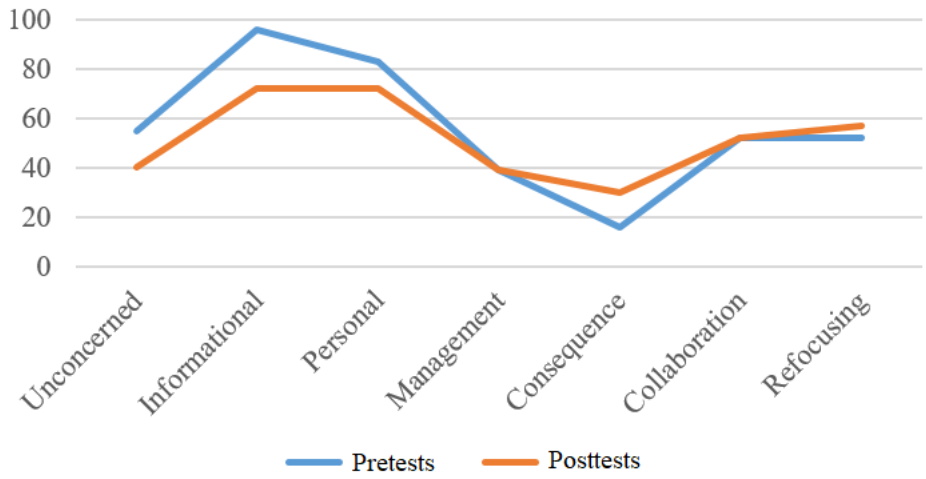

Figure 3. Group profiles of instructors in pretest and posttest.

The results indicated that while the Informational and Personal stages diminished, the Consequence stage increased in intensity. Although the intensity of Informational and Personal stages decreased, they remained higher than the other stages. Moreover, it is clear that the instructors became more concerned about the effects of the distance education courses on their students as the courses progressed.

In addition to the SoC profiles, we analyzed the instructors' level of use for the distance education again. As one can see in Table 5, all instructors moved up one or two levels. For example, while four instructors were at the Preparation level in the pretests, they switched to the upper levels in the posttests. In total, the instructors identified as being at the Routine and Mechanical levels for LoU in the posttests.

Table 5

The Instructors' Level of Use in Pretest and Posttest

Level of use		Pretest	Posttest
		n	n
Non-user	0. Nonuse	0	0
	1. Orientation	4	2
	2. Preparation	4	1
User	3. Mechanical	1	2
	4a. Routine	0	4
	4b. Refinement	0	0
	5. Integration	0	0
	6. Renewal	0	0

Note. n= Number of instructors.

Following the posttest, we conducted the final interview with the instructors to see how the instructors' concerns and level of uses changed after the training and four weeks of implementation. Table 6 illustrates the findings of the interview.

Table 6

The Instructors' Concerns and Level of Uses After Four Weeks of Implementation

Instructors' concerns and level of uses	*n*	*f*
Sufficient level of use	6	6
Personal - Time and energy commitment	5	6
Personal - Increased confidence in distance education	3	3
Consequence - Learning outcomes	5	8
Demanding pedagogical and technological training	6	8

Note. n = Number of instructors, f = frequency of data excerpts.

According to the findings, most of the instructors (n=6, f=6) see their level of use to be sufficient for implementing distance education courses. For example, one of the instructors said that "Of course, as I use the systems more and gain additional information, I think I'll reach a better level of use. I think I have enough knowledge for the moment."

Additionally, most of the instructors (n=5, f=6) stated that implementing their courses via distance education is helpful in terms of their time and energy commitment. A number of the instructors (n=3, f=3) also expressed an increased confidence level concerning their ability to implement distance education courses. One of the instructors explained:

> I think the process went well. I can present the information more concisely. My ability to lead an online course and self-efficacy increased. I was initially worried about doing an online course. Now, my ability to prepare and present online course materials improved.

On the other hand, the instructors also emphasized their concerns for the Consequence stage. In other words, most of the instructors (n=5, f=8) pointed out that the learning outcomes of students may not be fully achieved due to the students' need for personalized instruction, and due to their low engagement with course materials. One of the instructors stated: "We used to receive feedback from the students while lecturing face-to-face and revise the materials based on their needs. When we implement the classes now, we do not understand whether the students grasp it or not."

Lastly, most of the instructors (n= 6, f=8) demanded more training about pedagogical and technical aspects of implementing their courses. One of the instructors stated: "We might be provided support related to new approaches or instructional methods and strategies that could make distance education more effective."

In summary, the need analysis indicated that instructors were mostly concerned about the implementation process at the university and their abilities to handle the various technological aspects of distance education courses. Based on the findings, we designed a two-day training. While the instructors found the training helpful for lowering their concerns, they demanded ongoing training more specific to their needs. After the four-week implementation process, the concern stages of Informational and Personal diminished and the Consequence stage increased in intensity. All instructors moved up one or two levels in terms of LoU. The interview data supported the findings that the instructors grasped the implementation process and increased their self-efficacy for implementing

distance education courses. They started to be more concerned about the learning outcomes of students and demanded more training about pedagogical and technical aspects of implementing their courses.

Discussion

The current study investigated the concerns of the instructors moving from face-to-face to distance education. We first determined the instructors' initial concerns and then designed a two-day training based on their concerns. After the four weeks of course implementation, we explored how their concerns evolved in the process. The initial findings revealed that the instructors' intense concerns were at Informational and Personal stages suggesting the instructors were interested in learning more about the details of using innovation, and that they were uncertain about the demands of the innovation and their roles with it (Hall & Hord, 2014). George, Hall, and Stiegelbauer (2006) also stated that nonusers' concerns generally lie within the awareness, informational, and personal stages. Since the instructors lectured online for the first time in the current study, this finding is not surprising, as intense concerns at Informational and Personal stages indicate that the instructors want to learn more about distance education and how it will affect them personally. The initial findings also indicated that the least intense level of concern was at the Consequence stage, illustrating that the instructors did not intensely consider the effects of distance education on their students (Hall & Hord, 2014) because their concerns were more related to being nonusers and considering the effects of implementation on themselves.

Hall and Hord (2014) expressed that training should be designed based on the developing concerns of the learners rather than paralleling with the professors' concerns. The instructors stated that the two-day training we designed was supportive for them and lowered their initial concerns. Following the training, the instructors implemented their courses online for four weeks and, accordingly, their concerns evolved as illustrated in Figure 3. The Informational and Personal stages(self-concerns) decreased in intensity. Since the successful experience reduced the intensity of their self-concerns (a pattern also suggested by George et al., 2006; Hall & Hord, 2014), one can conclude that the training and subsequently the instructors' four weeks of implementations were successful at lowering the intensities of self-concerns and facilitating the instructors' adaptation process to distance education.

Despite the reduction in the intensity of self-concerns, these concerns remained predominant and the instructors demanded more technical and pedagogical training. The instructors' predominant self-concerns may not only be toward distance education but also toward technology adoption since distance education applications mostly rely on Web-based technologies. In this regard, the research studies in the literature express that technical and pedagogical knowledge can affect the instructors' concerns (Almarashdeh, 2016; Berigel, 2013; Shamoail, 2005). Similarly, Lochner, Conrad, and Graham (2015) also discussed the prevalence of self-concerns, noting that instructors may think about the innovations in terms of increasing administrative efficiency rather than supporting instructional activities. Therefore, the instructors in the current study might not have enough knowledge about technical issues and instructional methods and strategies that can be implemented in distance education and, accordingly, need ongoing pedagogical and technical training in their adaption process.

After four weeks of implementation following to the training (See Figure 3), the Consequence stage increased in intensity. George et al. (2006) state that individuals consider the effects of innovation on learning outcomes in this stage. In line with this, the instructors in the study at hand also showed concern about students' learning. The instructors in the study underscored that student engagement

with distance education courses was lower than in traditional face-to-face education. Thieman (2008) expressed that low engagement of students with the course activities can cause concern for the instructors. Therefore, the increase in intensity of the Consequence stage may have been due to the low engagements of students. In addition, the Consequence stage remained the least intense concern, indicating that the instructors experience self-concerns most intensely.

Conclusion and Implications

The current study has merit for a better understanding of the concerns of instructors moving from traditional face-to-face to distance education. This study indicated that using CBAM to design support for the instructors can facilitate their adaptation process to distance education. We initially found that the instructors had intense concerns at Informational and Personal stages. Hall and Hord (2014) underlined that successful adoption to an innovation occurs when the self-concerns (Informational and Personal) were resolved by the individuals. Hence, we designed training to target the Informational and Personal stages and, accordingly, let instructors implement their courses for four weeks. The findings indicated that this approach was successful at lowering the intensity of self-concerns and facilitating the instructors' adaptation process to distance education. However, the self-concerns remained predominant despite the reduction. Supporting the instructors before and during the implementation process is critical to helping them move from self-concerns to impact concerns (Hall & Hord, 2014; Lochner et al., 2015). Therefore, administrators or school leaders should provide ongoing training and professional support by targeting the instructors' self-concerns. Otherwise, the persistence of self-concerns may impact the effectiveness of instructors (Al-rawajfih, Fook, & Idros, 2010; Dunn & Rakes, 2010). In addition to the approach used in the current study which was helpful for lowering the self-concerns, strategies such as encouraging collaboration (Hall & Hord, 2014) among instructors or providing working examples related to distance education from which instructors can learn vicariously (Bandura, 1977) may also decrease the self-concerns and help facilitate the adoption process.

Although the Consequence stage increased in intensity, it remained the least intense concern after the four weeks of implementation. The instructors mostly discussed the low engagement of students in this process. Since the low engagement of students can cause concerns for the instructors (Thieman, 2008), it might be critical to support the instructors regarding this aspect. For example, Carr-Chellman and Duchastel (2000) underline the importance of using synchronous and asynchronous communication in distance education courses to increase students' engagement. Therefore; as Mishra and Koehler (2006) suggested in the TPACK (Technological Pedagogical Content Knowledge) framework, incorporating technology, pedagogy, and content knowledge while designing the training might be helpful to increase the intensity of impact concerns. By doing so, the instructors can learn not only the technical details of Web-based technologies but also how to use them to support instructional activities.

Administrators, faculty members, researchers, change facilitators, or educational planners can gain insights from this study about the concerns of the instructors moving from traditional to distance education. They can facilitate the instructors' adoption to distance education through the development of specific interventions that are focused on the instructors' most intense concern stages.

Limitations and Further Research

The current study is limited by the characteristics of the instructors and the small sample size: nine instructors in total. Hence, these factors should be considered when interpreting the findings. In this study, instructors switched to distance education as a result of a decision of the university's senate. For this reason, their concern development might be different from those instructors who switch to distance education voluntarily. Accordingly, further research should focus on the concern developments of these sort of instructors. In the scope of the study, we interpreted the group profiles of the instructors. Although we analyzed the individual profiles, we did not see any specific patterns related to gender, age, technology competence level, or years of experience possibly because of the small sample size. Hence, further research should form a larger sample size and analyze the individual profiles of the instructors regarding these variables. In addition, we did not collect any data related to the quality of the courses, students' grades, or course evaluation reports. Therefore, further research could collect such data to probe the instructors' concern in more detail. In the present study, we measured the instructors' concerns only twice through pretest and posttest questionnaires, with the posttest being administered after the fourth weeks of implementation. Hence, further research should measure the instructors' concerns regularly to see how their concerns evolve. Finally, the instructors' concerns might also stem from difficulties with technology adoption beyond distance education. Therefore, further research is needed to investigate the instructors' concerns in terms of technology adaption.

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Value of Open Microcredentials to Earners and Issuers: A Case Study of National Instruments Open Badges

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Abstract

While microcredentials and open digital badges have become increasingly popular in education, more research is needed to better understand their implementation and benefits to both issuers and users. In this paper, we use a case study approach to report and discuss the outcomes from the implementation of an open badges program at National Instruments, highlighting the effects this program has had on both National Instruments and its users. As the program evolves to better meet the needs of its stakeholders, we find that both participants (badge earners) and the issuer (National Instruments) see potential value in the National Instruments Badging Program. The value for both seems to stem from the way in which the program enables the sharing of badges, which helps the earner establish their skills/reputation while also increasing awareness of the program for National Instruments. This study adds to our understanding of why an organization may find value in offering open microcredentials as an alternative to traditional professional development and certificates for their customers and employees.

Keywords: open badges, microcredentials, credentials, professional development, microlearning

Introduction

With the ever-changing professional landscape and the gap between skills of college graduates and skills required by employers (Jaschik, 2015), opportunities for extended and enhanced learning are needed. Many colleges and universities offer exceptional programs and other learning opportunities specifically designed to meet the needs of the modern workforce; however, they are not available to all learners (Osam, Bergman, & Cumberland, 2017). Implementation of open badges and open microcredentials has been proposed as a solution to both the skills gap of recent graduates and the need for continued lifelong learning opportunities (Casilli & Hickey, 2016). Though early in its development, use of this technology is increasing; thus more research is needed to explore its use and value, along with detailed examples of organizations using it effectively.

Some forms of formal education, including many traditional colleges and universities, by their nature limit who has access to the education they provide. Osam, Bergman, and Cumberland (2017) identify three categories of barriers to formal education: situational, such as "finances, family life, health, work conflict, and transportation;" institutional, which includes "the availability of faculty, lack of night, weekend, and online courses . . . as well as difficulty in dealing with admissions and advising staff;" and dispositional, which includes "fear of failure [and] attitude toward intellectual activity, as well as perceptions about ability to succeed" (p. 55). Many university admissions procedures, by choice or by necessity, filter applicants through a process that excludes many from entering as students, especially the disadvantaged (Bastedo, Bowman, Glasener, & Kelly, 2018). Even those who are admitted must still deal with cost, time commitment (including class schedule), transportation, and their own fears, all factors which can prove challenging to many.

Open Digital Badges

Modern technologies and the distributive power of the Internet may provide solutions to some of the aforementioned higher education challenges. One example is the potential of open microcredentials, such as open badges. In 2012 Mozilla introduced the concept of open badges as a way to recognize and communicate various types of learning experiences (Mozilla Foundation, Peer 2 Peer University, & MacArthur Foundation, 2012). While the initial focus was to provide a way to credential informal learning, the concept has been adapted for use in primary, secondary, and higher education as well as in corporate training programs by small and large companies such as Microsoft (n.d.) and IBM (n.d.).

Open badges go beyond simple certification by embedding metadata about what the badge holder knows or can do. When they comply with the Open Badges Specification maintained by IMS Global Learning Consortium (IMS Global Learning Consortium, n.d.), they are portable and shareable across the Web. Utilizing this open standard, these badges can represent skills and knowledge gained from open platforms and informal learning experiences, providing details about potential employees such as which specific verified skills the individual has mastered, when and how the skills were attained, and who issued the badge—information that may interest hiring committees, employers, peers, or other entities (Lockley, Derryberry, & West, 2016).

Open badges are valuable because of the included metadata, which typically include the badge name, description, criteria, issuer, evidence, date issued, standards, and tags (Bowen, n.d.). This metadata connects evidence and criteria to the credential, better communicating what the learner accomplished. The recent Open Badge Infrastructure 2.0 specification additionally allows for endorsements of the badge from outside entities (Clements, West, & Hunsaker, in press). Those who share badges they have earned, provide access for others to see each of these pieces, providing a wealth of information beyond what current educational credentials communicate.

While open badges are a relatively new concept, they have received confirming attention over the past five years—a simple search in Google Scholar for "open badges" has returned over 1,700 results since 2014. In reviewing the literature, we found that much of the initial discussion has focused on how to set up a badge program, with details about the issuing platform and program design, along with guiding principles for designing the specific badges (Devedžić & Jovanović, 2015; Rodgers & Puterbaugh, 2017).

Other research has focused on the use of badges in secondary or postsecondary education environments. These papers have explored the impact of badges on motivating learners (Abramovich, Schunn, & Higashi, 2013; Cheng, Watson, & Newby, 2018), credentialing skills (Randall, Harrison, & West, 2013), and serving as pedagogical tools (Cheng et al., 2018). Fewer studies have focused on how badge earners or potential employers perceive badges (Dyjur & Lindstrom, 2017; Erickson, 2015). Casilli and Hickey (2016) noted that "the preexisting trust networks that operate between and among educational institutions, employers, and education consumers are not typically, nor even frequently, tested, investigated, or held accountable" (p. 118).

The research is even more scarce regarding open badges, which have the potential to extend and revise these traditional trust networks. Liyanagunawardena, Scalzavara, and Williams (2017), in their extensive synthesis on the literature about open badges, identified only three articles about employer perspectives. Recently, in a study examining the opinions of education employers, it was discovered that upon learning about education badges, education employers felt that such badges could be valuable pieces in an application (Randall & West, in press). Another study (Raish & Rimland, 2016), found in a nationwide survey of employers in the United States, that only 5% would not be interested in open badges. However, the concept is still largely unknown with employers, as Raish and Rimland (2016) also found that 62% of the respondents wanted to learn more about open badges.

Open badges are also being used outside of formal education environments, including by corporations such as IBM and Microsoft. More than 1,700 badges are listed on the IBM Skills Gateway site (IBM, n.d.). However, in the academic and non-academic literature, the benefit to the badge issuer is not always directly discussed. In one post David Leaser (2015), the senior manager for IBM's Gobal Skills Initiative, explained that issuing badges helps the issuer "attract, nurture, and progress a pool of talent and it helps establish the brand as a leader in the field" (para. 9). This seems to agree with a statement by Finkelstein, Knight, and Manning in The American Institutes for Research 2013 report:

> The issuer of a traditional form of achievement benefits from the act of bestowing an honor on those who meet the criteria or thresholds the issuer has set. Recipients of degrees or certificates are reflections of the institutions that nurtured and endorsed their abilities. When given in recognition

> of skills, behaviors, or contributions that an organization values, credentials are also a way of scaling the issuer's impact on the world. As such, any credential has a marketing component, as well as the potential to take the issuer's mission to scale through individuals it has essentially deputized. (p. 6)

While open badges would be assumed to carry similar benefits of marketing for the issuer, including greater "scale" of impact, there has been little research or discussion exploring the value of badges for both the earners and the issuers. Less than 10% of the total articles in Google Scholar on "open badges" are also related to the search string "workplace learning." Of these, most appear to be about teacher professional development (Gamrat, Zimmerman, Dudek, & Peck, 2014; Randall, West, & Farmer, in press), or theoretical articles about the potential of open badges to impact workplace learning (Aberdour, 2016). More investigation is needed specifically on the benefits that open badges can provide for employers as well as the employees engaged in professional learning. In addition, because open badges are still relatively new, examples of badging programs need to be shared so that effective practices can be disseminated. Thus, this paper seeks to provide a case study of National Instruments, an engineering technology provider, that implemented a large-scale open badges initiative. In discussing this case, we also seek to answer the following questions:

- What benefits might open badges provide to badge earners?
- What benefits might open badges provide issuers?

Method

A case study approach was used to consider the value of badges for National Instruments stakeholders. Founded in 1976, National Instruments (NI) is now a worldwide company with more than 7,000 employees. Their purpose is to help scientists and engineers overcome complex problems through technology solutions aimed at accelerating productivity and innovation. National Instruments produces engineering hardware and software such as automated test equipment and virtual instrumentation software. The company provides training for users of their products. They began issuing badges through the Acclaim platform (referred to in this article by its new name, Credly).

Context and Badging Program

To understand the NI badging program data requires an understanding of the evolution of this program over two phases: A pilot program in 2017 and subsequent expansion in May 2018.

Initial 2017 badging pilot. National Instruments' pilot program in 2017 included seven badges, covering fundamental engineering knowledge and skills related to the use of their products. Users participating in the program could view training videos tied to badges or use a number of other learning resources to prepare for the required assessment. They also had the option of taking the assessment without viewing those videos. Users who passed an assessment with 85% or higher (down from the original 100% requirement) were invited to create an account with Credly in order to claim their badge. Users who failed

an assessment could retake it as many times as needed. These assessments were offered to current National Instruments customers at no cost, as were the badges for passing scores.

Table 1 includes the seven badges provided by National Instruments, along with their digital image and the description provided on the National Instruments website and Credly page.

Table 1

Seven Badges Included in National Instruments Badge Pilot Program

Title	Image	Description
LabView Discovery		LabVIEW Discovery badge holders demonstrate a basic understanding of the LabVIEW environment. This badge holder can develop applications that acquire, analyze, and visualize data, execute repeatedly, and correctly handle errors. This badge is no longer issued by National Instruments and has been archived.
Programming NI-DAQmx		This badge indicates that an individual understands the functions used to program data acquisition devices and the benefits of different options. Holders of this badge can use the NI-DAQmx driver to measure, generate, and synchronize data acquisition tasks. They can program finite or continuous acquisitions and implement best practices for hardware or software timing, triggering, and logging. This badge is earned by passing the related assessment.
Sensors and Signals		Sensors and Signals badge holders understand the different types of signals and the sensors used to measure them. This badge holder can select the appropriate sensor for signals such as strain, vibration, and position, as well as having a foundational knowledge of sensor configuration and connectivity to data acquisition hardware. This badge is earned by passing the related assessment.
Measurement Fundamentals		Measurement Fundamentals badge holders understand the basic concepts of measurement including measurement accuracy, acquisition rates, and signal conditioning. This badge holder can make basic analog and digital measurements, select the right DAQ hardware based on resolution, range, and sensitivity, and correctly wire the system with proper grounding techniques. This badge is earned by passing the related assessment.

Channel Wire Communication		The badge holder is able to use channels in LabVIEW to communicate between parallel sections of code without forcing an execution order. This badge is earned by passing the related assessment.
Academic Instrumentation Fundamentals		The badge holder can engage in hands-on experiments to better understand filter behavior and transfer functions for active and passive analog filters by simulating and then experimenting with Multisim Live and Analog Discovery 2. The individual develops a working knowledge of fundamental engineering concepts, like filter slope, passband, stopband, and cut-off frequency, through interactive simulation analysis and hands-on measurement verification.
Academic Embedded System Fundamentals		The holder of this badge has demonstrated basic understanding for using myRIO with LabVIEW to create an interactive project incorporating myRIO's onboard accelerometer and LEDs. This individual has (a) discovered the power, speed, and determinism of the reconfigurable I/O (RIO) architecture by building an electronic level with myRIO and LabVIEW, (b) formed a basic understanding of how a real-time processor integrated with an FPGA along with some sensors and actuators become an embedded system, and (c) developed a LabVIEW program that converts an accelerometer measurement into a visual representation of the rotation angle using LEDs.

Note. From "Browse Badges," by National Instruments, 2019a (https://learn.ni.com/badges/resources), and "National Instruments," by Acclaim, 2019 (https://www.youracclaim.com/org/national-instruments). Adapted with permission.

2018 expanding badging program. After initial positive feedback on the pilot program (discussed below), in May, 2018 during their largest user conference titled "NIWeek," National Instruments launched an expansion of their badges project. This expansion included a new badging website (see Figure 1) with an overview of the professional badging system as well as recommended badges for learners. In addition, they now offer 32 Level 1 badges and 11 Level 2 badges, significantly increasing the badge initiative.

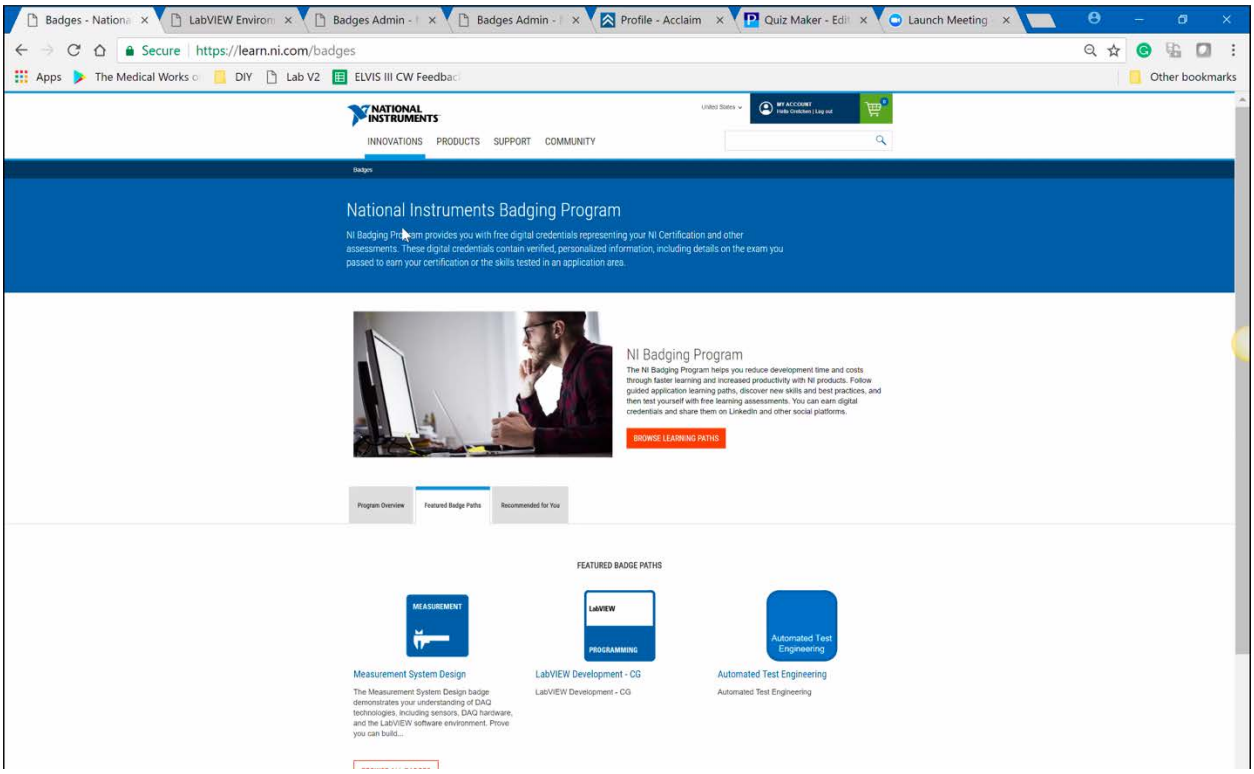

Figure 1. Revised launch of National Instruments badges. From "National Instruments Badge Program," by National Instruments, 2019b (https://learn.ni.com/badges). In the public domain.

A key feature of National Instruments' expanded badging project is learning paths. Touted on the main page (see Figure 2), these pathways help guide learners towards collecting badges that aggregate to automatically issue larger credentials. Earners' progress on these pathways is represented by the colored bar to the side of the badge (see Figure 2).

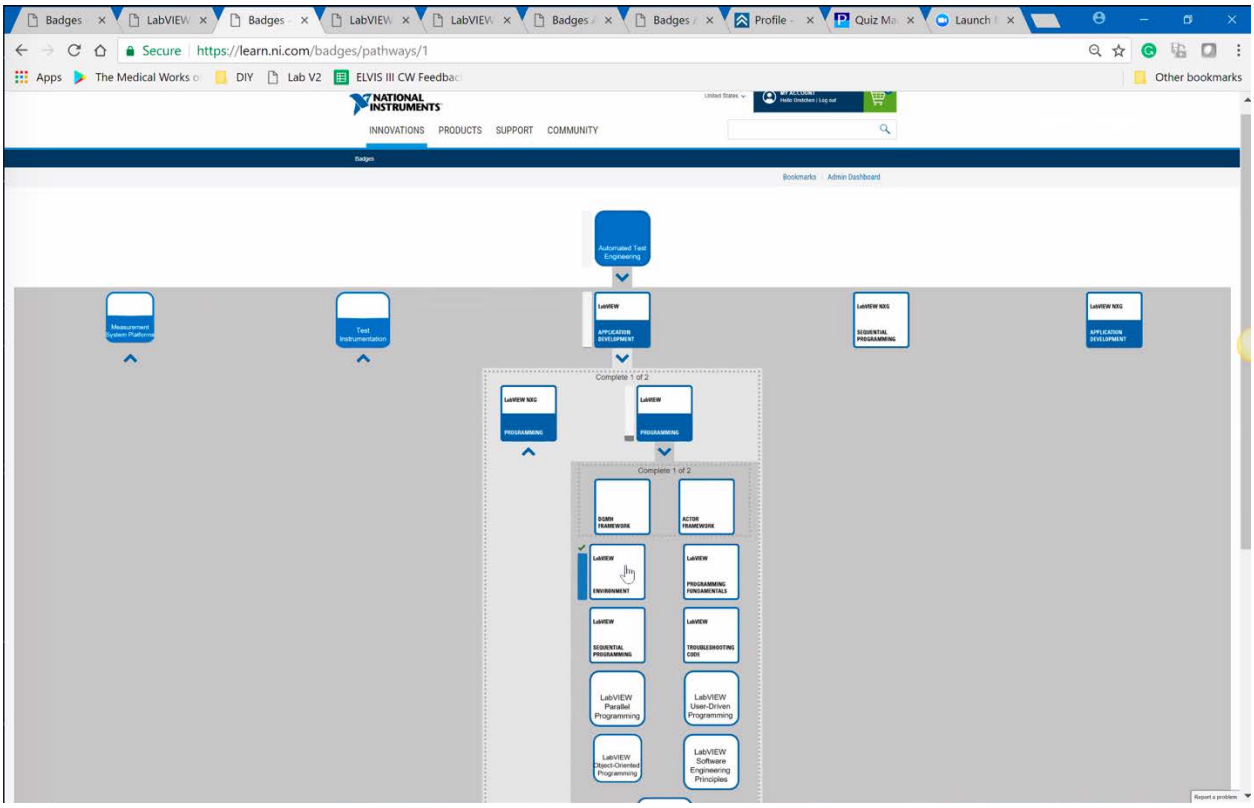

Figure 2. Learning pathways progress in National Instruments badges. From "National Instruments Badge Program," by National Instruments, 2019b (https://learn.ni.com/badges). In the public domain.

Options are provided to search or browse badges (see Figure 3), and assessments are accessed by clicking on a badge. An earner who completes an assessment without training is awarded the credential; for those who are not initially successful, training opportunities can be provided by National Instruments or its partners (see https://learn.ni.com/badges/resources/857). Allowing partners to also provide the training enables easy scalability of the National Instruments program into other languages.

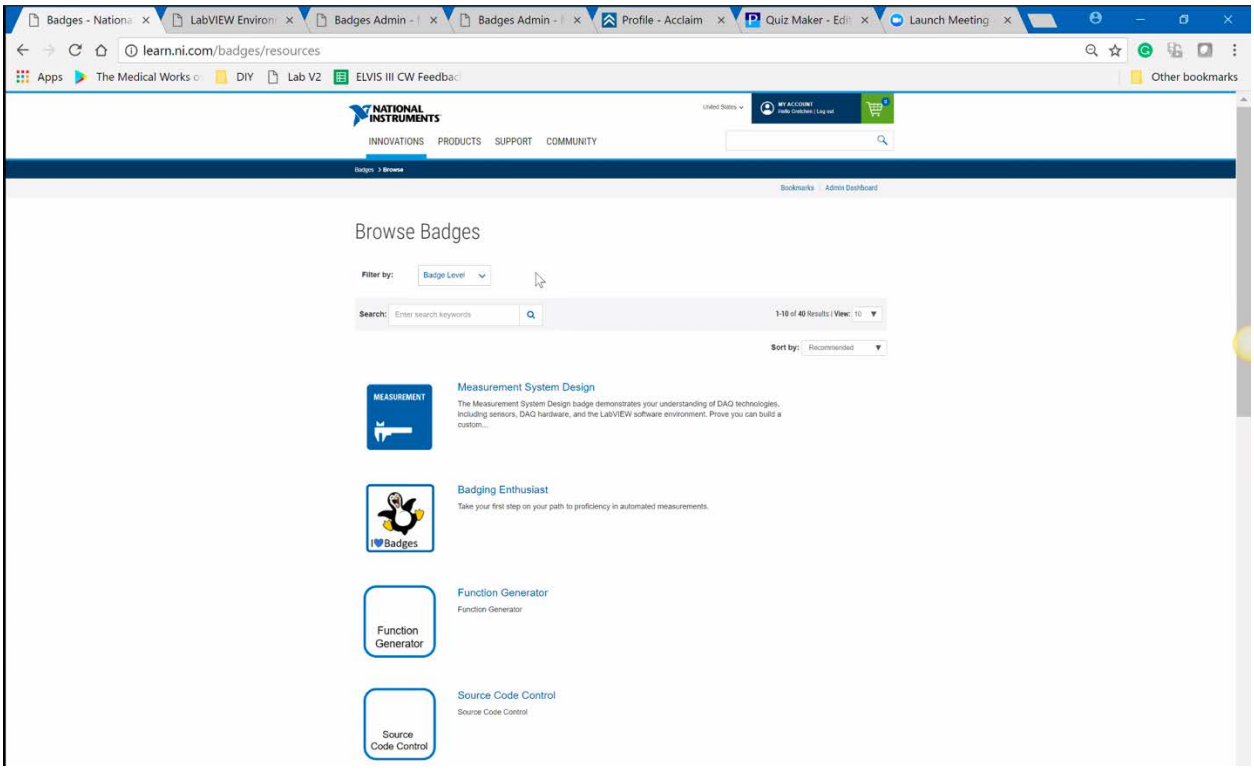

Figure 3. Browse feature for National Instruments badges. From "Browse Badges," by National Instruments, 2019 (https://learn.ni.com/badges/resources). In the public domain.

Survey Instrument

A survey was created to collect evaluation data on this professional learning initiative, in order to provide feedback data to National Instruments. Some of the survey questions asked were not directly related to badge credentials, but instead focused on the training content and participants' perception of the program:

- How well did the learning module material prepare you for the assessment?
- Is it clear where to go to learn the concepts tested in the assessments?
- Thinking about the assessments you attempted or completed, overall how challenging were they?

Still, the findings from these questions helped to provide context for our case study of National Instruments. In addition, several questions were included that were more directly related to the value of badges:

- Did you share your digital credential/badge in any of the following ways?
- How likely are you to recommend the NI Badging Pilot Program to a colleague?
- How likely are you to participate in NI's Badging Program in the future if the topics are relevant to your needs?

- Please select the response that best describes your level of agreement with the following statements about the NI Badging Pilot Program: (a) It helps to advance my engineering skills/knowledge, (b) It helps to advance my proficiency with NI products, (c) It enables me to successfully complete current or future projects.

These were the questions that we analyzed directly to answer our research questions. While the survey was administered to all participating in the National Instruments courses and assessments, the questions about credentials and badges were only sent to those who had actually earned a credential.

Survey Participants

Of those who participated in the new program, 426 were invited to be respondents to a survey in October of 2017, and 796 were invited to respond in October of 2018. Participants were those who participated in the NI assessments/courses and received a credential. Responses were received from 51 participants in 2017 and 122 participants in 2018. This article provides a descriptive analysis of the gathered responses.

Limitations of Survey

Since many of the survey questions focused on the training content, the data were limited. In addition, some of the respondents who were answering questions about the badging program might have focused their answers more so on their experience of the training provided than on their experience of the credentialing method. Thus, a follow-up study would benefit by improving the questions and adding in-person interviews to clarify survey responses and gather additional qualitative data. Additionally, this survey was limited by a 12% response rate, as well as by the reality that the context of professional training for a specific company's engineering products can be fairly specialized and may not generalize to the many other possible uses and contexts for open badges.

While these limitations may limit the generalizability of the results, we believe the case study of the information obtained can still provide valuable insight on the value of badges within a professional learning context.

Findings and Discussion

The insights gained from the 2017 survey are reported before those from the 2018 survey, as they report on different implementations and stages of the program. We focus on results regarding the potential benefits for earners, then consider the potential value for National Instruments. We embed discussion of the findings within each section.

2017 Survey Results

Benefits for earners. The survey results indicated that most of the participants found the NI Badging Pilot Program to be valuable. When the survey responses were grouped according to respondent' likelihood of repeating the program if more content became available, on a scale of 1 (*not at all likely*) to 10 (*extremely likely*), 13 responded with 8; 13 responded with 9; and 14 represented themselves with 10. A total of 40/51 respondents (78%) indicated that they would be likely to participate in NI's badging program

in the future for relevant topics. Of the 33 respondents who had shared an earned badge at least once, several had shared it multiple times, for a total of 61 shares, an average of 1.84 shares per person. This data on badge sharing is one more method for determining how much the user values a badge, as a willingness to publicly share a badge may suggest that the earner assigns value to it.

Additional data on the value of the badges for the participants can be determined by the acceptance rate. In open badging systems, badges are issued to earners, but earners must still accept those badges. This extra step can provide some indication into whether the earners value the badge. With the National Instruments case, data pulled from the Credly system showed that the acceptance rate overall (not just for those surveyed) was 89% and the share rate (the number of badges that earners shared to social media and the Internet) was 51%.

While these findings show that earners did value the badges, these responses do not indicate specifics on which aspects participants value. We further filtered the respondents by asking which of several statements "best describes your primary reason for participating in the NI Badging Pilot Program." We found that 18 of the respondents indicated that their reason for participation was that they "planned to use the badge for professional recognition (e.g., to help with a promotion or job interview, add to my resume/CV)." These 18 respondents accounted for 35 of the 61 total shares for the group. Table 2 shows how these individuals shared their earned badge and compares the number of shares from the total group to the 18 seeking recognition. These findings suggest that one of the primary values of badges is that the credential can be shared easily, enabling the earners to seek additional professional recognition from stakeholders who might otherwise be unaware of the training and skills they have earned.

Table 2

How Participants Shared Their Earned Credential

Method of sharing	Number of shares (all 51 respondents)	Number of shares (18 respondents seeking professional recognition)
Added to social media site (e.g., LinkedIn)	26	14
Added to job site (e.g., Indeed)	1	0
Added to my resume/CV	14	10
Added to my business card	1	1
Informed my employer	10	6
Informed my peers	6	3
Informed my customers	3	1
Did not claim badge/did not share	18	1

In general, the National Instruments badge pilot produced substantial media activity and multiple shares per person. The sharing of badges on online/ professional profiles indicates that the earners valued badges as a way to market their skills to supervisors, peers, and clients.

Benefits for the issuer. As stated previously, much of the presumed value to badge issuers consists of attracting talented people who will eventually help build brand recognition (Leaser, 2015). In addition, sharing of credentials on social media enhances marketing of the brand, which may ultimately lead to further recognition of the company. A follow-up study regarding the effects of badges on brand awareness would be useful.

We can identify a few data points from the survey that seem immediately relevant to answering the question of "in what way is the use of badges valuable to National Instruments?" First, 27 of the 51 participants indicated a high likelihood of recommending the program (as indicated with a response of 8 or above, see Figure 4), supporting a supposition that the program will help National Instruments attract people who may not have heard of their program otherwise. Figure 4 breaks down responses to the question of how likely participants were to recommend the program on a scale of 1-10.

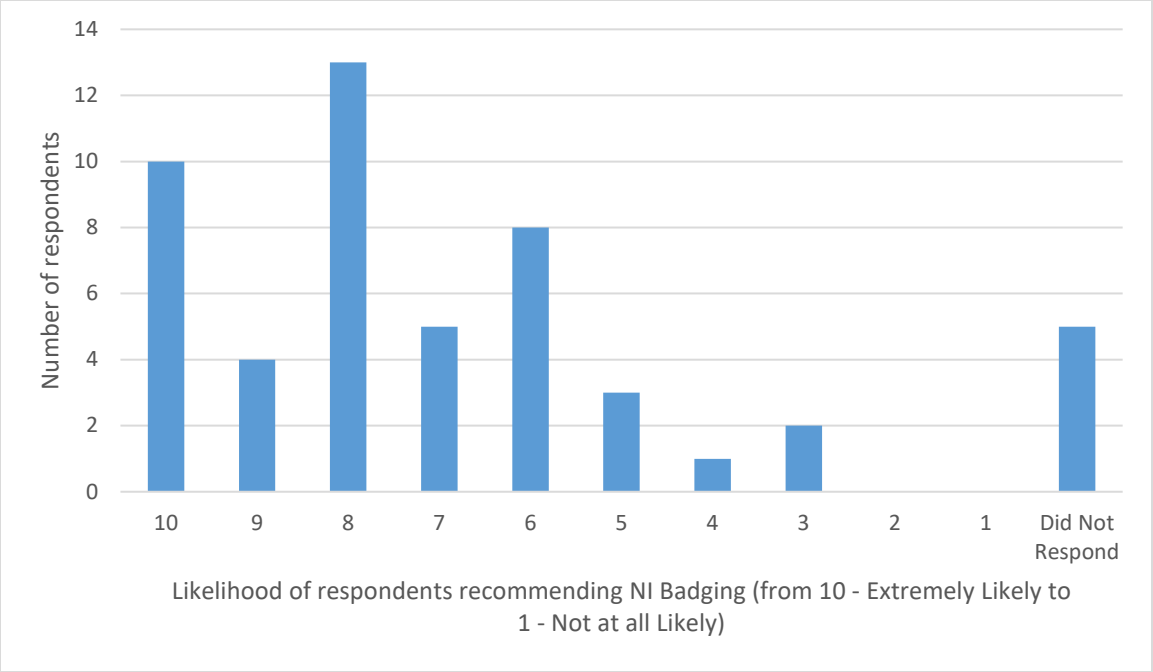

Figure 4. Likelihood of respondents recommending the NI badging pilot program to a colleague.

Second, participants responded to several questions on a 7-point Likert scale. Three of these questions directly related to the idea that the badge program may have the potential to strengthen the skills of talented people. First, participants were asked if the program helps advance their engineering knowledge, and responded with an average of 5.34 (on a 1-7 scale). Second, they were asked if the program advanced their proficiency with NI products, and they responded with an average rating of 5.6. Finally, they were asked if the program enables them to successfully complete current or future projects, and they responded with an average rating of 4.74.

Of these three questions, participants agreed most strongly with the statements that the NI Badge Pilot Program "helps to advance [their] engineering skills/knowledge" and "helps to advance [their] proficiency with NI products." Though most still agreed, responses were more spread out regarding the statement that they were enabled "to successfully complete current or future projects." While it might be assumed that the first two—advancing skills and knowledge, and developing proficiency with the company's products—would contribute to completing projects, it seems that participants were more concerned with their own personal interests in the training. This contributes to the assertion that the program helps strengthen the skills of talented participants rather than providing basic training for unexperienced individuals.

These initial data points provide some support for the assertion that badges do provide value to National Instruments and could also be valuable to other badge issuers. However, as we continued analyzing the data, we noted that 17 participants found the training on the NI website while specifically searching for training materials. This suggests that some participants may have already been interested in improving their skills, and would therefore have participated in the program regardless of whether badges were offered. However, 34 participants did find the training through other means.

We found that 23 respondents participated out of curiosity, perhaps because of the badges themselves since the program was marketed as the NI Badging Pilot Program (http://www.ni.com/white-paper/53685/en/). We grouped these 23 along with two participants who indicated that they participated specifically to earn badges and one who indicated doing it for fun. These 26 participants engaged in the training for intrinsic reasons, not directly related to their job. Of these 26 participants, 18 responded with a rating of 8 or higher to the question of whether they would participate again if the topic was of interest to them. This finding suggests that these experiences should be personally meaningful and that perhaps including badge credentials with training could help to capture people's interest, draw them into professional training, and promote their participation in future training as well.

2018 Survey Results

After the initial positive feedback from the 2017 survey, National Instruments expanded the badging program for a relaunch in May 2018. The data below were collected in October 2018, and provide information regarding this second stage of the program.

Benefits for the earners. A high majority of the 122 respondents to the 2018 survey were enthusiastic about the badging program. On a 7-point Likert scale, 83% agreed (scored a 5 or higher on a 7-point scale) that the badging program advanced engineering skills. The respondents in 2018 continued to value sharing their earned badges, finding it easy to accept a badge after completing assessments (82% agreeing that this process was easy). Although in 2017 40% indicated they added their badges to their resumes, in 2018 only 17% said they did this. However, 67% added their badges to a social media site like Linkedin or Facebook, 26% informed their peers, and 25% informed their employer. Also 47% reported they planned to use the badge for professional recognition of some kind.

Finally, data pulled from the Credly system showed that the acceptance rate (i.e., the percentage of badge earners who accepted the badge issued to them—an indication that they valued it) for the 2018 implementation for all badge earners between May and October was 93% (up from 89% in 2017), and the share rate was 33% (down from 51% in 2017). Two reasons are suggested for the decline in share rate for 2018. First, after the initial success of the badging program in 2017, National Instruments back issued nearly 19,000 professional certification badges to those who had completed the assessments before the badges were available. Possibly these badge earners felt less invested in the badges since they were receiving them so long after completing the assessments. In addition, as NI expanded the badging program to include more badges representing particular learning goals rather than overall certification, earners might be less likely to share badges that did not represent certification. This merits further study, as it may elucidate the kinds of badges earners find most useful.

In conclusion, it seems that participants find the badges valuable and nearly always accept these credentials when earned; they frequently share them, but they are sharing them in newer, more current ways rather than on traditional resumes.

Benefits for the issuer. Besides providing value for the earners, the NI badges seem to be providing benefits to National Instruments; 59% of respondents expressed a strong desire to participate in the badging program in the future (scoring 9 or 10 on a 1-10 scale). Also, 56% agreed (rating 5 or higher on

a 7-point scale) that the program helped them complete projects, and 81% agreed that it advanced their proficiency with NI products. One of the goals of the NI badging program has been to make sure customers are satisfied with NI products by becoming skilled at using them, and this result indicates that the badging program is meeting this goal.

In addition to being more skilled at using NI products, the participants indicated being very likely to promote the NI badging program to others: 40% indicated a likelihood of 9 or 10 on a 10-point scale. Once participating in the badging program, they often engaged in the NI-provided online training: 48% indicated they took or started the NI-provided online training after beginning the badge program.

Conclusion

This paper describes the pilot badging program implemented by National Instruments, demonstrating an innovative approach to supplementing the training they provide to their employees and customers through digital open credentials that can be stacked into learning paths, automated through assessments, and shared widely on social media. A survey of 51 badge recipients of the pilot project demonstrated overall high levels of satisfaction with the badges, indicating respondents valued them enough to share the badges on their social media accounts and to anticipate engaging in future National Instruments training.

These responses supported the expectation that the badges would provide benefits for both the badge earners and National Instruments as an organization. Earners appreciated being able to quickly share the credential, which provides professional recognition useful in seeking new jobs, requesting a raise/promotion, or impressing potential clients. For National Instruments, issuing badges showed potential to increase brand awareness, as earners were inclined to share their credentials and advise others to participate.

However, this was a pilot project, with a small sample, and some of the survey questions would require more detailed follow-up through interviews with respondents in order to verify some of the assumptions mentioned. National Instruments is expanding their project to include grouping badges into customized and automated learning paths, and they will collect more information on this expansion of the pilot to further test the value to the organization and to their employees/customers.

While the information in this study has been useful in guiding the development of the NI badging program, and we believe it has some generalizable usefulness as well, further research could be done. In particular, further study might focus on why some earners share their received badges and whether their propensity to do so is influenced by their positions at their companies, their own personal needs and goals, and the types of credentials they have been awarded. For example, we suspect that earners may be more likely to share overall credentials than smaller, more focused learning badges that are part of their professional development pathway. It might also be useful to study how the success of the badging program affects earners using additional NI products and services and how it affects brand awareness of the company on social media. For the earners, it would be important to better understand qualitative aspects of the value they get from earning the badges, including effects on their sense of professional identity and self-efficacy.

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Adoption and Diffusion of Open Educational Resources (OER) in Education: A Meta-Analysis of 25 OER-Projects

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Abstract

The concept of open educational resources (OER) is becoming increasingly prominent in education. However, research circles around defining OER, content and forms of OER, technological features of OER, and the importance of the issue or lack thereof. Vital aspects such as the notion of the adoption of OER by educational practitioners remain underdeveloped. In order to shed light on the question of how to adopt OER in education, the article presents findings of a meta-study which critically reviewed 25 state-funded OER projects located in Germany. All projects aimed to anchor OER across educational areas, such as school, higher, continuing, and vocational education. The meta-analysis disclosed a mixed bag of results. Although interest and willingness to deal with OER can be confirmed, reservation is rooted in the complexity of the topic and especially the legal concerns. However, the findings demonstrate that OER can by no means be ignored in the context of teaching and learning in a digital world. Integrating OER as an aspect of existing educational training should, therefore, be encouraged. Concerning future design recommendations, to conflate OER with other pressing issues and to simultaneously emphasise its added value explicitly is a promising approach. Moreover, establishing central contact points in educational institutions to accompany and monitor actors on their path to OER appears to be necessary. Notwithstanding the concrete measures, any strategy must operate persistently at both levels, institutional and practical, embracing all relevant stakeholders.

Keywords: open educational resources, OER, educational training, meta-analysis, learning and teaching support, cross-educational, OER mainstreaming

Introduction

The value and pivotal importance of open educational resources (OER) for the broader field of education have become evident ever since their first emergence at UNESCO's 2002 Forum on the Impact of Open Courseware for Higher Education in Developing Countries. Notwithstanding that there are no canonical, but numerous competing, definitions, a commonly accepted understanding is that OER describe

> any educational resources (including curriculum maps, course materials, textbooks, streaming videos, multimedia applications, podcasts, and any other materials that have been designed for use in teaching and learning) that are openly available for use by educators and students, without an accompanying need to pay royalties or licence fees. (Kanwar & Uvalić-Trumbić, 2011, p. 4).

It is important to mention that OER cannot be understood as being synonymous or interchangeable with open science, open pedagogy, or open education (Cronin & MacLaren, 2018). Although interdependence and overlap exist, substantial differences occur in terms of practical usage and fundamental objective (Wiley & Hilton, 2018). While open science aims to render scientific processes comprehensible and accessible, open pedagogy encourages students to improve or create course content. Open education can be understood as a wider movement towards broadening access to and participation in education. OER, on the other hand, are primarily content and not an educational model or practice per se (Mengual-Andrés & Rico, 2018). While the lack of clarity between the concepts can rightly be criticised (Kerres, 2019), the concept of OER is now based on a solid theoretical and empirical ground (Bozkurt, Koseoglu, & Singh, 2019). Moreover, the OER movement has gained momentum and extended rapidly (Clements, Pawlowski, & Manouselis, 2015; Santos-Hermosa, Ferran-Ferrer, & Abadal, 2017). The primary purpose for using OER is to facilitate access to education, and to enable collaborative and participatory innovative teaching and learning. OER are assumed to broaden access to education, to reduce the costs of materials, and to improve the overall quality of teaching.

Throughout the last two decades, a rapidly growing amount of OER has been developed in all fields of education (Clements et al., 2015). The OER World Map continuously monitors global OER development, and facilitates interaction and collaboration through collecting and sharing open data about actors and activities related to OER. The growth of OER also entails the creation of several repositories which make OER widely available and allow users to find, create, and share them. Santos-Hermosa et al. (2017) revealed that OER repositories are mainly multidisciplinary, institutional, and predominantly based in Europe or the US. Notwithstanding discussions about pedagogy, quality assurance, and sustainable business models, repositories have undoubtedly enhanced and facilitated access to OER. Several studies have focused on establishing guidelines for finding and using these repositories (Kanwar & Uvalić-Trumbić, 2011).

Despite these substantial achievements, one of the major problems is to attract attention to the adoption and practical use of these repositories and OER across all fields of education. This article is based on the argument that little attention has been paid to this subsequent—or concurrent—step which is to spur adoption and use by the main practitioners, namely teachers and students. This step is critical for the prevalence and diffusion of the practical use of OER in all fields and levels of education. The provision of training for practitioners and teachers on how to engage in the 5R activities (i.e., retain, reuse, revise, remix, and redistribute) is a decisive factor. Research hitherto circled around defining OER, content and forms of OER, technological features of OER, and the importance of the issue or lack

thereof. Central aspects such as the notion of the adoption and use of OER by practitioners remain underdeveloped. Referring to this, Mishra (2017) voiced concerns that to create awareness among teachers and students regarding the adoption of OER—the use and creation of OER, including the integration of OER in teaching and learning—is crucial, as they are the most important stakeholders in the OER ecosystem. To shed light on the question of how to adopt and thereby enhance the use of OER in education, this article presents findings of a meta-analysis which critically reviewed 25 state-funded OER projects located in Germany. All projects focused on enhancing the visibility, strengths, and potential of OER through training competence for educational and advisory staff in at least the following four sectors:

- finding OER,
- using OER,
- creating OER, and
- sharing and providing OER.

The projects' target groups comprised educational and advisory staff at all educational levels, such as schools, higher, continuing, and vocational education. For the meta-analysis, all projects were reviewed and clustered based on their target achievement, target groups, measures, and impact regarding OER. Factors that hamper or facilitate the adoption of OER were identified. As a further result, design recommendations were derived on how to implement and promote training about OER.

The article is structured as follows. The following section reviews the existing literature on the challenge of adopting OER in education. Section two presents the methodological approach that was applied to render the research results. In section three, the 25 OER projects incorporated in the meta-analysis are described in terms of their core objective, range, measure, and main output. The main results are presented in section four and discussed in the subsequent section. The article concludes with a summary view and recommendations on how to implement and promote training to enhance the adoption and use of OER in education.

Research on OER Adoption and Use

As previously mentioned, the availability and number of repositories for OER worldwide have expanded. Since the beginning of the OER movement, several types of initiatives have been launched such as institutional initiatives for open courseware models or sustainability projects for OER (D'Antoni, 2009; Wiley, 2016).

Despite the growing availability of OER, a glance at the literature suggests that the adoption of OER into teaching practices at all educational levels is sluggish at best. However, the exploration of OER needs to go beyond the creation of repositories, and focus on the inquiry of how to best transfer OER into practical education (Conole, 2012). Hitherto, studies have consequently been focused on incentives and barriers for the adoption of OER.

Belikov and Bodily (2016), based on 218 US faculty responses regarding OER, found that primary barriers to the adoption of OER are the need for more information, lack of discoverability of OER

repositories, and confusing OER with digital resources. A five-year program in the Netherlands called Wikiwijs was intended to encourage the use, creation, and sharing of OER by teachers from various education levels (Schuwer, Kreijns, & Vermeulen, 2014). The results suggest that for mainstreaming, OER has to be affiliated with other interventions that are focused on prescriptive policies and regulations. Directive persuasion of executive boards and teachers in schools to adopt OER is a crucial aspect. Schuwer and Janssen (2018) interviewed 55 stakeholders (educators, board members, and support staff) in 10 Dutch higher education institutions to facilitate the adoption of open sharing, and reuse of learning materials and open online courses. They found that motivation for sharing and reusing learning materials was connected to the ambition to achieve better education for students. An essential barrier for sharing and reusing learning materials is insufficient awareness of opportunities for open sharing and reusing, and lack of time. Bossu, Bull, and Brown (2012) examined the case of OER use across the higher education sector in Australia and confirmed existing misconceptions about the nature of OER and lack of awareness regarding its potential. From an Asian perspective (focused mainly on China, Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, Philippines, and Vietnam), whilst OER is becoming mainstream in many regions and institutions, uptake is slow, hampered by the inability to effectively search and locate desirable OER (Abeywardena, Dhanaraja, & Chan, 2012). Hart, Chetty, and Archer (2015) provided insights into the adoption of OER by staff in distance education in South Africa. Using a five-stage model, their survey conducted at the Unisa University revealed that while there was knowledge and understanding of OER, this had not been widely converted into active participation, and therefore had not moved towards the decision and implementation stage. In a similar approach, Percy and Belle (2012) explored barriers and enablers for the use of OER by university academics in Africa. Based on survey questionnaires, they identified that performance expectancy and effort expectancy had a positive effect on the use of OER; facilitating conditions did not have a statistically significant effect. As additional barriers, they identified discovery, relevance, context, and individual resources. A cross-cutting study was conducted by Kelly (2014) covering educators and training professionals in K–12 and higher education. Her discriminant function analysis discovered that especially K–12 educators find OER relevant to improve their practice.

All of the studies presented indorse that despite substantial achievements, significant barriers towards the adoption and engagement with OER exist in all of the institutions regardless of country and educational area. Across all studies, training educational and advisory staff appears to be a central mechanism to empower them to engage confidently in the 5R activities. However, research so far has predominantly contributed case studies that examine single institutional policies or practices, making them contextual and coupled with specific conditions. Therefore, recommendations and barriers are limited to inductive inferences which are bound to particularities of the case presented. Moreover, in terms of methodology, these studies primarily use survey data as a method of investigation.

Research Design and Method

Meta-analysis has become prominent as a methodological approach in the field of education (Ahn, Ames, & Myers, 2012). For a long period, meta-analyses have been predominantly perceived as synonymous with quantitative syntheses of information from several studies. Meanwhile, however, qualitative meta-analysis has spread in several subject areas (Levitt, 2018; Timulak, 2009; Zimmer, 2006). As it is a recent development in qualitative inquiry, there has been criticism that qualitative meta-analysis intrudes upon the tenets of the interpretive paradigm. However, a qualitative approach

towards meta-analyses can make a valuable contribution to deepening the understanding of results, and contextualising them in manners quantitative approaches cannot.

On a general level, a qualitative meta-analysis is particularly preferable for a systematic analysis of qualitative studies in a way that it is somewhat interpretive rather than aggregative (da Costa, Hall, & Spear, 2016). Since many systematic analyses, as this article illustrates, are designed to inform policy and practice in the field, it is essential to select a method of investigation that will yield the kind of inferences envisaged (Zimmer, 2006). The qualitative meta-analysis in this article is intended to derive lessons learned and design recommendations in an explorative manner. Hence, an inductive and interpretative method of qualitative content analysis was chosen to secure a systematic approach to rendering results (Mayring, 2000).

The relevant sample for the meta-analysis encompassed all 25 OER projects that were part of a project funding line. From these 25 projects, 22 were incorporated in the meta-analysis as they implemented measures regarding the adoption of OER. The remaining three projects were excluded because their primary objectives were either to aggregate and disseminate information or to conduct organisational or evaluative measures (Blees & Mollenhauer, 2018; JOINTLY, 2018; Waffner & Münzinger, 2018).

The data set used for the meta-analysis was a special volume of the German journal *Synergie* (Mayrberger, 2018). The journal is committed to topics around teaching and learning with digital media. The special volume was examined because it was dedicated entirely to all 25 OER projects to present their results, activities, and experiences with a particular focus on the lessons learned and future perspectives of OER. All contributions were structured in a similar manner which, in methodological terms, facilitated the analysis in terms of interpretation and comparison. The structure of the projects' reports mainly appeared as follows:

- project information,
- target group,
- objective of the project,
- results,
- lessons learned, and
- outlook.

The primary emphasis of the qualitative analysis was on the lessons learned and the outlook in each of the reports.

As the method for the qualitative analysis, the content analysis from Mayring (2000) was applied. This method consists of a bundle of techniques with the objective of systematic text analysis. Advantages of quantitative content analysis are merged with interpretative steps. The object of the content analysis can be all sorts of recorded communication. As the nature of the meta-analysis was explorative, seeking to derive lessons learned and design recommendations inductively, an inductive coding category development approach was chosen over deductive category application. A vital starting point for the analysis was "to develop the aspects of interpretation, the categories, as near as possible to the material,

to formulate them in terms of the material" (Mayring, 2000, p. 3). In the process of conducting the analysis, the inductively derived categories for each document were invoked to be compared and combined across the different projects to determine the effect size of the different categories. In the next step, the categories were aggregated to the extent of the lowest common trait that described all categories subsumed under the trait. As many of the projects covered multiple educational areas, aggregation of the final categories was transferred to a general level of education. However, the data was concurrently inquired to carve out particularities which could be assigned to certain educational areas.

As a final step, the categories derived were assigned to two broader classifications: lessons learned and design recommendations. Design recommendations refer to the design approach to educational research (Kerres & de Witt, 2011) and thus were intended to inform educational research and educational practice about educational problems, in this case, how to implement and promote training to spur the adoption of OER.

Sample Description

Table 1 describes the sample included in the meta-analysis. The overview systematically classifies all 25 projects of the funding line regarding the following categories: publication analysed, period, target group, area, measures implemented, and main output.

Practitioners in key positions in their respective fields of education (e.g., in charge of the training of educational staff), were the central target group of the projects. In this manner, a snowball effect was intended to anchor the topic systematically and institutionally in the respective educational areas.

Table 1

Overview of the 25 Projects Included in the Meta-Analysis

Project and publication analysed	Period	Target group	Area	Measures	Main output
LOERn (Fritz, 2018)	18 months	School, vocational education	Regional	Training, material production, self-study courses, production of explanatory videos.	About 870 persons trained to be professional OER multipliers
openUP (Honikel, 2018)	18 months	Higher education	National	Material production, workshops.	140 persons trained to be professional OER multiplicators.
MainstreamingOER (Waffner & Avseren, 2018)	18 months	School, higher education, continuing education, vocational education	Regional	Material production, online workshops.	Persons trained to be professional OER multiplicators.

OSM@BB (Nestler, 2018)	17 months	School, higher education, continuing education	Regional	Material production, training, conferences.	Persons trained to be professional OER multiplicators.
OER@RLP (Wiegers & Faber, 2018)	18 months	School, higher education, continuing education	Regional	Information, awareness and qualification events.	More than 1400 persons trained to be professional OER multiplicators.
MOIN (Bittner, Herbstreit, Krause, & Lehmann, 2018)	18 months	School, higher education, continuing education	Regional	Material production, networking for various actors.	Increase visibility, awareness, and qualification for OER.
MAT³ (Prediger & Kortenkamp, 2018)	17 months	Higher education, continuing education, vocational education	National	Material production, design guidelines for quality in adaption processes.	OER use for mathematics teachers.
OERsax (Lauber-Rönsberg, Bergert, Geburek, & Horlacher, 2018)	18 months	Higher education	Regional	Public relations, provision of free learning content.	Disseminate open teaching content.
use-oer@htwsaar (Use-oer@htwsaar, 2018)	23 months	Higher education	Regional	Website and press relations, focus seminars, information and consultation talks.	Raise awareness in the region, train lecturers and multipliers.
SynLLOER (SynLLOER, 2018)	18 months	School, higher education, continuing education, vocational education	Regional	Lectures, material production, training, cooperation formation.	18 lectures, 59 further training.
civicOER (Bremer, Leitzmann, & Sonnberger, 2018)	18 months	School, higher education, continuing education, vocational education	National	Consultation and qualification of actors, creation of OER materials.	Qualification of teachers at schools and universities, and actors in civil society.
OER-MuMiW (Lorenz & Preusse, 2018)	18 months	Continuing education	Regional	Workshops.	40 people completed workshops, creation of 40 projects.

MINT-L-OER-amt (Lubna, Röpke, & Berger, 2018)	20 months	School, higher education	Regional	Organisation of training.	Training for lecturers, teachers, and trainees from the region.
LOERSH (Kuttner & Dander, 2018)	18 months	School, higher education, continuing education	Regional	Training.	25 in school, 10 for media scouts, 3 for student teachers, 11 for higher education.
JOINTLY (JOINTLY, 2018)	18 months	School, higher education, continuing education, vocational education	Regional	Face-to-face and online meetings, community set up, legal and OER production booklet series, decision makers guidance.	Raise awareness and provide information on OER among the target group.
OERinForm (Langfelder & Berger, 2018)	20 months	Higher education	Regional	Planning a comprehensive consultation concept.	Raise awareness and provide information on OER.
ProOER (Ogurol & Richter, 2018)	24 months	Higher education	Regional	Courses.	Raise awareness and establish OER in higher education.
OERlabs (Becker, Hofhues, Bence, Reder, & Schiefner-Rohs, 2018)	18 months	School, higher education	National	Courses.	Raise awareness, provide training.
#OERcamp (Borski & Muuß-Merholz, 2018)	24 months	School, higher education, continuing education, vocational education	National	Organisation of OER camps.	In addition to OER camps, several projects and products have been created.
Edulabs (Neuschäfer, Kolbe, & Voigt, 2018)	18 months	School, education, educational training	National	Workshops.	Teaching didactic skills and participative forms of learning.
OER.UP (OER.UP, 2018)	18 months	School, higher education, continuing education, vocational training	National	Courses.	Training, networking, raise awareness, qualify distributors.
ÖWR	18 months	Continuing education,	National	Material production, training, courses.	Visibility in administration, raise

(Raffl et al., 2018)		vocational education			awareness, qualification.
OpERA (Dives, Gröger, Karl, & Novy, 2018)	16 months	Higher education, continuing education	National	Network events, Webinars, training courses.	Visibility, raise awareness, qualification.
OERinfoKIT (Waffner & Münzinger, 2018)	24 months	School, higher education, continuing education, vocational education	National	Assistance to disseminate and evaluate measures.	Reflexion tools, evaluation of measures.
OERinfo (Blees & Mollenhauer, 2018)	24 months	School, higher education, continuing education, vocational education	National	Creation of an online-platform as a central contact point for OER in Germany.	Central Internet platform for OER, development and dissemination of information material.

Results

As the main result of the qualitative meta-analysis across all educational areas, Figure 1 illustrates how the codes for the two main classifications (i.e., lessons learned and design recommendations) were distributed.

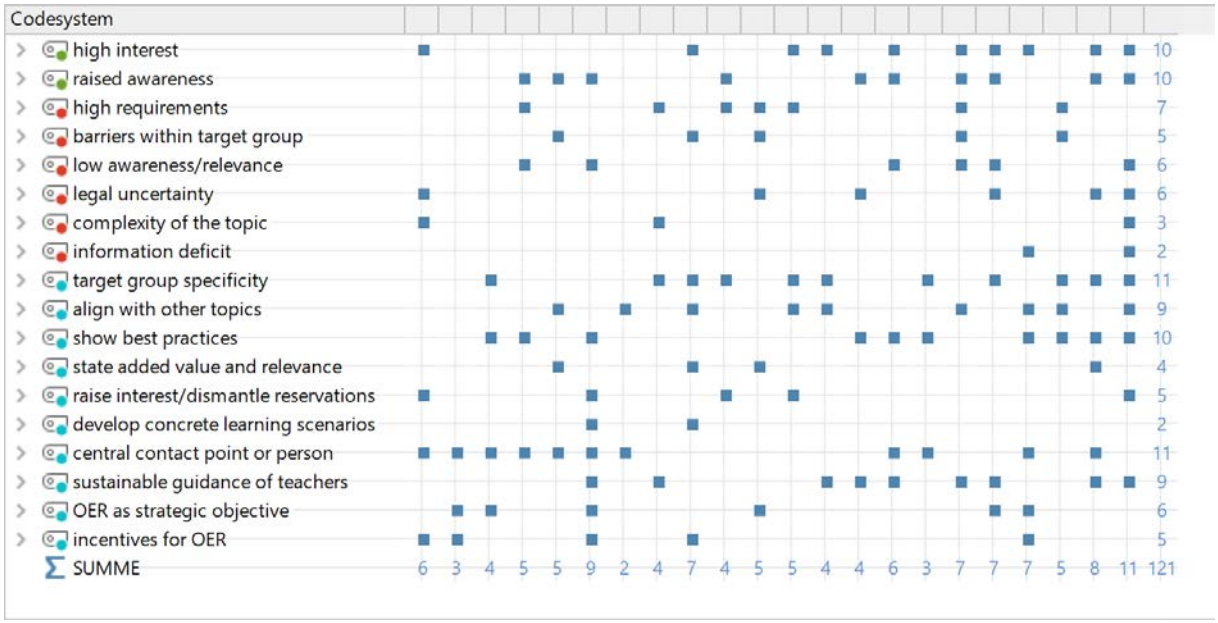

Figure 1. Overview of the coding for the meta-analysis.

Each code in Figure 1 represents the highest level of aggregation and describes all other codes subsumed under it. The green and red flagged codes refer to the projects' (positive and negative) lessons learned

(n=60) whereas blue flagged codes relate to the design recommendations (n=61) derived. The horizontal scores accumulate the total codes for each category (total n=121) while the vertical scores represent the sum of the codes for each of the 22 projects.

Discussion

Lessons Learned

Regarding the lessons learned, the results of the meta-analysis are at least twofold. On the one hand, the projects mostly state a high interest in OER and that the projects mainly accomplished raising awareness for OER. Exemplarily one project stated that in principle, the OER information event awakened awareness of the scope and complexity of the legal aspects involved in the production of teaching/learning materials (Use-oer@htwsaar, 2018).

This manner of perception is amplified by the activities implemented in the course of the project duration concerning find, use, create, share, and provision of OER. As shown in Table 1, the projects have managed to qualify hundreds of trainers and multipliers in various fields of education through courses, workshops and training, and many projects intended to anchor the topic of OER institutionally.

On the other hand, low awareness of OER was stated by six projects across all educational areas. According to Wiegers and Faber (2018) the creation and use of OER in Germany is still in its infancy despite the multifaceted measures of the last 18 months. Many teachers are not yet familiar with the term OER.

The high requirements for OER were identified as one of the key reasons for the limited use of OER. This lack of use encompassed, in particular, the creation of OER materials. Creative Commons (CC) licenses pose a key hurdle which participants must face in order to enable OER applicability. This aspect of CC licenses is also concomitant with the problem of legal uncertainties mentioned by six projects. Participants in OER training and workshops were hesitant about explicit debates on copyright and CC licences. Many uttered a fear of legal infringements and warnings (Lorenz & Preusse, 2018). These legal problems can be considered as a major obstacle that prevents many actors from working with OER. It also makes it challenging to spur participants to create and share OER. As the OpERA project indicated, for the field of higher education and continuing education, the associated implications of creating such a culture of exchange affect established and accustomed ways of working and above all, causes insecurity in the administrative apparatus (Dives et al., 2018). However, uncertainties mostly stem from the unfamiliarity of handling copyright issues and thus are mainly circumvented by compartmentalisation.

A distinctive feature of the OER projects was that they were engaged in various areas of education. These preconditions enabled the meta-analysis to derive statements about OER within different educational sectors. In the process of coding, specific barriers were identified that were mentioned by the projects related to their field of education. These statements were subsumed under the barriers in target groups code.

For schools, OER and open educational practices (OEP) found remarkable attention within the target group. At the same time, there is an immense information deficit about OER. However, once the contact

was established, there was usually an immediate interest to learn more about OER and its potential (Nestler, 2018). In the course of implementation with teachers, knowledge transfer, and cooperative and collaborative working methods, proved to be difficult (Waffner & Avseren, 2018). It turned out that forms of self-directed and autonomous learning were unusual concepts for participants. The full-time employment of teachers is another limiting factor (i.e., lack of time) as well as the fact that they do not usually have an office computer or workstation, or an office e-mail address.

Regarding higher education, students, teachers, and administrative staff had difficulties experimenting with new educational spaces beyond the usual range of teaching (Becker et al., 2018). However, a project working across educational sectors reported that in higher education, there is a need to engage with OEP (Bittner et al., 2018). In case of lecturers in higher education, the primary interest is in OER materials that are as small as possible rather than having complete modules or courses. This interest suggests that lecturers primarily strive to enrich their existing material or compile it individually according to their needs.

In vocational education, some projects were critical of commercial actors and regarding the topic of OER in general (Bittner et al., 2018). It appears that the idea of free and open educational material is sometimes difficult to reconcile with commercial interests. When interested in OER, there is a particular need for practice-proven, easy-to-use material.

In continuing education, the distribution of free materials and confidence in their quality, especially in the niches where most educators operate, is rather small (Lorenz & Preusse, 2018).

Design Recommendations

In contrast to the lessons learned, which are rather ex-post and diagnostic, the design recommendations are intended to deliver forward-looking guidelines and strategies for the adaption of OER in education. Thus, they do not merely concern improved training, but correspondingly provide institutional considerations to amplify and spur the adaption and use of OER.

Training and workshops. In terms of improving training and workshops, the most striking results are to align OER with other topics. The projects' reports indicate that resonance was paramount in all areas of education when, for example, OER training or workshops were announced in conjunction with copyright law (Bittner et al., 2018). OER and the entire debate and movement around open access cannot perpetuate and diffuse into education as a detached phenomenon, but rather must be interrelated with various disciplines and future challenges, particularly in the context of teaching (Bremer et al., 2018). Embedding the discussion about OER in the broader context of media education and school culture is considered to be particularly crucial for further training of teachers (Kuttner & Dander, 2018). Such training can include explaining the significance of flexible, networked, collaborative, and open forms of learning in terms of space and time, which are enabled by the use of OER. Another example is one project which integrated OER into a course about design and production of digital learning materials that made it possible to establish a link to media didactics (Becker et al., 2018).

Notwithstanding that aligning OER with other topics might be fruitful, its added value and relevance need to be clearly stated. In this respect, diverse aspects can be highlighted. For example, the problem that teachers have little time to create teaching material can be countered with student-generated

content (Honikel, 2018). Another distinct advantage of OER is that teaching material is ready-to-use and thus time-saving which will also score points with teachers (Kuttner & Dander, 2018).

On a more fundamental level, many projects have made use of and recommend OER-related events as an anchor to exchange with teachers across the entire spectrum of teaching. This approach also offers an opportunity to encourage them to engage with the digitalisation of teaching and learning under the auspices of openness. In this manner, OER can diffuse into the more multifaceted theme of teaching and learning in a digitalising world.

A corollary of aligning OER with other topics is to show best practices of how to adopt OER in the different educational areas. Training and workshops should therefore not simply impart basic knowledge. In higher education, OER training needs to pinpoint typical problems that could be addressed through OER deployment, for instance, concrete situations in which the production and re-use of OER could bring added value for both teachers and students (Honikel, 2018). Further development of this approach is the provision of particular learning scenarios as recommended by two projects. Through the creation, use, and dissemination of OER in concrete research study projects as part of the curriculum, teachers and students can both become actors in open and participatory educational scenarios (Ogurol & Richter, 2018).

The target group specificity planning of training and workshops is another prevalent design recommendation. As already mentioned in the lessons learned, there is a need to cogitate about the target groups. A differentiated approach, as well as the customised design of information and qualification measures, is a prerequisite. Nevertheless, it seems necessary to reflect this consistently in the planning process. For instance, regarding teacher education, awareness and qualification measures should start as early as possible, to familiarise teachers with the use of OER in school (Lubna et al., 2018). Following this thought, each target group requires a specific design of an OER measure. The latter is also consistent with the recommendation to raise interest/dismantle reservations. The aversion that material produced contains errors also has to be alleviated (Dives et al., 2018). After all, science and research thrive from drawing new conclusions from mistakes.

Institutional considerations. As a dominant and cross-educational recommendation, the analysis yielded the suggestion of establishing a central contact point or person at the institutional level. Experiences in the projects demonstrated that institutions encounter problems when they are faced with the task of creating a legal and quality framework to enable or support open work, and specifically the use of OER. However, to trigger change, individual or group efforts are mostly insufficient. At a structural level, too, support units must be created that can signal to teachers or groups that their initiatives concur with the overall strategic alignment of the institution. The latter coincides with the recommendation of six projects to transform or elevate OER into a strategic objective.

Notwithstanding this approach, decision makers such as management and faculty heads should be involved in the development process or kept informed through communication (Ogurol & Richter, 2018). At lower levels, small steps can consist of creating incentives for adopting OER, such as the prospect of access to good audio and video material as a result of participating in training (Kuttner & Dander, 2018). Students, for example, can support OER through their committee work and provide cross-subject information (Dives et al., 2018). As incentives from the institutional level, OER could be incorporated as a topic area in appointment committees in higher education. Another project suggests the creditability of training for teachers (Nestler, 2018). Moreover, the inclusion of an OER perspective

in higher education seminars can be expeditiously realised within the existing framework in which such seminars take place.

The category of providing a central contact point or contact person is related to the suggestions that providing teachers with sustainable guidance is necessary to enshrine OER in the long run. This recommendation comprises both the technical aspects, as well as networks for the exchange of OER materials and experiences that have been formed as a result of the training. Of particular note, however, is the issue of copyright and the insufficient legal advice for teachers and lecturers which needs to be addressed (Use-oer@htwsaar, 2018).

Conclusion and Recommendations

This article aimed to solidify the empirical basis regarding research on the adoption of OER in education utilising a meta-analysis. The latter was applied to surpass contextual and situational factors. The meta-analysis incorporated 25 OER projects in Germany of which 22 were part of the subsequent inquiry. Apart from the results, the mere number of projects and the achievements thereof indicates that OER is at least on its path to entering the mainstream in all areas of education.

The main analytical focus of the meta-analysis was on carving out generalised statements about the lessons learned, and to yield design recommendations for OER in education and the question of its adoption. This approach served to enrich previous studies, which are often more diagnostic rather than pragmatic-prescriptive. In this respect, the intent was to build a nexus between educational research and educational practice. Neither of the two is more entitled to guide the future development of OER; both must inform and enrich each other mutually.

The findings of the meta-analysis do not support the notion that there is one ideal way for adopting OER. As discussed, the findings reveal a mixed bag with which to stimulate the adoption of OER in education. Although interest in OER and the willingness to deal with OER can be confirmed by most of the projects, reservations are mainly rooted in the complexity of the topic, especially legal concerns. These findings widely resonate with results from other studies previously mentioned. Despite this, prior sectoral findings amalgamated with the findings from the meta-analysis indicate peculiarities encapsulated in each educational sector that require further research. However, reconciled with the diagnosis from present research and practitioners, the meta-analysis corroborates that OER is on the road to mainstream acceptance and can by no means be ignored in the context of teaching and learning in a digitalising world. Hence, to conflate OER with other pressing issues and to simultaneously emphasise its added value explicitly might be a promising approach. Single voices that call for replacing the label OER or using a synonym may be idiosyncratic for the case of Germany. Nonetheless, regarding mainstreaming OER, at least for the case of Germany, OER is receiving less attention than, for instance, massive open online courses (MOOCs; Fischer, 2014; Otto, Bollmann, Becker, & Sander, 2018; Sandeen, 2013). Subsuming or integrating OER as an aspect of existing educational training to increase awareness, is, therefore, another essential design recommendation.

Last but not least, the creation of a central contact point in institutions, regardless of its final design, to accompany and monitor actors on their path to OER, has proven to be an essential prerequisite. A promising strategy towards a successful implementation of OER is to operate perennially at both levels, institutional and practical, embracing all relevant stakeholders.

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A Survey of OER Implementations in 13 Higher Education Institutions

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Institutions in many jurisdictions are in the process of implementing Open Educational Resources (OER). This short paper is based on a report commissioned by Contact North/Contact Nord as part of their Pockets of Innovation series to better understand the impact of OER implementations at diverse institutions.

The investigation looks into 13 different OER implementations at the postsecondary level: three community colleges and one university. Four are in the United States; three universities and one Indigenous college in Canada; and five international universities—in Africa, the Middle East, South America, and Southeast Asia[i].

The format of the investigation followed a standard five-point inquiry model:

1. **Opportunity**: Why did they decide to implement OER?
2. **Innovation**: What did they do?
3. **Benefits**: What were the outcomes of the intervention?
4. **Challenges:** What were the problems in the implementation?
5. **Potential**: How do they see the future of the project?

The data collected consisted of researching relevant papers and soliciting opinions from lead participants in OER implementations. All information was taken directly from telephone interviews with a local reporter or by studying the documentation that was available either in articles or on websites. Points not stated by these reporters were not necessarily missing from their implementation, but they were not highlighted in the reports. The only consensus found among the different implementations was on the cost savings OER provided for students and/or the administration, with no other generally agreed upon points in the five areas of inquiry. As well, there were no other consensus points among the institutions in Canada, the United States, and the five international institutions.

Cost savings for students was the only agreed upon consensus (12/13 institutions). The lone outlier was an institution (Athabasca University in Canada) that included course material costs in the tuition. This institution reported on significant savings for the institution. Seven other institutions also reported cost savings over and above those of the students.

Opportunity

For a small majority (7) of the institutions, the OER opportunity was catalysed by an external grant. Seven institutions also mentioned quality assurance as a major reason for deciding to implement OER, and, for seven implementing institutions, teaching effectiveness was reported as being an important factor in their decision. Some institutions mentioned more than one of these factors. Three institutions identified the following reasons: Their desire to promote innovation among the staff; aspiring for leadership in technology; encouraging both internal and external collaboration among faculty; using OER to more closely align the content with the curriculum; reducing development time; student retention; and student access. Surprisingly to this author, only one institution mentioned the desire to design a MOOC (Massive Open Online Course). This could be because the main priority of most of the institutions researched was for classroom-based and blended learning, with little interest in fully online courses.

Innovation

A significant number (6) of institutions reported that their innovation was in building a culture of openness among faculty, while several (4) others highlighted the creation of a content repository as their innovation. A few (3) noted that simply introducing new technologies was the most important innovation for their institutions. Several highlighted the creation of a content repository as their innovation. A smaller number (3) of institutions made the following points: That the integration of OER into their courses was the most innovative result; adding ancillary content was considered progressive; faculty became innovative in their pedagogy; faculty and librarians collaborated for the first time; and implementing OER raised the institutional reputation for innovation in their communities.

Benefit

Most institutions (8) felt that the primary benefit for faculty was the sharing of resources (both internal and external) and collaborations. Many (6) reported on significant improvements in both content and teaching quality, noting that OER gave them the legal, technical, and pedagogical flexibility that they needed to localise, update, or otherwise improve content and their teaching. Legally, the permission to alter the content was considered to be an important improvement over the commercial content that they could not change when needed. Technically, the OER could be ported to any device and pedagogy was improved when instructors could decide on the content and fit it to their teaching styles. Other benefits for institutions mentioned (4) include using OER to introduce new pedagogies, reducing the time needed for course development, and the ability to adapt and change the content to suit their teaching. Some institutions mentioned the ability to update their courses and use technology effectively. Other institutions noted that implementing OER left them with increased time for research as OER saved them significant preparation time and in addition, this resulted in their increased recognition as innovators.

Student benefits focused on the significant cost savings as mentioned above. Several (5) felt that improvements in content quality and more innovative teaching combined with the easy access provided by OER that could be ported to different devices was an important benefit. Some (3-) commented that because of the cost-savings of OER, students were able to successfully remain in their courses.

Institutional benefits mentioned included the cost savings and the retention of students (which translates into increased revenues). The OER implementation also led to open policies improving the working environment for faculty and administration.

Challenges

As a major challenge, while some institutions reported reduced workload due to OER implementation, others (5) suffered from work overload, primarily associated with the time needed to assess the quality of imported OER. The lack of technical expertise by faculty was also a significant challenge; as was the lack of understanding of the legal issues around copyright. Also, some faculty felt it was time consuming to search out, find, and then adapt imported OER to their requirements. The low bandwidth (or none) available at home was considered a major obstacle for students. This problem was identified in the international institutions and not mentioned in the North American ones. Some felt that there was excessive content in the OER courses. Faculty reported difficulties in citing OER, while others reported difficulties in printing out the content when needed.

A major challenge for institutions was building faculty awareness of OER. They also reported on problems related to the poor infrastructure available that caused serious problems in implementation.

Potential

There were a wide variety of responses regarding the potential for OER at their institution. They reported on the potential for more cost savings and a more active faculty. They felt that OER would help them to attract and retain students, but strategies and plans needed to be developed.

One university reported on using OER to support a public – private partnership with a company that specialized in testing, while another such partnership was created between community college and a private company that aided in the actual implementation of the OER. There was one indigenous community college that became very excited about OER and their ability to adapt the content to address their unique concerns.

These 13 implementations have provided important information of use to any institutions considering OER initiatives in the future. Each institution identified specific opportunities, challenges, etc. Other than the cost-savings, there was no consensus on any other issues. While access to a grant was important for the majority of institutions, almost half chose to proceed with their OER initiative with no external support. Nearly half the institutions surveyed identified that a principal driver for innovation in their institution was the common desire for a culture of openness. This points to the need for faculty awareness in the possibilities of OER and other aspects of open learning.

Discussion

In addressing the high cost of course content, while supporting a culture of collaboration, the majority of institutions recognized the need for sharing resources among faculty. Thus, they promoted the OER initiative as a means of supporting sharing and teamwork among faculty, both within and outside the institution. Several institutions reported on a reduced workload, while several others complained that their workload increased. This phenomenon could be ascribed to the approach that the different institutions took towards implementation. If an institution searches and finds a course textbook or a large module and adopts it "as is," this reduces the workload. These faculty may not be too concerned with the content being an exact match, while those who reported an increased workload, either created their own materials or spent much time in adapting, integrating, and localising the OER chosen. Whatever the path chosen, it is evident that the OER movement is not simply about free content. The affordances of OER, across different cultures, includes many benefits, such as supporting learning design, a more collaborative faculty, and increasing student retention

The case studies form part of Contact North/ContactNord's *Pockets of Innovation* series. These 13 examples provide insights into multiple facets of OER development, use, and impact:

- Use of OER for teaching and learning;
- Integration of OER into programs and courses;
- Development of OER by individual faculty, as well as teams;
- Adaptation of OER to match culture, language, and course content requirements;
- Strategies to involve faculty in the development and use of OER;
- Benefits of OER for student learning and faculty effectiveness; and
- Organizational change resulting from the integration of OER.

The descriptions outline the organizational contexts that motivated the introduction of OER into teaching and learning, as well as details of the policies, practices, development processes, and resources involved. Benefits and challenges for faculty, students, and, in some examples, institutions, receive particular attention, followed by consideration of the potential for OER use in each academic situation.

Contacts from each institution are provided for each description with links to further information.

[i] https://teachonline.ca/tools-trends/open-education-resources-oer-applications-around-world/taxonomy-term

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Research on Virtual Education, Inclusion, and Diversity: A Systematic Review of Scientific Publications (2007–2017)

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Abstract

This article covers a topic related to increases in the existing heterogeneity of the university student population, specifically in virtual learning environments. There is a growing concern for offering training alternatives that include all students. As the first step in a line of research related to quality, equity, and inclusion in e-learning, we aim to identify emerging trends in research on inclusive virtual education (IVE) at the higher education level and how inclusion is conceptualized. Our goal is to provide ideas on future research topics and raise issues for further exploration. This research was conducted through a systematic review of articles published in the last decade in the WOS and Scopus databases. Upon reflection, we suggest the need for inclusive e-learning educational designs with greater emphasis on human diversity in all of its complexity. By doing so, we may be able to contribute to increasing the equality of educational opportunities and overcoming the barriers that restrict the access, continuity, and successful exit of the entire student population, regardless of their individual learning needs.

Keywords: inclusive e-learning, inclusive Web design, e-learning and accessibility, inclusive virtual education

Introduction and Background

As one of the biggest challenges in education today, attention to student diversity is an important part of academic discussion. The issue was included in the UNESCO goals to be met by 2020 and is still a central focus in the 2030 education goals, as part of Sustainable Development Goal 4 to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (UNESCO, 2015, p.6).

Since this requirement also extends to virtual education, it is necessary to specify and describe some concepts on which this study of inclusive virtual education (IVE) is based. We begin with the principles that govern educational designs that aim to address the diversity of the student body, seen as the core of inclusive education. In addition, we will provide a conceptual explanation of some terms that we will use regularly, such as diversity and differences. This will allow us to contextualize our view of inclusive education, and will make our perspective clear.

When discussing inclusive education, we inevitably come across a series of principles that regulate how to handle the diversity of students from the perspective of education as a human right. Thus, we find principles such as tolerance, respect, educational equity, accessibility, quality, social justice, and inclusion, in accordance with the concept of equal educational opportunity (EEO), and even though debating these principles is not the goal of this article, since the concept of EEO implies a very broad perspective, based on multiple dimensions from different disciplines, it is necessary to mention these principles as they are involved in our vision of inclusive education.

It is also important to clarify our view of diversity as an intrinsic property of the human condition. This diversity is evident in the differences, which, according to Sánchez and Pulido (2007), "are not intrinsic, neither objective, nor *a priori*, but dominant social constructions that produce certain mental outlines, and are produced by them" (p.16). Thus, we can see how diversity, being an abstract property, cannot be seen by the human eye, while the differences may be seen.

These statements about diversity and human differences, suggest a grouping of types of differences proposed by Fermín (2011), who considered different classifications introduced by various authors. These classifications are merely didactic in nature, and help make human differences clearly visible. The author proposes four large groups of differences which allow us to characterize human diversity, understanding that they are not mutually exclusive. They include:

- biological and/or physical differences, including age, gender, biological rhythms, and state of health;
- cultural and/or racial differences, such as different cultures, social classes, ethnic groups, and races;
- learning differences, to address cognitive and learning styles, as well as different learning abilities; and
- personal differences, such as personality and socio-affective characteristics (Fermín, 2011, p.28).

It is worth noting that this is not a closed set of groups, nor is it completely exhaustive. It is an approach to visualizing human differences that should be addressed with various educational designs, and for the issue that concerns us, that of developing IVE, which deals with learner differences in all of their complexities. An emerging category of analysis, that surfaced from the analysis carried out by us, refers to a vision of IVE that is focused on other human differences, distinguished from that focused on persons with disabilities.

This brief discussion of the concepts of diversity, difference, and inclusion supports the notion that this study seeks to highlight: all of the human differences that make diversity perceptible. Therefore, we considered it convenient to include a brief discussion on this matter, as well as to highlight how it is linked to inclusive education, as a thematically interesting epistemological approach.

Likewise, we also wish to first clarify our conceptualization regarding inclusive education, and then deal with IVE. Although there does not seem to be an agreed-upon definition in the academic community, inclusive education is linked to the idea that absolutely all students have the right to be recognized in their uniqueness. It is their right to be accepted, to be valued, and above all, to have equal opportunities to participate, according to their abilities and talents, in order to achieve the maximum development of each one's potential. According to some authors (Echeíta, Simón, López, & Urbina, 2013; UNESCO, 2001), the inclusive education approach, with its emphasis on students with disabilities, is still present in some countries. However, progress has already been made in recognizing the complexity that characterizes human diversity, in which inclusive education is considered a reform that responds to diversity among all students. Three key ideas make up this conceptual space. Inclusive schools are those that: (a) train everyone for and in diversity; (b) do not address the needs of a minority, but keep the entire student population in view; and (c) entail a paradigm shift, which implies a different way of understanding education and society.

As may be seen, inclusive education is not limited to curricular or methodological adjustment, or to restructuring special education. It is a different way of understanding education, a new paradigm that reflects a new philosophy and values (Colás-Bravo & Lozano, 2011), and that also views education as positive and a right for all people (Echeíta & Ainscow, 2011). In addition, as a constant innovation and improvement process, it demands optimization of conditions, resources, and the supports that serve as process facilitators (Echeíta et al., 2013). Once inclusive education truly comes into existence, it will have direct implications for society, reflected in true social inclusion.

Based on this premise, we examine how virtual education fits within this approach and consider ways to consolidate the e-learning modality under the inclusive paradigm. Creating a foundation on which to build IVE involves everything indicated in inclusive education, within the modality of virtual teaching and learning. From this premise and set of assumptions, we developed a conceptual approach based on our results found, which will be detailed in the corresponding section.

Research Problem

In the field of virtual education, practices that seek to combat segregation and exclusion have been developed, based on inclusive educational designs for the world of e-learning. Therefore, it is relevant to

explore these practices, to determine the concept of inclusion on which they have been proposed, and the audience they have been designed for.

To answer these questions, we set out to conduct a systematic review of research related to IVE at the university level: What inclusive e-learning educational designs exist today? How do they describe and explain the idea of inclusion? How do they conceptualize IVE? Do they recognize all of the complexity that characterizes human diversity in inclusion? The goal of our research was to identify the emerging trends in higher education IVE research and its conceptualization of inclusion, and to provide ideas to other researchers on future research topics, as well as issues for further exploration. In order to accomplish this, we conducted a systematic review of articles published in the last decade.

Research Method

This article presents exploratory research, through which we studied the research trends of IVE in higher education. The documented bibliography describes an extensive, systematic review of the literature regarding IVE in higher education, based on articles published in scientific journals indexed in Web of Science (WOS) and Scopus during the period of 2007 to 2017.

We used data collection techniques and instruments designed (a) to guarantee the systematicity of, and the veracity of the information presented, (b) to show how the evidence justifies the results that are presented, and (c) to offer contributions to help us better understand the phenomenon being studied.

The review was conducted as a systematic process of searching for, collecting, organizing, and analyzing information from a clearly formulated question, as well as implementing explicit methods to critically identify, select, evaluate, compile, and analyze the data from the studies included in the review according to certain criteria (Krull & Duart, 2017).This review was conducted considering the seven steps suggested by Cooper (2010), as cited in Krull & Duart (2017, p.4):

1. Draft the research problem.
2. Search the literature.
3. Gather information from the studies.
4. Assess the quality of the studies.
5. Analyze and integrate the results of the research.
6. Interpret the evidence.
7. Present the results.

It is important to note that these steps are not exclusive or rigid, but are part of a continuous process. Since we have already discussed the first step, we will now describe the remaining steps in detail.

In terms of reviewing the literature, we decided to look for research that would address IVE at the university level in the last decade (2007–2017), in the Scopus and WOS databases. The following search descriptors were established: (a) inclusive e-learning, (b) inclusive e-learning accessibility, and (c) inclusive e-learning diversity. Next, inclusion and exclusion criteria were established to select the publications to be analyzed.

The inclusion criteria ensured that the studies: (a) responded to the search descriptors, (b) addressed higher education, and (c) consisted of research published between 2007 and 2017. Initially, we considered using only articles in peer-reviewed journals; however, in view of the valuable results provided by other publications in the Scopus and WOS databases, published articles, books, book chapters, and speeches were included. Finally, our review included only articles for which the full text was available publicly or through the researchers' institutional subscription.

Two exclusion criteria were considered. First, we excluded research related to an educational level that was different from university or that came from other fields of study, or social realms. Second, we excluded research that addressed inclusive education that was not in a virtual university education context, or if it did address virtual university education, it did not consider the inclusive education approach.

The first search based on the descriptors yielded 34 articles reported in WOS and 309 in Scopus. Then, the aforementioned criteria were applied to this total of 343 publications. Studies repeated in both databases were eliminated, leaving a total of 89 publications for analysis.

The next two steps addressed collecting and assessing the quality of information, and they complemented each other. In the first instance, a protocol was developed to organize the relevant information from the articles according to the criteria of authorship, publication date, title, journal or publication medium, and abstract. This information is presented in a matrix (see matrix on https://sites.google.com/view/elearning-inclusive-research/página-principal). As for quality, since the studies in these two databases are subject to peer review, we presume that this guarantees the accuracy and quality of the studies.

The next steps of analysis, interpretation, and presentation of research results will be explained in the following sections.

Results and Research Analysis

For the purposes of this study, content analysis was carried out in order to organize, analyze, and interpret information. Cáceres (2003) suggested the following steps for this type of analysis: (a) select the object of analysis; (b)conduct a pre-analysis to consider prior research and determine the unit of analysis (in our case, the publications that met the established criteria); and (c) code, categorize (to ensure the reliability of this step). These steps were developed by following Glaser and Strauss (1967), with the constant comparative method (CCM).

To analyze the data that arose from the review, two qualitative research tools were used—the CCM, as a theoretical and practical tool, and ATLAS.ti, a tool of a more purely practical nature. These complementary tools helped us structure an analytical process of high methodological quality, which enabled us to construct conceptual networks based on the categories and subcategories that arose from the 89 studies analyzed.

Four phases must be addressed during the analytical process. Due to the exploratory scope of our study, we used the first three phases: (a) initial review and selection; (b) categories, codes, and groupings (open coding); and finally, (c) integration, description, and interpretation (axial coding). The process was inductive, a characteristic of content analysis and, although data was allowed to surface during the analytical process, the focus of analysis was guided by our research questions. Fundamentally, our interest was in knowing how inclusive education has been understood, since this determines the type of educational design that is offered. Figure 1 shows the first conceptual network, illustrates the central category and how it is connected to the other elements.

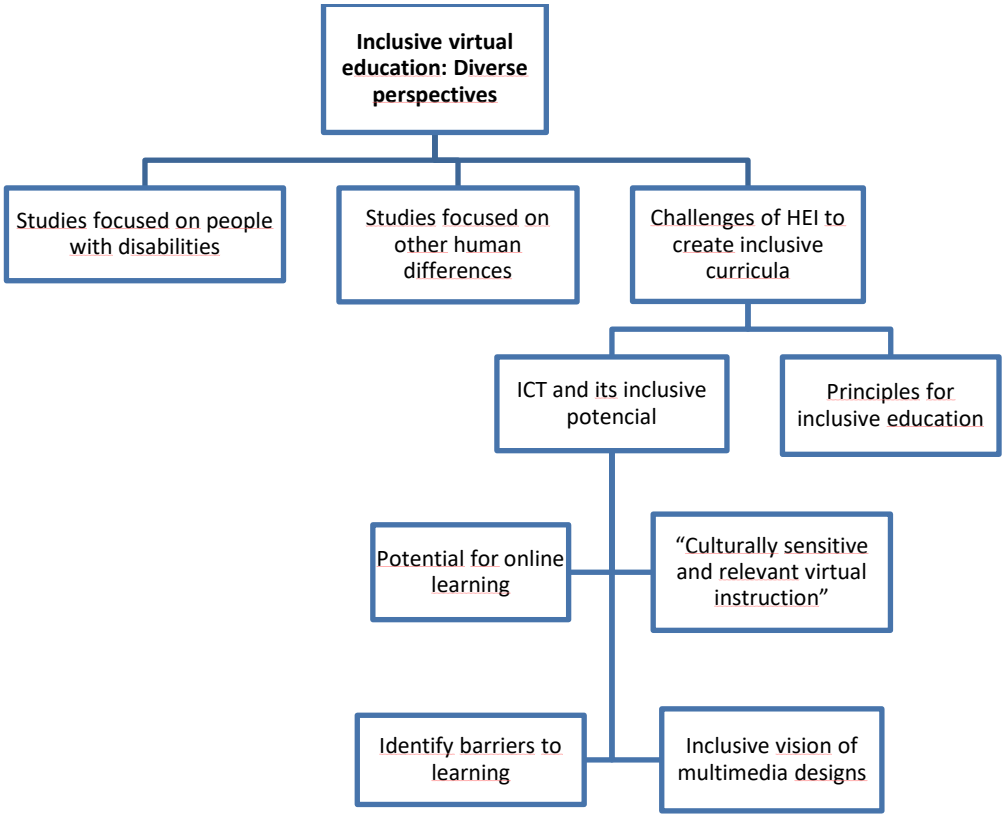

Figure 1. Main elements of inclusive virtual education with central category highlighted. This mind map illustrates the categorization process, including the central category and its subcategories. The text within quotation marks corresponds to the codes "in vivo," i.e., to an expression taken textually from the articles reviewed, while the others are constructions or conceptual codes generated by the researcher during the analysis process.

As Figure 1 illustrates, IVE is a complex process involving different perspectives. Three major categories are evident and may be defined as: (a) focused on other human differences; (b) focused on people with disabilities; and (c) challenges of higher education institutions (HEI) to create inclusive curricula. Of the 89 studies analyzed, 51 (57.3%) focused on people with disabilities, while 38 studies (42.7%) addressed IVE educational designs for other human differences. Having this been identified, we did not intend to determine whether or not any of the approaches were appropriate or not, but rather to simply question the relevance of continuing to develop educational designs that address a single type of human difference. The current student reality is highly complex and diverse, and requires the development of educational designs that may address this complexity while also considering the students' individualities. Similarly, this analysis helped us appreciate the many challenges facing HEI as they respond to student diversity by designing inclusive curricula.

Studies Focused on People With Disabilities

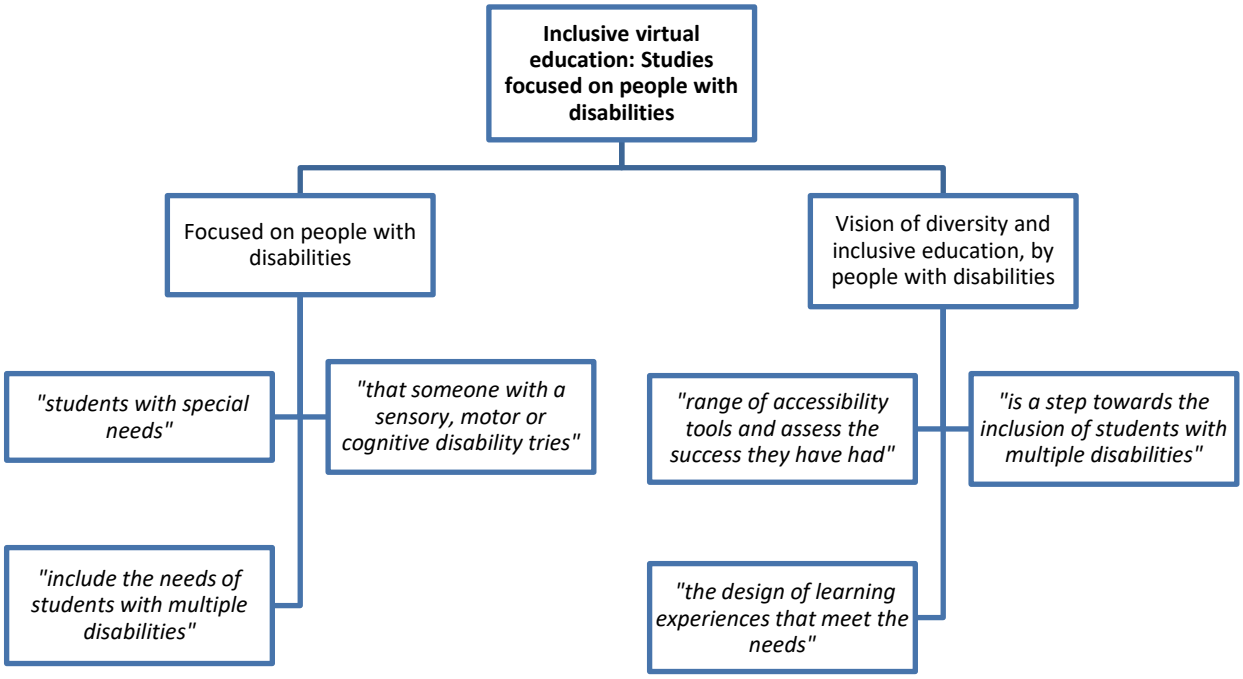

Figure 2. Studies focused on people with disabilities. This mind map illustrates the subcategory and its properties. Regarding the properties, some of the text is framed in quotation marks and italics, which correspond to brief textual quotations of some of the articles studied.

Figure 2 illustrates that the studies address different types of disabilities, including: (a) sensory, (b) motor, (c) cognitive, (d) multiple, and (e) dyslexia or other types of learning difficulties. The various pedagogical

approaches for inclusion to meet the requirements of these students are essentially accessibility educational designs to develop virtual learning environments that allow this population to overcome the different barriers related to their limitations (Amado-Salvatierra & Hilera, 2015). Such designs suggest: (a) the use of assistive technology, (b) the development of accessible e-learning materials and activities, (c) curricular designs of accessible content, (d) the development of metacognitive processes to motivate learners through ICT, and (e) other adaptations to facilitate learners' access to knowledge. Most of the studies analyzed in this research focused on the inclusion of people with disabilities. Some dealt with actions aimed exclusively at students, while others indicated an understanding that the inclusion of people with disabilities does not depend exclusively on assistive technologies; these learners are also helped when programs train teachers to handle appropriate strategies to meet students' needs, and Web developers to design software that meet the technical criteria which is used to develop inclusive platforms, and that are dealt with below. These efforts make it possible to address this educational challenge of caring for people with disabilities more broadly, as they do not assume that guaranteeing access alone is a sufficient measure. Strategies must allow for all students to continue in the program (continuity) and to successfully complete it, regardless of their personal differences; this requires the development of institutional programs that focus on students with disabilities, as well as their peers, teachers, and all of the assistive technology that has been developed in recent decades (Fermín, 2013).

As researchers in this field, we value the effort in developing virtual learning platforms that allow students with disabilities to navigate autonomously, in an approachable manner, and where their opportunities to interact with resources and other key actors in the learning process are facilitated. However, we know that, at present, this is insufficient. Thus, especially in recent years, inclusive e-learning educational designs are being developed in which other human differences are recognized.

Studies Focused on Other Human Differences

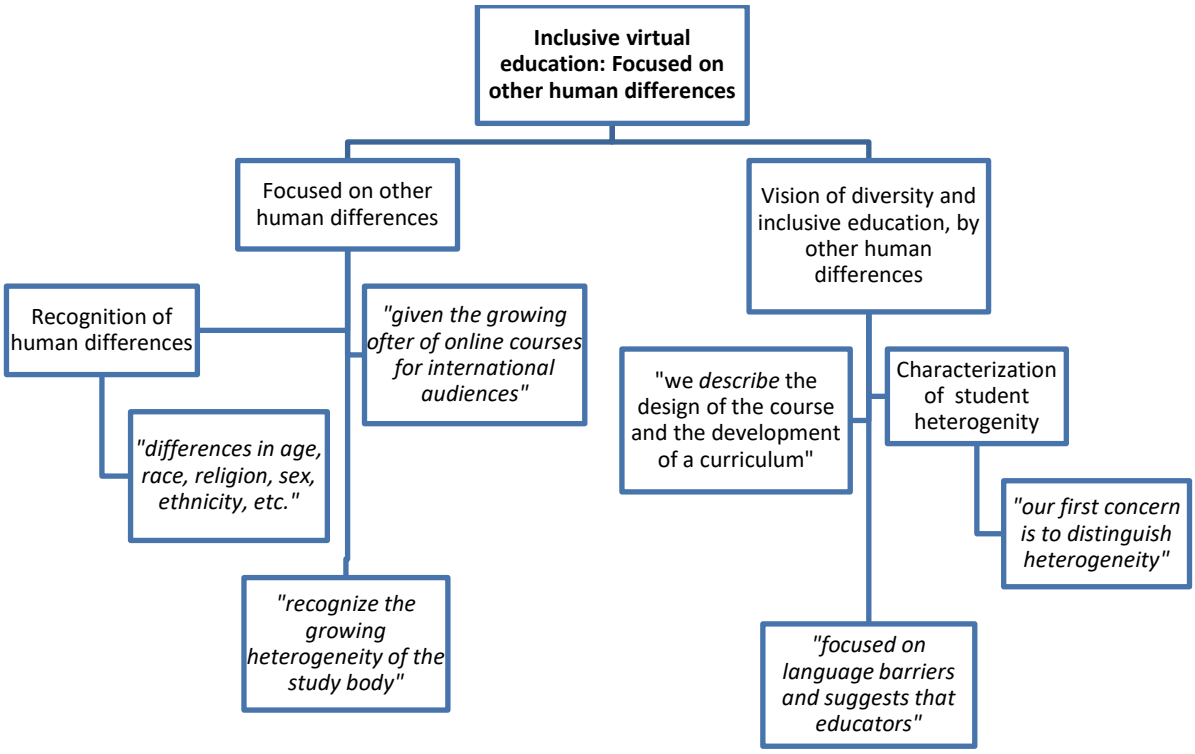

Figure 3. Focused on other human differences. This mind map illustrates the subcategory and its properties. Regarding the properties, some of the text is framed in quotation marks and italics, which correspond to brief textual quotations of some of the articles studied.

Figure 3 shows that the studies reviewed for this research explicitly recognized other human differences, such as (a) age, (b) race, (c) religion, (d) gender, (e) ethnicity, (f) culture, and (g) social status. There is clearly a need to characterize growing student heterogeneity, in terms of making it visible, as the only possible mechanism for developing educational designs that allow these students to appropriately meet their needs (e.g., those who speak another language or come from other cultural contexts). In developing an IVE educational design, it is assumed that learning must be accessible to all, under the principle of inclusive universal access. In developing concrete strategies, it is clear that the principles of the universal design for learning (UDL) and how it is applied in an e-learning environment are linked (Al-Azawei, Parslow, & Lundqvist, 2017).

Moreira (2016) reflected on the impact of online education, given the increased numbers of students, and, consequently, the presence of students' diversity in online classes. Different types or forms of reasoning need to be developed within a student body with differences in terms of: (a) education, (b) culture, (c) rationality, (d) learning styles, (e) age, (f) race, (g) nationality, (h) expectations, and (i) demands. In recent years, as more online courses are offered for international audiences, the number of learners studying online has also increased and a more diverse student population has resulted from this. In this systematic review, we examined various studies that offer alternatives to address this educational challenge; most of

them focused on understanding a particular educational phenomenon—to discover what is happening, who the students are, and to highlight the diversity of the student population. Some also questioned which of the barriers they encounter are in their learning process, and how these could be addressed. It is not the purpose of this study to determine the pertinence (or lack) of the strategies developed. However, it opens a line of research that could systematize strategies or approaches to address the so-called other human differences, and evaluate their impact on the three pillars of inclusive education, namely students' access, continuity, and successful completion.

Simultaneously, another growing category emerged from our analysis, allowing us to compile a list of the challenges HEIs must address in order to serve the entire student population. This category highlights the challenges faced by HEI seeking to develop IVE educational designs.

Challenges Faced by HEI in Creating Inclusive Curricula

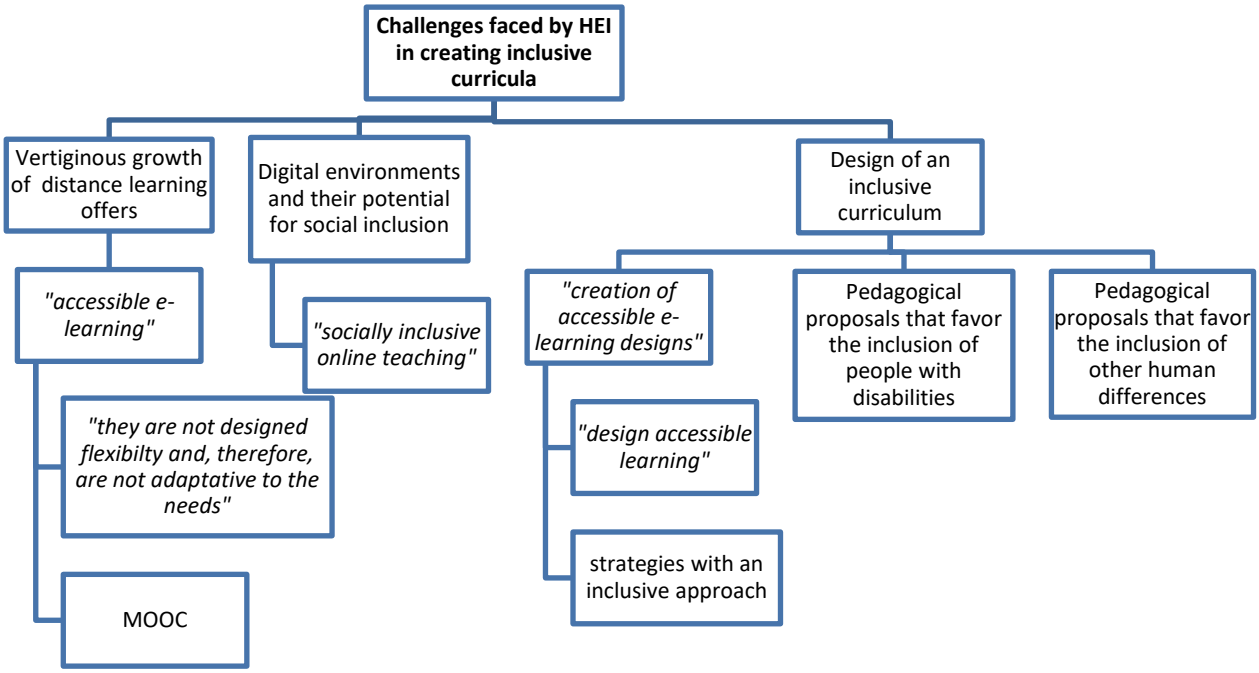

Figure 4. Challenges faced by HEI in creating inclusive curricula. This mind map illustrates the subcategory and its properties. Some of the text is framed in quotation marks and italics, which correspond to brief textual quotations from some of the articles studied, while the others correspond to codes created by the researcher.

Among the challenges HEI face in creating inclusive curricula, there are two large subcategories (see Figure 1), namely ICT and its inclusive potential and principles of inclusive education. These will be dealt with later. However, as Figure 4 illustrates, these challenges also stem from the dramatic growth of distance

learning, from the possibility of digital environments to address social inclusion, and from an obligation to design inclusive curricula that adjust to the heterogeneity in our virtual classrooms. Regarding the inclusive potential of ICT, its flexibility and use of technical aids to enhance learning has been extensively discussed in the literature. Some studies have questioned the inclusiveness of online courses, recognizing the development and advancement of assistive technologies, with a focus on accessibility, to address all student diversities and almost all existing disabilities. It is valid to emphasize the positive role that people with disabilities have played in this technological advance, as seen from the social model of disability. As a limiting variable, it is well known that some of these aids are costly, one reason why they do not reach all social and economic sectors, which becomes one of the barriers that hinders the learning possibilities of ICT (Fermín, 2013).

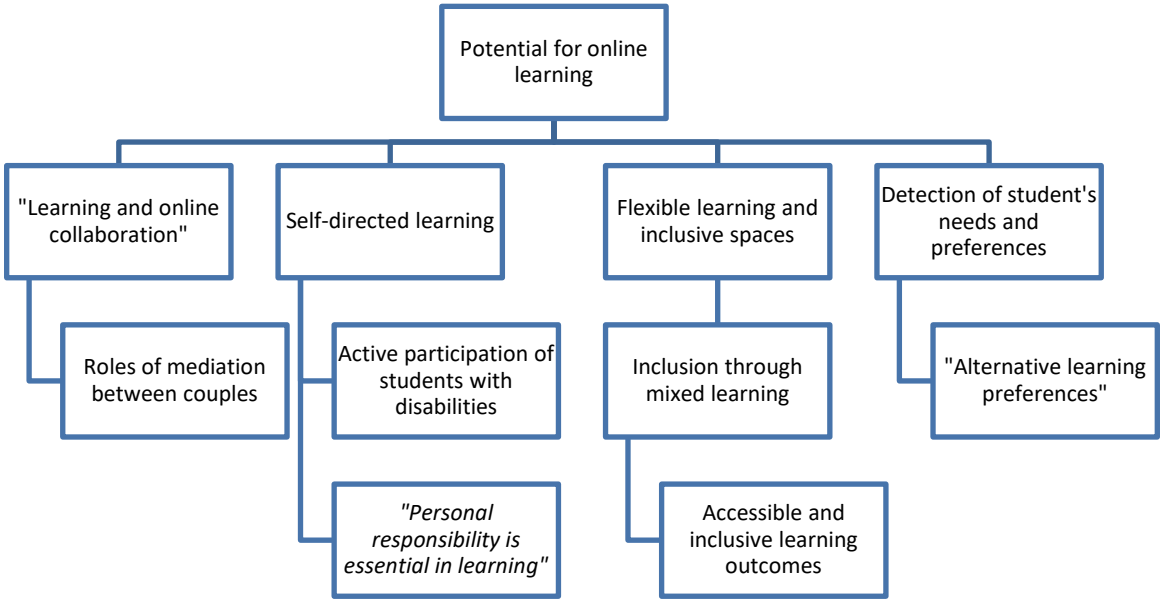

Figure 5. Contributions to the learning process generated by distance education. This mind map illustrates the property and its dimensions. The dimensions give off codes, with some of them framed in quotation marks and italics. This is because they are "in vivo" codes and/or quotations from some of the articles studied, while the others are codes created by the researcher.

In Figure 5, one dimension in the subcategory related to online learning potential deals with the mediating role among peers, a condition that favors online collaborative learning. Sadykova (2014) examined the mediation roles that peers may play in the context of multicultural online learning environments. Peers become invaluable mediators of knowledge. To this effect, the previous author proposed the design of proactive, collaborative learning courses. This aligns with the socio-constructivist approach to teaching and learning that underlies educational designs from different countries, and therefore becomes an interesting contribution to be considered by curricular and instructional designers.

Additionally, self-directed learning acknowledges the importance of students' responsibility in their learning process. It is important to consider the flexibility needed in learning environments that are turned into inclusive spaces, as well as how technology is used to detect students' needs and preferences (Santos et al., 2013). We highlight this personal responsibility to the flexibility explained above, as a significant contribution to planning for teaching and learning processes that generate an impact on how courses are designed, considering all necessary adjustments from the design stage.

An important concept emerged from our research: teacher training and support for developing inclusive e-learning. There are three aspects to this concept. First, there is the idea of the teachers' role in the accessible design of e-learning, which is significantly focused on people with disabilities. This aspect is apparent in several studies that conceived educational inclusion as being focused on people with disabilities. Second, some studies demanded that teacher training address the inclusion of other human differences, complemented by the express need to train academics in online learning technologies in inclusive environments, beyond merely technical issues. It is necessary to take a closer look at the principles of inclusive education, in order to provide educators with the necessary knowledge and tools they need to design opportunities for inclusive learning. In this regard, it is worth noting that training for teachers cannot be limited to a specific moment, but should rather be part of on-going support for the development of processes that attend to diversity (e.g., a support unit that may respond to the multiple challenges teachers face in their pedagogical praxis). As a starting point, we must assume that IVE is part of a dynamic, multi-factorial, and complex process, which involves the participation of multiple actors. If we simply take actions that focus on students, we ignore a key factor in the process—the teacher—and set ourselves up for failure.

Thirdly, in parallel, there is evidence of a greater awareness of the cultural diversity that characterizes the student population at HEI, which merits the development of educational designs that recognize, value, and respect that diversity (Sadykova, 2014; Shimoni, Barrington, Wilde & Henwood, 2013). Thus, it is worth highlighting the development of culturally sensitive and relevant educational designs as an attribute of virtual education.

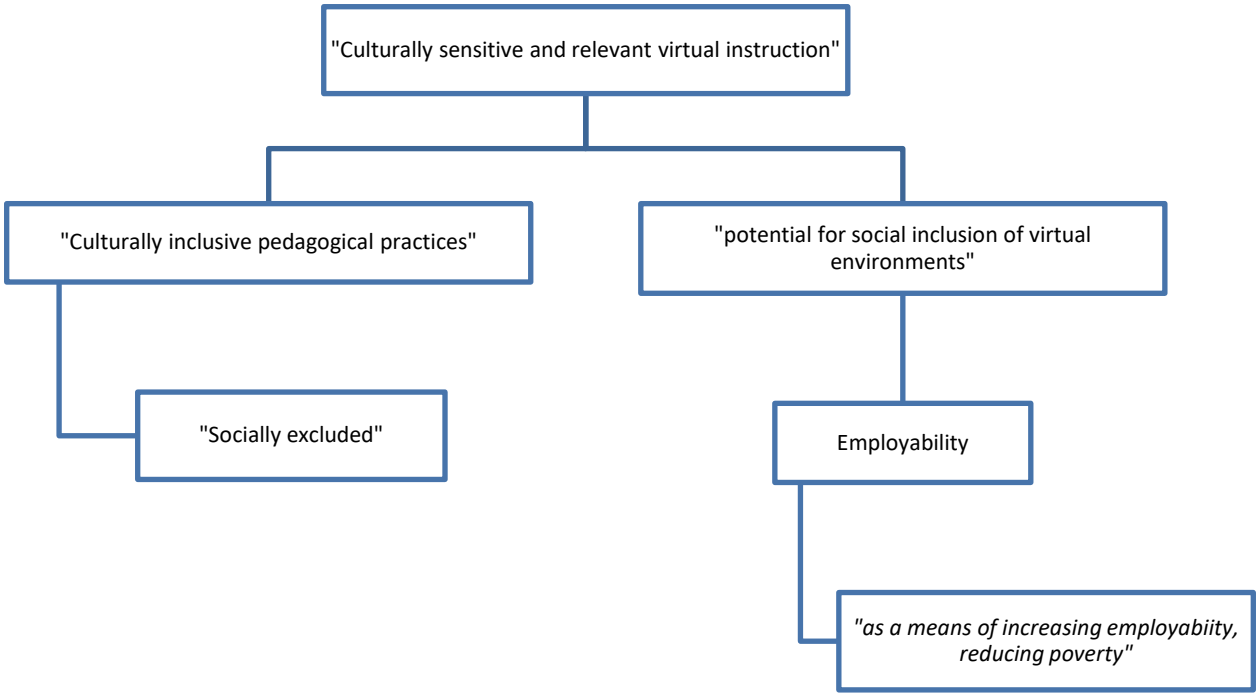

Figure 6. Contributions to the learning process generated by distance education. This mind map illustrates the property and its dimensions. The dimensions give off codes, with some of them framed in quotation marks and italics. This is because they are "in vivo" codes and/or quotations from some of the articles studied, while the others are codes created by the researcher.

Figure 6 illustrates the potential for social inclusion in virtual environments, with the need to design culturally inclusive pedagogical practices that serve socially excluded sectors, often a product of the digital gap. Such practices may contribute to improving employability rates, reducing poverty, and increasing education rates for those who cannot have access to higher education due to a lack of economic and social resources, geographic distance, and poor technological competences, among other risk factors. Parrish and Linder-VanBerschot (2010) recognized the multicultural nature of educational environments, which suggests that instructional designers, especially those working in online environments, need to develop skills in delivering culturally sensitive and adaptive instruction. It is worth considering whether we have taken advantage of this potential for social inclusion or whether, on the contrary, we have widened the gap. Perhaps, efforts to include people in vulnerable socio-economic conditions have not sufficiently improved their technological skills so they can have access to better job opportunities, thus allowing them to overcome the limitations of their impoverished situation. Deepening this line of research would allow us to take action to reduce the educational exclusion of certain social, cultural, and economic groups, as a guarantee of the right that assists them to receive a quality education under conditions of equity.

In parallel, in order to take advantage of ICT's potential, it is necessary to identify the barriers to learning in virtual environments.

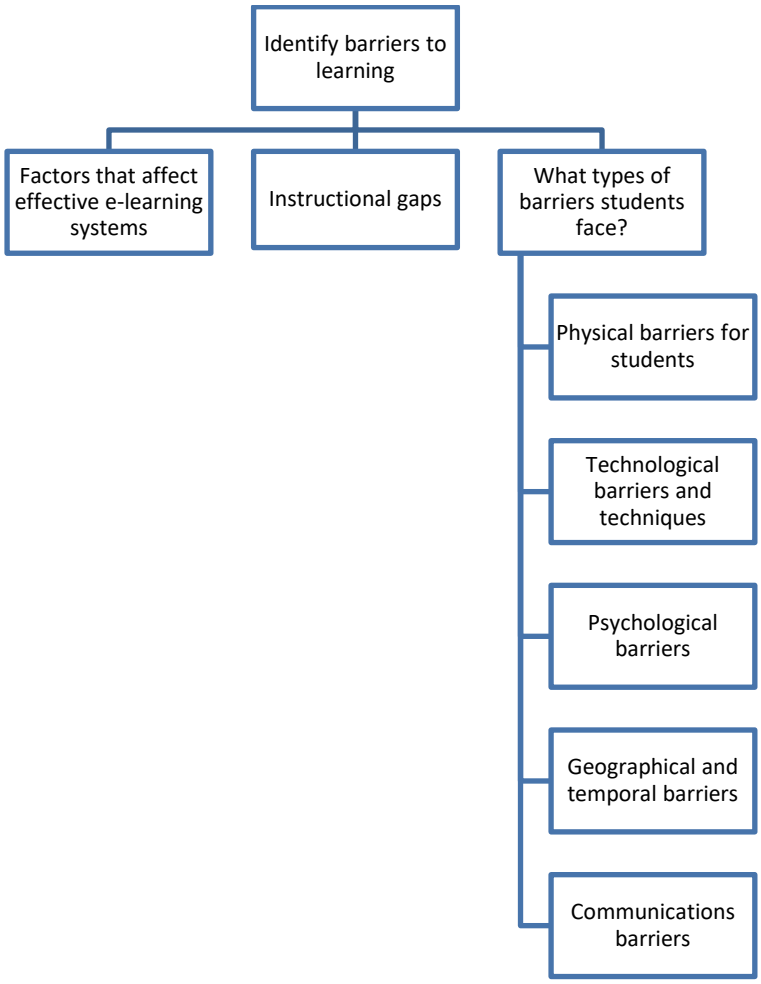

Figure 7. Identifying barriers to learning. This mind map illustrates the property and its dimensions.

Figure 7 illustrates how some studies are focused on identifying the factors that affect effective online learning systems, as well as instructional gaps. Above all, we emphasize the importance of recognizing the types of barriers students face, with a clear impact on their learning processes. Most of the time, this translates into very high rates of student desertion, as a result of the insufficient development of programs that guarantee not only access, but above all continuity thin the educational system and successful completion. We are aware that this situation is not exclusive to virtual education, since it is also observed in face-to-face modalities. Based on our review of the research, we were able to classify these as (a) physical, (b) technological and technical, (c) psychosocial, (d) communication, and (e) geographic-temporal barriers.

And finally, within this subcategory, we find the attribute related to multimedia design; therefore, we ask ourselves whether current designs may be considered inclusive.

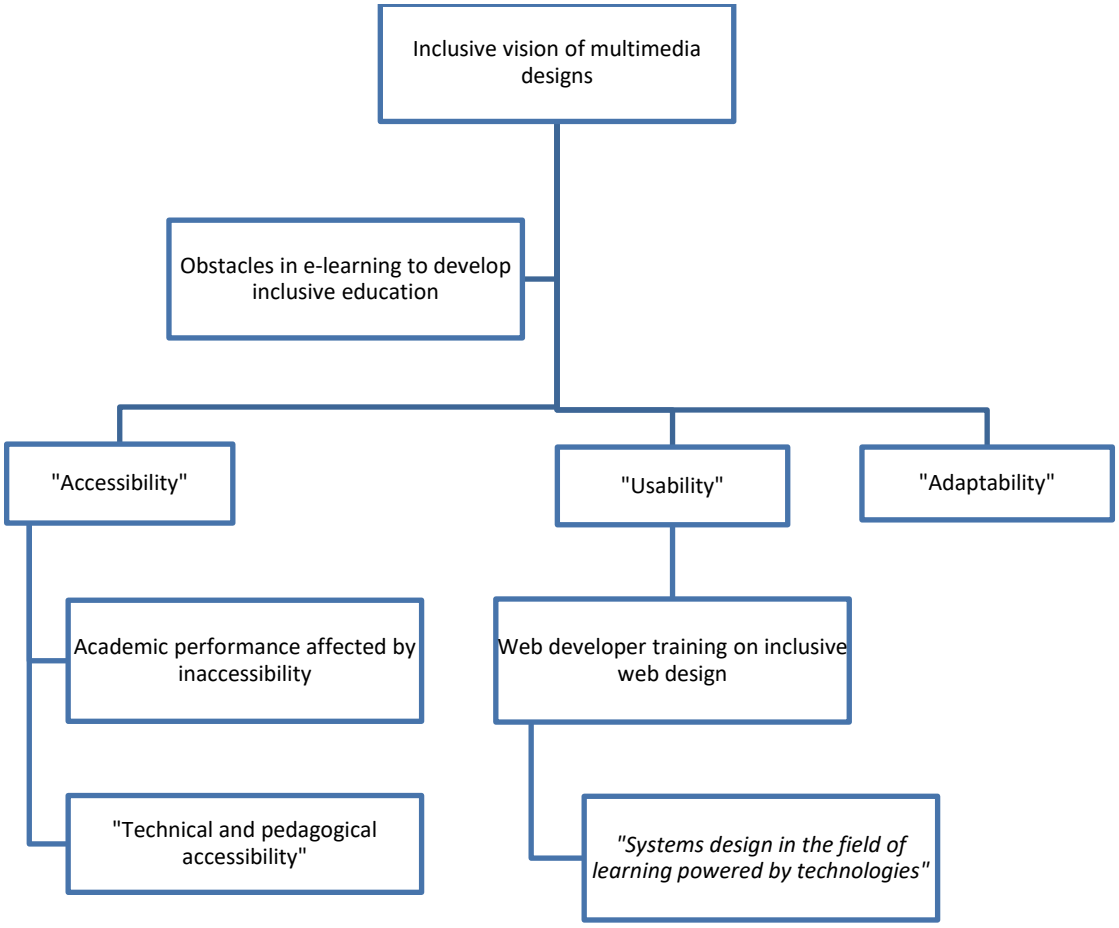

Figure 8. Inclusive vision of multimedia design. This mind map illustrates the property and its dimensions. The dimensions give off codes, with some of them framed in quotation marks and italics. This is because they are "in vivo" codes and/or quotations from some of the articles studied, while the others are codes created by the researcher.

There are two perspectives regarding this attribute. First, there are studies that highlighted the qualities of their designs within the framework of an inclusive proposal, such as accessibility, usability, and adaptability, with many stressing the importance of training Web developers in how to design inclusive Web systems for virtual learning (Granic & Adams, 2011; Radovan & Perdih, 2016). Second, it was necessary to redefine those that question the inclusiveness of Web designs, in terms of reflecting on the obstacles of e-learning to develop inclusive education, and which are closely related to the barriers mentioned above (Calvo, Iglesias, & Castaño, 2017). Not designing or using inclusive learning resources means that you do not allow all students to have access to information; and this may affect their academic performance or result in them not completing the course, not as a product of their personal limitations, but because of the inaccessible design of virtual courses.

Furthermore, in the category of challenges of HEI to create inclusive curricula, the second subcategory (i.e., the principles of inclusive education) was found in several studies.

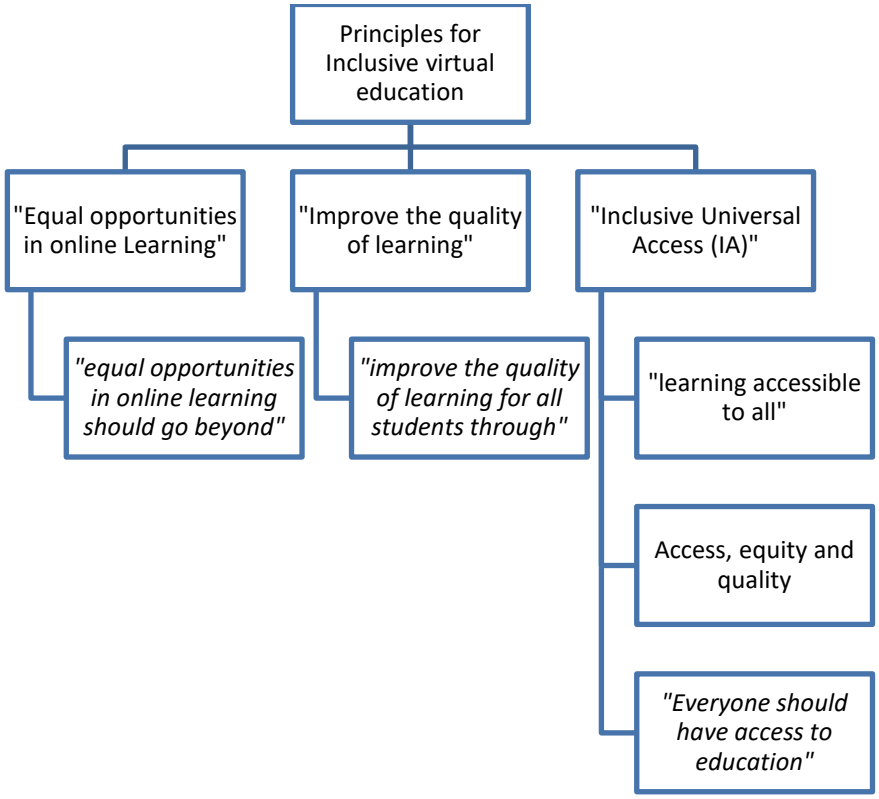

Figure 9. Principles for inclusive virtual education. This mind map illustrates the property and its dimensions. The dimensions give off codes, with some of them framed in quotation marks and italics. This is because they are "in vivo" codes and/or quotations from some of the articles studied, while the others are codes created by the researcher.

As may be seen, the studies we analyzed highlighted principles that determine inclusive education, such as (a) inclusion, (b) accessibility, (c) equal opportunities, (d) non-discrimination, (e) affordability, and (f) universal design of learning. As indicated earlier, these are closely related with access, equity, and quality. Any design for virtual education that intends to be inclusive must be closely linked to diverse actions that guarantee accessibility, overcoming the barriers described above. Such programs must guarantee educational quality, and allow for the development of optimum competences in all students, without any discrimination. They must, finally, respond to the principle of equity. Educational policies and programs need to not only reduce access gaps, as has been the case until now, but also address the digital divide between those who have the necessary skills to benefit from the use of computers and those who do not. These skills are closely linked to students' social, economic, and cultural capital.

Our analysis found research in which inclusion in online university education recognized the most explicit and traditionally defined differences, expressed as people with disabilities in its various manifestations. Thus, these studies proposed multiple strategies to support the inclusion of this student population. We explicitly see the contribution of ICT through, among others:(a) assistive technology; (b) the development of accessible electronic learning materials and activities; (c) the curricular design of accessible content; (d)

the development of metacognitive processes to motivate students through ICT; (e) affordable, accessible, and available technologies: and (f) development of accessible online learning environments.

Other research proposed inclusive e-learning while assuming that diversity recognizes the multiple differences that characterize human beings. These studies include Granic and Adams (2011), who proposed active and accessible learning, by way of effective e-learning systems. They considered various factors, such as accessibility, individual differences, and student models.

Al-Azawei et al. (2017) suggested that the standardization of learning content and teaching approaches denies the diversity of the student body and they recognized student diversity based on individual skills and preferences. Thus, they proposed to integrate the UDL (i.e., multiple means of representation, action and expression, and participation) with a technology acceptance model theory of information systems.

Finally, there is the potential of social inclusion in higher education that may be achieved with IVE proposals, based on the study developed by Moreira, Reis-Monteiro, and Machado (2017). They recognized that the widespread increase in higher education, with learning accessible to all, requires a flexible and inclusive option focused on students, including those who are socially excluded, such as those who are imprisoned.

Conclusion

We did not expect to reach definitive conclusions from an exploratory study intended to identify emerging trends in IVE research at the higher education level according to their conceptualization of inclusion, in order to provide ideas for future research topics and issues for further study. In order to achieve our goals, we set a series of questions that allowed us to focus our analysis, following the methodological guidelines described above on a systematic review of research published in the WOS and Scopus databases in the last decade. However, our findings surpassed the focus of our initial questions. This suggests a series of interesting data that provide a broader view of the phenomenon studied, and offer ideas regarding potential lines of research. Initially though, we will present the conclusions based on our research questions.

By studying current designs for inclusive e-learning and examining how they define inclusion, we were able to find a total of 89 studies that address this issue from different approaches and perspectives. While 51 focused on IVE as directed to people with disabilities[1], the remaining 38 focused on other human differences. Pointing out this distinction does not imply that we are qualifying the approaches as being pertinent or not. However, the accelerated changes occurring in the massive growth of virtual education, among other issues, leads us to question the relevance of continuing to develop IVE designs that address only one type of human difference. The premise that the current university reality is much more complex and diverse demands the development of online education alternatives that may include all students, considering their singularities. As distance learning at universities increases, it is becoming a space of growing student diversity. This implies a challenge for all of those who are responsible for virtual educational offerings at all of its stages: these include: (a) curriculum and instructional designers, (b) Web

developers, (c) principals, and significantly, (d) teachers, who will have to rethink their pedagogical praxis in order to respond to this challenge.

We encountered a range of challenges for HEI. The development of IVE proposals that guarantee the principle of EEO recognize the potential of education to overcome socio-educational inequality. This is why it is so important for there to be an increase in the number of virtual educational offerings, with flexible modalities. In addition, this growth cannot be limited to access, but must be balanced with quality and equity. This reinforces a specific concern raised in the analysis. In the studies we reviewed, there was a clear emphasis on improving conditions that increase access to virtual courses. However, there was practically no development of support programs to assure the IVE that we aspire to, implementing actions to guarantee the continuity and successful graduation of all students, so we may increase the competitiveness of society.

The ways in which research conceptualizes IVE is obviously closely related to their vision of inclusion. By assuming inclusion with a focus on people with disabilities, multiple initiatives have intended to ensure accessibility, including the development and innovation of various technical aids to enhance learning, supported by assistive technologies. Lebenicnik, Pitt, & Starcic (2015) emphasized the importance of the UDL model in responding to the needs of inclusive learning environments. Meanwhile, Santos & Boticario (2015) compiled guidelines to produce personalized recommendations in order to encourage active learning in online courses. It must be emphasized that all of the efforts and innovations in the design of accessible resources and platforms serve to benefit not only people with disabilities, but represent benefits for all. However, the more heterogeneous the student population is in online university courses, the more other innovations are required.

In some studies, inclusion encompassed other human differences (e.g., gender, age, socioeconomic situation, ethnic origin, culture, health condition, learning capacity, language, lifestyle, learning) as well as students with heterogeneous levels of foreknowledge, and working students with different professional expectations and demands. These studies discussed a series of pedagogical innovations that allow students to be served according to their uniqueness, overcoming the barriers that restrict learning. For example, Lalla (2015) described the development of inclusive pedagogical practices to address communication barriers, focusing on language proficiency as a major challenge for international students in online education. In addition, Allison and Turner (2017) highlighted how students in virtual studies can perform their tasks associated with specific learning objectives by using virtual resources without geographical location or time constraints, thus enabling collaborative learning to take place.

It was a constant in several of the studies analyzed, that for the development of an IVE educational design, it is not enough to invest in advanced technologies incorporated in virtual platforms; it is essential to train two key actors in the process, namely teachers and Web developers (including instructional designers). This training must place the needs of students at the center of accessibility. In order to do so in a virtual mode, through the development of inclusive learning experiences that respond to the principles that regulate IVE, it is necessary to overcome technical issues, and include, indisputably, pedagogical aspects.

In recent years, while there has been a growth in the development of IVE educational designs that recognize all human diversity, this has not been enough. It is necessary to evaluate the innovations made so far,

optimize them, and replicate them in other contexts, so that in the coming years, we may be able to respond to the phenomenon of a massive university student population, expressed in its most absolute heterogeneity, through flexible and inclusive educational designs.

Based on the above, we suggest inclusive e-learning designs be developed with greater emphasis on all human differences. In this way, we may contribute to increasing equality of educational opportunities and to overcoming the barriers that restrict access, continuity, and successful completion by all students, regardless of their individual learning needs. Likewise, greater emphasis should be placed on developing skills for employability. Educational inequality persists; there are more and more educational requirements to access jobs that allow social advancement.

Finally, we are aware that there are still many questions that remain unanswered, and we hope that the data presented will contribute to consolidating lines of research that will provide new insights to ensure the development of truly inclusive e-learning processes. We believe that there is not a single answer to these and other questions. How should a training proposal respond to the principles of educational inclusion outlined at the beginning of this article? How could all human differences be addressed from a virtual education design? This article cites several studies that may lead us to some answers for these questions.

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[1] These results coincide with what was presented in Almeida, Santos, Batista, Pereira, and Sousa (2016), who analyzed the Websites for Higher Education Institutions in Portugal. They found that the initiatives focused mainly on people with disabilities, and we agree that, historically, this population has been excluded from various educational designs. Today we know they are not the only ones excluded, and in order to guarantee education as a human right for all people, our efforts must encompass the other human differences mentioned in this article.

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A Systematic Review of Technology-Supported Peer Assessment Research: An Activity Theory Approach

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Abstract

With the advancement of information and communication technologies, technology-supported peer assessment has been increasingly adopted in education recently. This study systematically reviewed 134 technology-supported peer assessment studies published between 2006 and 2017 using a developed analysis framework based on activity theory. The results found that most peer assessment activities were implemented in social science and higher education in the past 12 years. Acting assignments such as performance, oral presentations, or speaking were the least common type of assignments assessed across the studies reviewed. In addition, most studies conducted peer assessment anonymously and assessors and assessees were randomly assigned. However, most studies implemented only one round of peer assessment and did not provide rewards for assessors. Across studies, it was more often the case that students received unstructured feedback from their peers than structured feedback. Noticeably, collaborative peer assessment did not receive enough attention in the past 12 years. Regarding the peer assessment tools, there were more studies that adopted general learning management systems for peer assessment than studies that used dedicated peer assessment tools. However, most tools used within these studies only provide basic functionalities without scaffolding. Furthermore, the results of cross analysis reveal that there are significant relationships between learning domains and anonymity as well as learning domains and assessment durations. Significant relationships also exist between assignment types and learning domains as well as assignment types and assessment durations.

*Keywords***:** peer assessment, systematic review, activity theory, collaborative learning

Introduction

Peer assessment is a process by which learners can evaluate peers' products based on assessment criteria (Sadler & Good, 2006). Applying peer assessment can engage learners in providing constructive comments for peers and improving their own works, making peer assessment a meaningful assessment model (Topping, 2017). Moreover, there are theoretical and empirical evidences of the positive effects of peer assessment on higher-order thinking skills (Topping, 2017), social skills (Ching & Hsu, 2016), learning motivations (Hsia, Huang, & Hwang, 2016), and learning outcomes (Zheng, Chen, Li, & Huang, 2016). Due to rapid technological advancement, the implementation of technology-supported peer assessment is becoming more and more effective (Yu & Wu, 2011). More specifically, technology-supported peer assessment can facilitate online submission of works, random assignments, reciprocal peer reviews, and structured feedback (Hsu, 2016). Compared to the traditional peer assessment, the benefits of technology-supported peer assessment include: anonymity, speed and efficiency, random distribution of essays, automatic calculation of marks, and feedback availability (Mostert & Snowball, 2013). In addition, online peer assessment systems can automatically record emotional responses through the self-assessment manikin measurement (Cheng, Hou, & Wu, 2014). Despite of all the advantages described above, many instructors are struggling with how to design and improve technology-supported peer assessment in real practices. Literature also suggests that optimizing peer assessment design is crucial for improving assessment practices (Bearman et al., 2016). A systematic review of technology-supported peer assessment literature can provide better insights for instructors to design and implement peer assessment.

A design feature refers to a particular consideration for making a decision during the process of peer assessment design, which ensures the success of peer assessment to a large extent (Adachi, Tai, & Dawson, 2018). However, the design features of peer assessments are often neglected by instructors due to focusing on peers' works or final scores (Adachi et al., 2018). More specifically, 'front-line' educators and practitioners often find it very challenging to implement and improve peer assessment in practice (Bearman et al., 2016). They often design peer assessment activities based on their assumptions and experiences which leads to problems in selecting appropriate peer assessment tasks, learning domains, and criteria development (Adachi et al., 2018). In addition, there is a lack of a systematic review of technology-supported peer assessment studies in previous literature. These research gaps and problems underlying peer assessment drive us to conduct a comprehensive review of technology-supported peer assessment. A systematic review of technology-supported peer assessment can shed light on how peer assessment works as well as provide useful references for implementing peer assessment. The findings can also contribute to the design of peer assessment and inform educators on how technology can be effectively applied in peer assessment.

The purpose of this study is twofold. One is to investigate the research status of the technology-supported peer assessment studies in the past 12 years. Another is to conduct a correlation analysis among assignment types, learning domains, anonymity, and assessment duration so as to provide insights into the design of peer assessment activities. Based on the research purpose described above, the following eight research questions (RQ) are addressed in this study:

RQ1: What school levels participated in the technology-supported peer assessment research?

RQ2: What kinds of rules were adopted in the technology-supported peer assessment research?

RQ3: What kinds of evaluation criteria were adopted in the technology-supported peer assessment research?

RQ4: How were labors divided in the technology-supported peer assessment research?

RQ5: What were the learning objectives in the technology-supported peer assessment research?

RQ6: What kinds of tools were used in the technology-supported peer assessment research?

RQ7: Are there any significant relationships among anonymity, learning domains, and assessment durations in the technology-supported peer assessment research?

RQ8: Are there any significant relationships among assignment types, learning domains, and assessment durations in the technology-supported peer assessment research?

Literature Review

Technology-Supported Peer Assessment

Peer assessment was conceptualized as an instructional method that requires learners to evaluate the amount, quality, value, and success of the products or learning outcomes of peers (Topping, 1998). Typically, two kinds of learning activities were involved in peer assessment. One was evaluation of peers' works and the other was revision of self-work (Cheng, Liang, & Tsai, 2015). Currently there are many technologies that can support and facilitate peer assessment, including Wiki environments (Gielen & De Wever, 2015), massive open online courses (MOOCs) (Wulf, Blohm, Leimeister, & Brenner, 2014), and mobile technologies (Hwang & Wu, 2014). Furthermore, in research by Tsai (2009), a Web-based peer assessment system was used to automatically record student participation and interactions within peer assessment activities. In addition, Shih (2011) used Facebook to conduct peer assessment and found that the emoticons stimulated learners' motivations for English writing and enhanced interpersonal relationships. Xiao and Lucking (2008) conducted online peer assessment in a Wiki environment and found that students' writing performance and satisfactions were improved through the provision of both quantitative and qualitative feedback. To sum up, technologies can facilitate the efficiency and effectiveness of peer assessment. However, previous studies did not systemically analyze how to use technologies to facilitate peer assessment. The present review aims to identify how technology-supported peer assessment is being designed and implemented.

Deficiency of the Previous Peer Assessment Reviews

The initial literature review done by Topping (1998) revealed that peer assessment had positive effects on learners' attitudes and achievements. Recently, some reviews were conducted to investigate the status of peer assessment. These reviews of peer assessment mainly addressed students' perceptions toward peer assessment (Chang, 2016), peer assessment diversity (Gielen, Dochy, & Onghena, 2011), the effectiveness of peer assessment (Topping, 2017), as well as reliability and validity of peer assessment (Speyer, Pilz, Van Der Kruis, & Brunings, 2011). However, none of the previous reviews systemically analyzed how technology-supported peer assessment activities were designed and

implemented. Furthermore, these review studies were not carried out based on a well-recognized analysis framework such as activity theory. Challenges like how to choose anonymity and assessment durations based on learning domains as well as how to choose learning domains and assessment durations based on assignment types remain lacking. A systematic analysis of 12 years of studies on technology-supported peer assessment may provide better understanding and insights about the current research status and future trends for researchers, educators, and practitioners. Such an analysis may also be helpful to teachers, to provide guidelines on the design and implementation of technology-supported peer assessment.

Activity Theory

Activity theory was initially proposed by Vygotsky (1978) and extended by Engeström (1999) who proposed six elements to be included in this theory, namely: subject, object, tools, community, rules, and division of labor. In the literature, Engeström (2001) claimed that activity theory can effectively represent how learning activities occur as well as highlight the dynamics of learning activities. Furthermore, activity theory has been used to analyze and evaluate various kinds of learning activities (Chung, Hwang, & Lai, 2019; Park & Jo, 2017). Therefore, activity theory is adopted as a framework in this study for analyzing technology-supported peer assessment studies published in the past 12 years.

Methodology

Data Sources and Paper Selection

Papers related to peer assessment and published from 2006 to 2017 were selected from the Web of Science databases, including: the database of science citation index expanded, social sciences citation index, arts and humanities citation index, and emerging sources citation index. These databases were selected because they are well received by academia. There were two stages included in the paper selection process (Zheng, Huang, & Yu, 2014). In the first stage, specific keywords that are closely related to peer assessment were chosen to search papers in the aforementioned databases. These keywords included: “Peer assessment” OR “Peer feedback” OR “Peer review” OR “Peer evaluation” OR “Peer rating” OR “Peer scoring” OR “Peer grading;” “Online peer assessment” OR “Online peer feedback” OR “Web-based peer assessment.” In the second stage, the full text of each paper was screened based on the following criteria:

1. Only journal research papers were included in the present study. Book reviews, conference papers, book chapters, abstracts, news, editorials, and reviews were excluded.

2. The papers should be closely related to peer assessment.

3. The papers should address using information and communication technologies (ICT) to support peer assessment.

4. The papers should report the subjects, objects, tools, rules, criteria, and division of labor for peer assessment. Conceptual papers that did not describe the details of peer assessment were excluded.

5. The papers should be published from 2006 to 2017.

6. The papers should be reported in English.

At this stage, three coders were given training regarding the inclusion criteria, to ensure that they had a common understanding of this criteria. Then, 15 papers were chosen from the search results of Stage 1 and read the full text to decide whether the three coders achieved a common understanding of the criteria. Finally, the rest of papers were coded independently by the three coders according to the criteria. Discrepancies were discussed and resolved face-to-face.

Search Results

Figure 1 shows the search results. Initially, 1628 papers were located using the aforementioned keywords. Among 1628 papers, 184 were not research articles, 8 papers were not written in English, 726 papers were not closely related to peer assessment, 354 papers did not adopt technology to support peer assessment, and 222 papers did not report six elements of peer assessment activities. Finally, 134 papers were selected for further analysis.

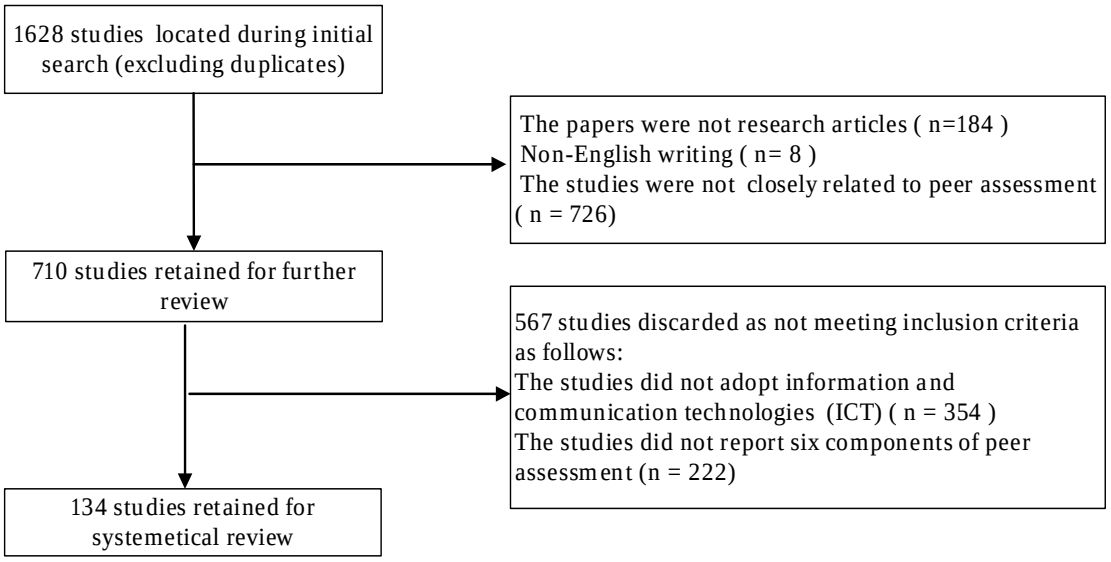

Figure 1. Papers selection process.

Data Analysis

The content analysis method was adopted to analyze the collected papers. Specifically, an analysis framework as shown in Figure 2 was developed based on activity theory. This analysis framework includes six components, namely: subjects, objects, tools, rules, criteria, and division of labor (Engeström, 1999). Table 1 shows the coding scheme based on this analysis framework. The coding scheme and development of subcategories were based on the research questions and purpose. The subcategories and associated coding values for peer assessment features were identified according to the 134 technology-supported peer assessment research articles published from 2006 to 2017. However, the subcategories of peer assessment criteria and tools were developed by the authors. All collected papers were coded independently by the three well-trained coders majoring in educational technology. Furthermore, the adjusted residual value (AR) was adopted to investigate the relationships among assignment types, learning domains, and assessment duration as well as the

relationships among learning domains, anonymity, and assessment duration. If the absolute value of AR is larger than 1.96 then the correlation between the two attributes is significant.

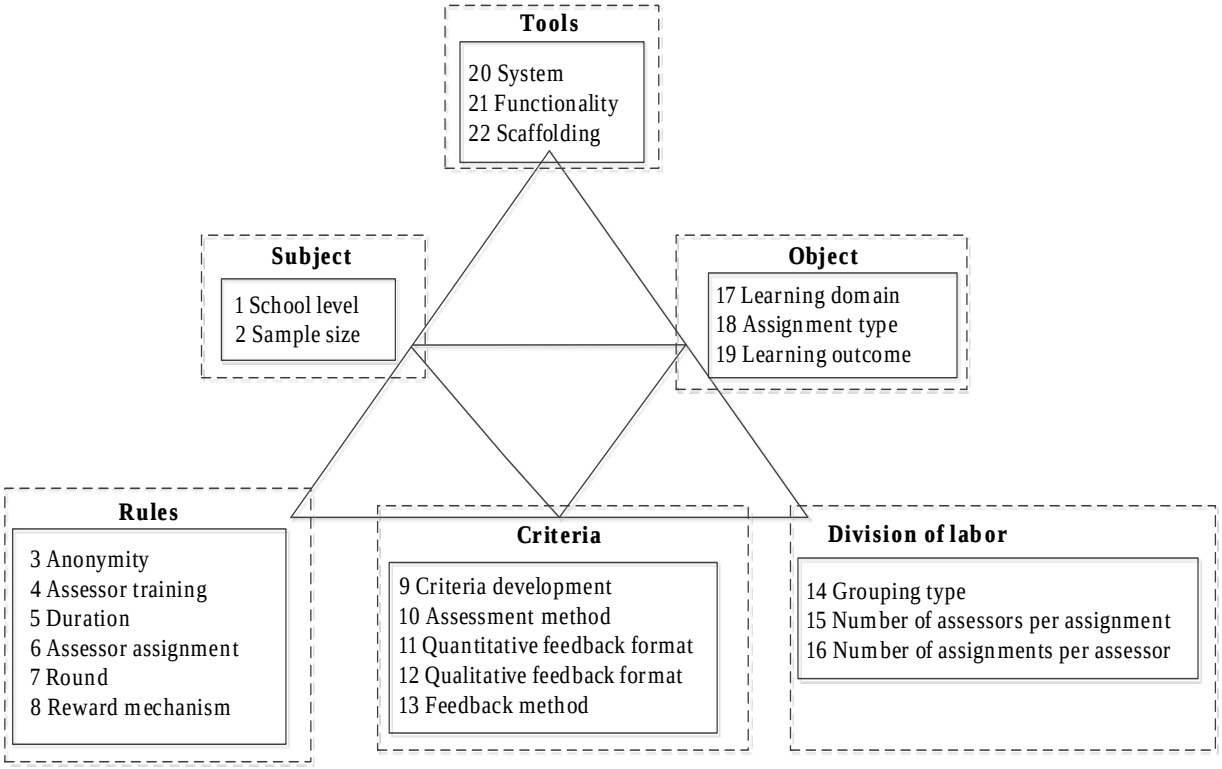

Figure 2. The analysis framework for peer assessment research based on activity theory. Adapted from "Activity theory and individual and social transformation," by Y. Engeström, in Y. Engeström, R. Miettinen, & R.-L. Punamäki (Eds.), *Perspectives on activity theory* (pp. 19–38), 1999, New York, NY: Cambridge University Press. Copyright 1999 by Cambridge University Press. Adapted with permission.

Table 1

The Coding Scheme

Component	Category	Subcategory
Subject	School level	1. Primary school.
		2. Junior and senior high school.
		3. Higher education.
	Sample size	1. 1-50.
		2. 51-100.
		3. More than 100.
Rules	Anonymity	1. Anonymous.
		2. Non-anonymous.
	Assessor training	1. Received training.

		2. No training.
	Assessment duration	1. Less than one week.
		2. 2-5 weeks.
		3. 6-10 weeks.
		4. More than 10 weeks.
	Assessor assignment	1. By system.
		2. By teachers.
		3. By students.
	Round	1. One round.
		2. Two rounds or more.
	Reward mechanism	1.With reward (course credit, reinforcement for participation).
		2. Without reward.
Criteria	Criteria development	1. By teachers.
		2. By students.
	Assessment method	1. Quantitative only.
		2. Qualitative only.
		3. Both quantitative and qualitative.
	Quantitative feedback format	1. Score.
		2. Likert scale.
	Qualitative feedback format	1. Structured feedback.
		2. Unstructured feedback.
	Feedback method	1.Written feedback.
		2. Speaking feedback.
		3. Video feedback.
		4. Mixed feedback.
Division of labor	Grouping type	1. Individual.
		2. Collaborative.
	Number of assessors per assignment	1. Less than 5.
		2. Between 5–10.
		3. More than 10.
	Number of assignments per assessor	1. Less than 5.
		2. Between 5–10.
		3. More than 10.

Object	Learning domain	1. Natural science (science, mathematics, physics, biology, geography, medicine, and so on). 2. Social science (politics, history, education, psychology, linguistics, art, and so on). 3. Engineering and technological science (engineering, computer science, educational technology, and so on).
	Assignment type	1. Writing essay. 2. Project proposal (for example, WebQuest project, training plan, research report, and so on). 3. Artefact (for example, poster, website, multimedia video, course material, and so on). 4. Acting (for example, oral presentation, performance, and so on).
	Learning outcome	1. Cognitive outcome. 2. Attitude or perception. 3. Mixed.
Tools	System	1. Dedicated Web-based peer assessment system. 2. General learning management system. 3. Social media. 4. Mobile application.
	Functionalities	1. Basic (assignment submission, peer grading, and making comments). 2. Advanced (assignment submission, peer grading, making comments, discussing with reviewers, and criterion development).
	Scaffolding	1. With scaffolding. 2. Without scaffolding.

Validity and Inter-Rater Reliability

To ensure the validity of the coding, two experienced domain experts were asked to confirm the suitability of the coding scheme and the accuracy of the coding results. To evaluate inter-rater reliability of coding, the Cronbach alpha test was conducted and the alpha coefficient achieved was 0.95, showing good reliability. All discrepancies were discussed face-to-face and solved by the three coders.

Results and Discussion

RQ1: What School Levels Participated in the Technology-Supported Peer Assessment Research?

Table 2 presents the number of schools that participated in the 134 technology-supported peer assessment studies. With regard to the school level, it was found that most peer assessment studies were conducted in higher education (81%). Few studies (19%) were conducted in K-12 settings. However, it is necessary to provide quality training and structured guidelines or scaffolding for assessors when peer assessment is implemented in K-12 schools. It is recommended to allow university students to develop criteria and provide high quality feedback when peer assessment is conducted in higher education institutions. With respect to the sample size of studies reviewed, 40% of studies involved less than 50 participants, 35% of studies involved more than 100 participants, and 25% included between 51 to 100 participants.

Table 2

Descriptive Data for Peer Assessment Subject

Category	Subcategory	Total n (%)
School level	Primary school	8(6)
	Junior and senior high school	17(13)
	Higher education	109(81)
Sample size	1-50	54(40)
	51-100	33(25)
	More than 100	47(35)

RQ2: What Kinds of Rules Were Adopted in the Technology-Supported Peer Assessment Research?

Table 3 shows the peer assessment rules adopted in the technology-supported peer assessment studies. Many interesting results were found from the analyzed data. The following sections explain and discuss the findings one by one.

First, the results indicate that most technology-supported studies conducted peer assessment anonymously (69%). The main reasons for this, are that anonymity can reduce scoring bias (Magin, 2001) as well as protect learners' privacy with the support of technologies (Lin, 2016). Non-anonymous peer assessment may lead to the inflation of scores (Panadero & Brown, 2017). In fact, the choice of using anonymous versus non-anonymous peer assessment mainly depends on learning domains. A detailed analysis between anonymity and learning domains can be found in the results of RQ7.

Second, for peer assessment duration, around 54% of studies implemented peer assessment for more than 10 weeks, 22% of studies implemented peer assessment for 6-10 weeks, 14% of studies

implemented peer assessment less than one week, and 10% of studies implemented peer assessment for 2-5 weeks. It is suggested that practitioners should select appropriate assessment durations based on assignment types and learning domains. A further analysis on relationships among assessment durations, assignment types, and learning domains can be found in the results of RQ7 and RQ8.

Third, this study also investigated how assessors and assessees were matched in the technology-supported peer assessment studies. The results revealed that most studies randomly matched assessors and assesses by peer assessment supporting systems (65%), by teachers (23%), and by students themselves (12%). The tendency of studies to use systems to randomly match assessors and assessees may be due to previous research suggests that random assignment leads to less assessment bias (Li et al., 2016). In addition, students' products can be randomly distributed to peers for assessment by using the convenience of technologies, such as online peer assessment systems or social media. Therefore, it is suggested that random matching of assessors and assesses with the aid of technologies should be adopted in future studies.

Fourth, it was found that 78% of studies implemented only one round of peer assessment, the rest conducted peer assessment in two rounds or more. However, the internal reliability of peer assessment, namely the consistency within one assessor, can only be calculated after at least two rounds of peer assessment. In one study in which students took part in three rounds of peer assessment, it was discovered that students were engaged in cognitive processing in the first round, meta-cognitive processing in the second round, and providing affective feedback in the third round (Tsai & Liang, 2009). Thus, it is suggested that at least two-round peer assessment exercises should be conducted.

Finally, the results revealed that 73% of the studies did not provide reward for assessors. It is strongly suggested that learners who carefully participate in peer assessment activities and provide accurate feedback be rewarded through course credits, class participation points, extra points, bonus grades, books, and excursions in a timely manner so as to improve learners' engagement in peer assessment.

Table 3

Descriptive Data for Peer Assessment Rules

Category	Subcategory	Total n (%)
Anonymity	Anonymous	92(69)
	Non-anonymous	42(31)
Assessor training	Received training	73(55)
	No training	61(45)
Assessment duration	Less than one week	19(14)
	2-5 weeks	14(10)
	6-10 weeks	29(22)
	More than 10 weeks	72(54)
Assessor assignment	By system	87(65)
	By teachers	31(23)
	By students	16(12)
Round	One round	104(78)
	Two rounds or more	30(22)
Reward mechanism	With reward	36(27)
	Without reward	98(73)

RQ3: What Kinds of Evaluation Criteria Were Adopted in the Technology-Supported Peer Assessment Research?

Table 4 shows the descriptive data for the peer assessment criteria present across the studies reviewed. The results indicated that peer assessment criteria were developed by teachers among 94% of studies. Furthermore, it was found that most studies adopted both quantitative and qualitative feedback (61%). The rest of studies only adopted either quantitative (14%) or qualitative feedback (25%). This finding is in line with previous studies by Gielen and Wever (2015) who found that both scores and comments had the greatest effect on product quality. From this, it is suggested that peer assessment criteria should integrate both the quantitative and qualitative feedback in practice. Employing quantitative feedback may be most appropriate when the peer assessment is intended to evaluate peers' works in a summative way. Adopting qualitative feedback may be most suitable when the peer assessment intends to get detailed comments, constructive suggestions, or solutions.

With respect to the qualitative feedback format, the studies that adopted unstructured feedback (60%) are more than those that used structured feedback (40%). It is suggested that future studies adopt both structured qualitative feedback and quantitative feedback in order to provide guidelines, prompts, and templates to facilitate peer assessment.

Regarding the feedback method, most studies (97%) adopted written feedback. Few studies used a mixed feedback method (2%) or video feedback (1%). However, video or audio feedback can enable

better understanding of peer comments or suggestions. Thus, a mixed feedback format is recommended for future studies.

Table 4

Descriptive Data for the Peer Assessment Criteria

Category	Subcategory	Total n(%)
Criteria development	By teachers	126(94)
	By students	8(6)
Assessment method	Quantitative only	19(14)
	Qualitative only	33(25)
	Both quantitative and qualitative	82(61)
Quantitative feedback format	Score	61(60)
	Likert scale	40(40)
Qualitative feedback format	Structured feedback	46(40)
	Unstructured feedback	69(60)
Feedback method	Written feedback	130(97)
	Video feedback	1(1)
	Mixed feedback	3(2)

RQ4: How Were Labors Divided in the Technology-Supported Peer Assessment Research?

Table 5 demonstrates the division of labor in 134 technology-supported peer assessment studies. Regarding the grouping type, it was found that most studies adopted individual peer assessment – only 5% of studies conducted collaborative peer assessment. Collaborative peer assessment can increase the reliability and validity of peer assessment of the same student product, as it enables group members to discuss the quantitative and qualitative feedback before submitting final assessment results. Thus, bias will be decreased, and the accuracy of peer assessment will be increased. From this, it is suggested that collaborative peer assessment be adopted more frequently in future studies.

In addition, it was found that less than five assignments were evaluated by one assessor in 52% of studies. Among 26% of studies, 5-10 assignments were evaluated by one assessor. Among 22% of studies, more than 10 assignments were evaluated by one assessor. The reason for this might be that too many assignments may increase cognitive load for assessors. Concerning the number of assessors per assignment, it was found that 52% of studies invited less than five assessors to evaluate one assignment, 25% of studies invited more than 10 assessors, and 23% of studies invited 5-10 assessors. Within these studies, it may have been difficult to find assessors to evaluate assignments, thus leading to the relatively low number of individuals invited to assess assignments. It is suggested that in future studies, the number of assessors should be an odd number, and that at least three assessors should be required per assignment.

Table 5

Descriptive Data for the Division of Labor

Category	Subcategory	Total n (%)
Grouping type	Individual	127(95)
	Collaborative	7(5)
Number of assignments per assessor	Less than 5	70(52)
	Between 5–10	35(26)
	More than 10	29(22)
Number of assessors per assignment	Less than 5	69(52)
	Between 5–10	31(23)
	More than 10	34(25)

RQ5: What Were the Learning Objectives in the Technology-Supported Peer Assessment Research?

Table 6 presents the learning objectives of the 134 technology-supported peer assessment studies, including learning domains, assignment types, and learning outcomes. It was found that most peer assessment studies are conducted in social science (49%), followed by natural science (26%), and engineering and technological science (25%). In addition, the results indicated that the acting assignment is the least adopted type among four different assignment types (7%). Most studies focused on writing essays, project proposals, or artefacts. This implies that acting assignments such as performance, oral presentations, and speaking did not get enough attention in the technology-supported peer assessment studies. This reveals a mismatched to on the current educational trend, which is emphasizing on cultivating students' competence. It is suggested that future studies should pay more attention to assessing acting assignments with the aid of technologies. Furthermore, the findings also revealed that very few studies investigated students' attitudes or perceptions (9%) as learning outcomes. This suggests that future studies should focus on learning outcomes such as learning attitude, learning experience, satisfaction, and so on.

Table 6

Descriptive Data for the Learning Objectives

Category	Subcategory	Total n (%)
Learning domain	Natural science	35(26)
	Social science	66(49)
	Engineering and technological science	33(25)
Assignment type	Writing essays	47(35)
	Project proposals	31(23)
	Artefacts	47(35)
	Acting	9(7)
Outcome type	Cognitive outcomes	25(19)
	Attitudes or perceptions	13(9)
	Mixed	96(72)

RQ6: What Kinds of Tools Were Used in the Technology-Supported Peer Assessment Research?

Table 7 shows the tools adopted in the technology-supported peer assessment research. The results show that 42% of studies used a general learning management system, 35% of studies used dedicated peer assessment, 20% used social media, and 3% used mobile applications. Therefore, mobile applications were the least adopted tool used in the last 12 years within peer assessment studies. However, mobile devices such as mobile phones, and iPads have been widely used in the field of education. Mobile technologies enable learners to receive real-time feedback from peers and instructors, interact with peers instantly, and share information conveniently (Lai & Hwang, 2015). Therefore, it is strongly suggested that mobile-supported peer assessment should be adopted in practice so as to improve peer assessment efficiency and effectiveness.

In terms of the functionality of peer assessment system, most systems included basic functionalities such as assignment submission, peer grading, and making comments. Only 19% of studies developed dedicated systems with advanced functionalities, such as functions for supporting discussing with reviewers and criterion development.

Concerning scaffolding, the studies that providing scaffolding (17%) were less than those without scaffolding (83%). Hence, it is suggested that scaffolding should be embedded in peer assessment tools in order to facilitate peer assessment.

Table 7

Descriptive Data for the Peer Assessment Tools

Category	Subcategory	Total n (%)
System	Dedicated Web-based peer assessment system	47(35)
	General learning management system	56(42)
	Social media	27(20)
	Mobile application	4(3)
Functionalities	Basic	109(81)
	Advanced	25(19)
Scaffolding	With scaffolding	23(17)
	Without scaffolding	111(83)

RQ7: Are There any Significant Relationships Among Anonymity, Learning Domains, and Assessment Durations?

The present study also investigated how to choose anonymity and assessment durations based on learning domains as well as how to select learning domains and assessment durations based on assignment types. Table 8 shows the relationships discovered between learning domains and anonymity. The results indicated that there was a significant association between learning domains and anonymity ($\chi^2 = 8.47$, $p = 0.014$). For the studies whose learning domains were social science, non-anonymous assessment was adopted more than anonymous assessment (AR = 2.4). On the contrary, anonymous assessment was employed more than non-anonymous in engineering and technological science domains (AR = 2.7).

In addition, a significant relationship between learning domains and assessment durations was found ($\chi^2 = 17.88$, $p = 0.007$) (see Table 9). For the studies that centered on natural science domains, the assessment duration of less than one week demonstrated a growing tendency (AR = 3.4) and the assessment duration of more than 10 weeks showed a declining tendency (AR = -3.1). On contrast, if the studies were related to social science domains, the assessment duration of more than 10 weeks showed an increasing trend (AR = 2.6) and the assessment duration of less than one week displayed a decreasing trend (AR = -3.1).

Table 8

The Relationships Between Learning Domains and Anonymity

Learning domains	Anonymity
Natural science	1. Anonymous (AR = 0.0)
	2. Non-anonymous (AR = 0.0)
Social science	1. Anonymous (AR = -2.4)
	2. Non-anonymous (AR = 2.4)
Engineering and technological science	1. Anonymous (AR =2.7)
	2. Non-anonymous (AR = -2.7)

Note. AR: Adjusted residual values (AR with absolute values larger than 1.96 are significant).

Table 9

The Relationships Between Learning Domains and Assessment Durations

Learning domains	Assessment durations
Natural science	1. Less than one week (AR = 3.4)
	2. 2-5 weeks (AR = 0.9)
	3. 6-10 weeks (AR = 0.2)
	4. More than 10 weeks (AR = -3.1)
Social science	1. Less than one week (AR = -3.1)
	2. 2-5 weeks (AR = -1.1)
	3. 6-10 weeks (AR = 0.3)
	4. More than 10 weeks (AR = 2.6)
Engineering and technological science	1. Less than one week (AR = 0.2)
	2. 2-5 weeks (AR = 0.4)
	3. 6-10 weeks (AR = -0.6)
	4. More than 10 weeks (AR = 0.1)

RQ8: Are There any Significant Relationships Among Assignment Types, Learning Domains, and Assessment Durations?

The relationships between assignment types to be assessed and learning domains are shown in Table 10. As shown in Table 10, there was a positive relationship between assignment types and learning domains in the past 12 years (χ^2 = 30.96, p = 0.000). The adjusted residual value indicated that writing essays in social science subject domains had the fastest increasing trend (AR = 5.0), followed by artefacts in engineering and technological science (AR = 2.6) and natural science (AR = 2.2). On the other hand, writing essays in engineering and technological science domains (AR = -3.2) and in

natural science domains (AR = -2.6) as well as artefacts in social science domains (AR = -4.2) demonstrated a decreasing trend in the past 12 years. Therefore, teachers can select writing essays as the assignment type when the learning domain belongs to social science. When the learning domain focuses on engineering and technological science, teachers can engage students to design and assess artefacts, such as posters, websites, videos, course material, and so on. When the learning domain centers on natural science, project proposals such as WebQuest projects, training plans, research reports, and so on can be adopted as the assignment types.

Table 11 shows the relationship between assignment types and assessment durations. It was found that there was a significant association between assignment types and assessment durations (χ^2 = 18.61, p = 0.029). The adjusted residual value revealed that the assessment duration of time it typically took to assess written essays was 10 or more weeks (AR = 3.5), and that the assessment duration of time it typically took to assess project proposals was 6-10 weeks (AR = 2.1). It is recommended that assessment duration differ depending on the type of assignment. Usually, assessing written essays should take more than 10 weeks. Assessing project plans should take 6-10 weeks.

Table 10

Relationships Between Assignment Types and Learning Domains

Assignment types	Learning domains
Writing essays	1. Natural science (AR = -2.6)
	2. Social science (AR = 5.0)
	3. Engineering and technological science (AR = -3.2)
Project proposal	1. Natural science (AR = 0.8)
	2. Social science (AR = -1.5)
	3. Engineering and technological science (AR = 1.0)
Artefacts	1. Natural science (AR = 2.2)
	2. Social science (AR = -4.2)
	3. Engineering and technological science (AR = 2.6)
Acting	1. Natural science (AR = -0.7)
	2. Social science (AR = 1.2)
	3. Engineering and technological science (AR = -0.7)

Note. AR: Adjusted residual values (AR with absolute values larger than 1.96 are significant).

Table 11

Relationships Between Assignment Types and Assessment Durations

Assignment types	Assessment durations
Writing essays	1. Less than one week (AR = -1.9)
	2. 2-5 weeks (AR = -1.7)
	3. 6-10 weeks (AR = -1.4)
	4. More than 10 weeks (AR = 3.5)
Project proposals	1. Less than one week (AR = 0.4)
	2. 2-5 weeks (AR = -0.2)
	3. 6-10 weeks (AR = 2.1)
	4. More than 10 weeks (AR = -1.9)
Artefacts	1. Less than one week (AR = 1.1)
	2. 2-5 weeks (AR = 1.1)
	3. 6-10 weeks (AR = -0.3)
	4. More than 10 weeks (AR = -1.2)
Acting	1. Less than one week (AR = 1.1)
	2. 2-5 weeks (AR = 1.6)
	3. 6-10 weeks (AR = -0.5)
	4. More than 10 weeks (AR = -1.4)

Conclusions

The present study extended the previous reviews on peer assessment by investigating subjects, objects, tools, rules, criteria, and division of labor for 134 technology-supported peer assessment studies published from 2006 to 2017. The main findings are summarized as follows.

First, it was found that most peer assessment activities were implemented in higher education. Usually, there were less than 50 participants who engaged in peer assessment activities. In addition, most peer assessment studies focused on mixed learning outcomes, rather than cognitive outcomes, attitudes, and perceptions. Acting assignments such as performance, oral presentations, or speaking were the least common type of assignments assessed across the studies reviewed. Second, it was found that anonymous assessment was more prominent in the studies than non-anonymous assessment. Most studies matched assessors and assesses randomly and implemented only one round of peer assessment. There were less studies that provided rewards to assessors than studies in which assessors were not provided rewards. Third, the results revealed that most studies developed peer assessment criteria by teachers rather than by students. Most studies adopted unstructured feedback

rather than structured feedback. There were more studies that adopted numeric scores than studies that employed Likert scales. Fourth, most studies conducted peer assessment individually rather than collaboratively. The analyzed result shows that in over half of the studies reviewed, less than five assessors were invited to evaluate an assignment; and less than five assignments were assigned to one assessor. Fifth, it was found that there were more studies that adopted a general learning management system than those that used a dedicated peer assessment system. There were less studies that provided scaffolding for peer assessment tasks than studies without scaffolding. Peer assessment tools with basic functionalities were more prominent within studies than peer assessment tools with advanced functionalities. Sixth, across studies, there were significant associations between learning domains and anonymity as well as assessment durations. Significant relationships between assignment types and learning domains as well as assessment durations were also found in this study.

Implications

The present study had several implications for practitioners and researchers. First, peer assessment is a very effective strategy that can be adopted in both small scale courses (Hsia et al., 2016) and massive open online courses (MOOCs; Formanek, Wenger, Buxner, Impey, & Sonam, 2017). In order to achieve better peer assessment results, teachers and practitioners should design peer assessment activities based on the following six components, namely subjects, objects, tools, rules, criteria, and division of labor. Second, the rules of peer assessment are very important for successful peer assessment activities. It is suggested at least two-rounds of peer assessment should be conducted. In addition, assessors who participated in peer assessment activities should be rewarded to stimulate motivations and improve feedback quality. Third, peer assessment criteria is another crucial element. The criteria development, assessment method, and feedback format (qualitative, quantitative, combination of both) should be designed elaborately before implementation. It is recommended that various formats of quantitative and qualitative feedback be integrated in peer assessment practice. Finally, peer assessment tools should be developed to facilitate the implementation of peer assessment. Different types of systems, advanced functionalities, and scaffolding should be developed in advance. Appropriate use of technologies to develop learners' positive attitudes, cognitions, metacognitions, emotions, behaviors, and values should be an ultimate goal of peer assessment.

Limitations and Future Studies

This study was constrained by two limitations. First, this study only included 134 studies published in related journals from 2006 to 2017. Therefore, cautions should be made when generalizing the results due to the small sample size and descriptive analysis. More data sources should be included in future study to conduct advanced statistical analysis. Second, this study mainly investigated six components of peer assessment activities. It is suggested that future studies should analyze students' behaviors and high-order thinking skills during technology-supported peer assessment activities. The following strategies are also recommended for peer assessment studies in the future.

Only few studies adopted mobile apps to conduct peer assessment. It is suggested that mobile-supported peer assessment should be adopted in future studies. In addition, learners' perceptions of peer assessment, behavior patterns, and higher-order thinking skills should also be investigated in future studies. In the study at hand, researchers did not explore how emotions may impact peer assessment. However, previous research suggests that emotional states have a great

impact on peer assessment quality (Cheng, Hou, & Wu, 2014). For example, learners who are experiencing positive emotions during assessment usually provide positive feedback, and learners who are experiencing negative emotions may tend to make negative comments. Therefore, it may be worth to explore how to promote positive emotions during peer assessment activities. Lastly, new techniques can be applied to automatically evaluate the quality of feedback, and intervention can be designed to help assessors provide high quality feedback.

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Strategies to Assist Distance Doctoral Students in Completing Their Dissertations

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Abstract

Completing doctoral dissertations is difficult work and may be harder for distance students physically separated from institutional and collegial supports. Inability to complete independent research contributes to doctoral student attrition. Factors impacting completion include institutional factors, student characteristics, and supervisory arrangements (Manathunga, 2005). This paper shares proactive strategies used by a Midwestern university in the United States to support distance doctoral students. Strategies and technology tools are described that (a) cultivate a shared culture of responsibility and commitment, (b) increase effective communication between researchers, and (c) grow departmental and institutional services and technologies for faculty and students. This paper suggests the use of a specific framework to help students develop a shared culture of responsibility. This framework encourages students to discuss their social network, as well as teaches students how to manage their split life by using a tool which evaluates a student's readiness for the dissertation process and maps out where dissertation skills and knowledge are developed throughout the program. Strategies for effective communication include availability, effective feedback, trust, and humor. Services and technologies provided to build capacity include the use of online and library resources, campus-wide use of research software, writing and research services, and department supports and processes to promote student research. These mechanisms for accountability, mentoring, training, and trust increase the likelihood of success.

Keywords: dissertation completion, distance doctoral students, graduate student services, online doctoral programs

Introduction

Writing a dissertation is a grueling experience. In fact, in the United States, about half of prospective doctoral candidates fail to advance beyond all-but-dissertation (ABD) status (Ali, Kohun, & Levy, 2007; Jairam & Kahl, 2012; Lovitts, 2001, 2007; Walker, Golde, Jones, Bueschel, & Hutchings, 2008). While 40-50% of students in traditional doctoral programs don't complete, distance doctoral students are dropping out of their programs at rates 10-20% higher than students in traditional programs (Terrell, Snyder, & Dringus, 2009). This attrition rate may be higher for women and minorities (Lovitts, 2001). Imagine students' disappointment at having spent years of work and significant finances toward an unfinished degree. The reality can be discouraging—both in regards to the way that the problem is kept invisible and the reality of its extensiveness—which has generated calls for changes, motivating some individuals, groups, and researchers to use their research to find attrition reducing solutions (Lovitts, 2007; Lovitts & Wert, 2009; Maki & Borkowski, 2006; Ross, Gallagher, & Macleod, 2013).

The Council of Graduate Schools has produced four reports related to challenges and innovations attempting to improve doctoral completion rates (King, 2008; Sowell, 2008, 2009; Sowell, Zhang, Bell, & Kirby, 2010). They have provided suggestions on how to improve six areas: administrative processes, admissions, advising, program environment, financial support, and research (Sowell et al., 2010). This article focuses primarily on the advising and program environment suggested by Sowell. Strategies of shared responsibility, commitment, communication, and institutional services and technologies are discussed.

The authors of the research paper at hand work at a small Midwestern university (about 3400 online and on-campus students). Twenty faculty members in the School of Education consistently serve over 125 doctoral students at the dissertation stage, graduating an average of 12 – 15 doctoral students each year for the past two decades. Many of those graduates have been a part of the university's Leadership program – an innovative, competency-based program started in 1994. Over the years, useful strategies to support doctoral students may have resulted in generally higher than normal (Terrell et al., 2009) success rates over the first 15 years of the Leadership program, as shown in Table 1.

Table 1

Doctoral Student Graduation Rates

Year of cohort starting	Starting participants	Graduated participants since start year	Completion rate
1994	19	12	63%
1995	20	16	80%
1996	11	10	91%
1997	8	7	88%
1998	17	13	76%
1999	19	14	74%
2000	26	18	69%
2001	16	14	88%
2002	12	9	75%
2003	29	22	76%
2004	23	13	57%
2005	11	6	55%
2006	22	19	86%
2007	19	14	74%
2008	9	8	89%
2009	6	5	83%

The PhD Leadership program is job embedded, which is more common for master's level programs than doctoral level programs (Bondy, Shannon, Eda, & Munarriz-Diaz, 2017; Duesbery, Frizelle, Twyman, Naranjo, & Timmermans, 2019), and requires students to remain in full-time employment to allow their jobs to function as platforms for research and the development of leadership competencies. This connection to work enables students to continue with their employment and family responsibilities without relocating to the university for onsite education while working toward their PhDs. This program advantage attracts many working professionals. The downside of this program is the reduced time for research and writing, and sometimes the lack of support and face to face time with faculty (Kennedy, Terrell, & Lohle, 2015). However, institutional cultures that accommodate distance doctoral students have been recognized as having the potential to increase student persistence and success (Terrell et al., 2009).

The founding faculty members designed the program based on social constructivist principles (Vygotsky & Cole, 1978), a set of principles that are rooted in the belief that individuals actively participate in the creation of their knowledge by interacting with diverse learners. The unique and atypical components of the program that demonstrate the faculty's commitment to social constructivism are: the Leadership and Learning Groups, the Leadership and Learning Plan where participants design their own program of studies, and the required on-campus Annual Leadership Conference. Each of these components provides unique opportunities for participants to interact with others to move toward the completion of their program.

The approach to dissertation support in this program is multifaceted and has arisen from an analysis of the challenges, feedback, and successes of the participants. The strategies documented in this paper focus on three primary areas impacting success rates in this doctoral program: building a shared responsibility and commitment, increasing effective communication between student and faculty researchers, and constructing departmental and institutional services for both students and faculty.

Shared Responsibility and Commitment

The fundamental first step to creating a culture of shared responsibility is recognizing the completion/attrition issue as a shared problem. Faculty convey the truth that faculty and institutions share the journey with students. When both students and faculty are committed to learning the skills needed to complete a dissertation, a positive environment is created for dissertation completion. In this section, four approaches to help develop shared responsibility and commitment are reviewed including: (1) a tool to discuss the distance doctoral student's social network, (2) teaching students how to manage their split life, (3) a tool to evaluate the student's readiness for the dissertation process, and (4) mapping out where dissertation skills are developed in the program.

Distance Doctoral Student's Social Network

A social network with clear roles is a crucial starting point for talking about the expectations and boundaries of responsibility. Students need to be connected to a caring collective of people and resources (Dombroski et al., 2018; Fahlman, 2009; Jairam & Kahl, 2012). Table 2 presents a brief overview of one tool useful for facilitating dialogue with students regarding how others share their journey. Although the dissertation process will often feel like the loneliest aspects of a graduate students' work, in reality, without a social network, few people find the resolve to finish. The social network consists of individuals outside and inside the university. Family, friend, and work social networks become crucial for giving deep emotional support as well as financial and practical support (van Rhijn, Murray, & Mizzi, 2018; Williams, Wall, & Fish, 2019). Social networks inside the university contribute to technical skill development as well as academic and intellectual development necessary to finish. Besides the traditional university social network, students in this program are required to participate in a Leadership and Learning Group, which, as seen in other online doctorial programs (Denman, Corrales, Smyth, & Craven, 2018; Kumar, Dawson, Black, Cavanaugh, & Sessums, 2011) creates additional support and motivation. Students also annually return to campus for the Roundtable Conference, where they network with faculty and peers and attend required workshops and optional research camps. Returning to campus is an essential component of the program, providing social networking opportunities and support to distance students and increasing the number of professional friends that students have to support them in their doctoral journey (Grady, 2016; Williams et al., 2019).

Table 2

Social Network and Role in the Dissertation

People	Role played	Distance doctoral student expectations of the social network	Social network expectations of distance doctoral student
		Outside the university	
Immediate family and close friends	Concern for student's holistic self, guarding the student's schedule, providing a break	Love, slack from other duties, understanding, encouragement, trust	Focus on the dissertation, completion, normal will return, respect of their contribution to success
Boss, employer, coworkers, employees	May provide accountability, may provide flexibility, may provide distraction	Flexibility, understanding, encouragement	No drop-in productivity, completion
		Inside the university	
Chair	Main mentor for the dissertation, provides feedback, provides assistance with decisions on methods, content, and interpretation	Timely communication (two week turn-around), provide resources and support	Receive feedback well, show ownership and individual initiative, share clear arguments in defense of work, keep in communication, avoid complaining
Committee member: Content	Expert mentor, theoretician	Has read extensively in the field of study, provides assistance with literature and theories	Listen and adapt to advice, collect and read literature, write the literature based on advice
Committee member: Method	Methodologist, statistician	Provide guidance on data collection and analysis, and methods related to research questions	Read about methods beyond assigned courses, take additional methods courses as needed
Faculty of research and content courses	Instruction in research methods, literature reviews, data analysis methods, provide background and theory	Guidance and resources in writing dissertation proposal, provide structure for reading and writing, support in transition to self-directed research, transition course work and reading into research plan	Acquire and manage literature collection, find and use technology, take initiative, improve writing

Fellow students informal, as well as leadership and learning groups (L&L Groups)	Colleagues in research journey	Meet regularly; provide feedback, ideas on content, methods, analysis; share stories of endurance, encouragement	Meet regularly, share material, be honest about challenges, ask for assistance, timely production of material, sharing tips

Time Management

Another useful discussion to facilitate with distance doctoral students regards the reality of their own "split" lives while working on a dissertation. Finding the balance between doctoral work and life is particularly challenging for mature students (Fung, Southcott, & Siu, 2017). Discussing this challenge encourages students to acknowledge the difficulty of creating time for everything in their lives. Students and faculty discuss what hobbies they will set aside and what new habits (better sleep, exercise schedules, eating plans, etc.) can make their work more efficient. As students consider their split lives, they can carve out time slots to work consistently on their dissertation. Small chunks of regular time prove effective for students and researchers alike (Bolker, 1998; Silvia, 2007). Faculty teach students how to divide dissertation tasks into "high focus" and "low focus" tasks. Students can then assess their mental state and select dissertation tasks accordingly. High focus tasks may include writing new text, reading, or analyzing data. Low focus tasks include downloading PDFs of journal articles and cleaning references in reference management software. Such strategies can increase a distance doctoral student's commitment and sense of shared responsibility.

Doctoral Student's Dissertation Readiness

An evaluation tool to assess students' readiness for the dissertation focuses the student's attention on the immediate dissertation tasks. Self-evaluation contributes to building a foundation of shared responsibility and commitment to each task and is a key component of this distance doctoral program (Alaby, 2002; Freed, Covrig, & Baumgartner, 2010). Figure 1 shows one example of a Likert scale evaluation that faculty use to guide students through considering their readiness for the dissertation phase, and toward working on specific tasks in preparation for beginning their dissertation.

DISSERTATION PROPOSAL READINESS EVALUATION Indicate level of readiness with an x from Low ..... High					
1. Previous reading on a specific area. You cannot write a good dissertation without the advice of others. Much of this wisdom comes from reading journal articles and well-chosen books and contacting experts and asking the right questions. The goal is to build on other's work. Most dissertation bibliographies have 100-200 references. How much have you read on your particular area of research?	**1** 10 articles/ books	**2** 50 articles/ books	**3** 100 articles/ books	**4** 150 articles/ books	**5** 200 articles/ books
2. Literature search, review and synthesis.	**1** Search	**2**	**3**	**4**	**5**

Do you know how to search and retrieve material from the university library databases, ERIC, and other public databases? Have you signed up for Table of Contents updates of key journals and publisher databases? Do you know how to systematically review literature, write an article or book review, and synthesize conflicting and complex literature?	database				Synthesize complex literature
3. Research topic / title / problem / purpose / research questions. You have a focused understanding of what you are studying, the data you need, why the study matters, and how to accomplish it, as well as clear integration and consistency across these five areas.	**1** Have 1 or 2	**2**	**3** Have draft of all 5	**4**	**5** All 5 with integration
4. Qualitative research knowledge, training, and skills. Avoid the minimalist view, i.e. "How little research can I learn to get through the dissertation?" Those who secure a doctorate are looked upon as individuals with special wisdom, discretion, advanced skills of analysis, and the ability to detect falsehood. Research is a wonderful analysis tool for life, work, writing a dissertation.	**1** Adequate knowledge to read and evaluate qualitative papers	**2**	**3**	**4**	**5** Deep knowledge about the specific method for your research
5. Quantitative research knowledge, training, and skills. Avoid a minimalist approach. Doctoral students in the social sciences are expected to be able to interpret quantitative data, including: survey validation; instrumentation; experimental or correlational design; use of parametric and non-parametric tests of significance, ANOVA, path analysis, and other statistical techniques.	**1** Adequate knowledge to read and evaluate quantitative papers	**2**	**3**	**4**	**5** Deep knowledge about the specific method for your research
6. Passion and commitment. Hard work needs fuel and a clear and steady passion. How much fuel do you have? Is the tank full?	**1** Some passion	**2**	**3**	**4**	**5** Driven, high value, clear vision
7. Relationship with dissertation chair and committee. Dissertations are the product of a scholarly community. Trust and good communication between the researcher	**1** Three names	**2** Talked with all three	**3** Emergent trust	**4**	**5** Call often; get quick feedback; work

and the chair are essential. How well connected are you?					through conflict
8. Resources (financial, social, emotional, physical, mental). Time, energy, space, money, and social understanding all assist in the journey. When one or two are missing, it is harder.	**1**	**2**	**3**	**4**	**5** Full time; $ for data collection; good health
9. Graduate writing ability. All right, poetry is more fun to write, but this is a dissertation. Skills are needed in technical writing and the precision of research. Extra points if you write enjoyable as well as readable APA cited and institution-formatted prose.	**1**	**2**	**3**	**4**	**5** Had thesis in MA; review published

*Figure 1***.** Dissertation proposal readiness evaluation.

Curriculum Mapping

Finally, since the 1990's the faculty began mapping out the specific courses or experiences within which participants developed the research skills to complete a dissertation, a method also used by Breen and Martin (2018) and Garcia and Yao (2019). The program requires the typical courses like proposal development, and qualitative and quantitative research methods. However, unique aspects of the program, specifically the Leadership and Learning Plan, Leadership and Learning Groups, Writing Retreats and Annual Roundtables presented special opportunities for research development. The structure of these face-to-face gatherings provided opportunities for just-in-time-learning and students came with a readiness to learn. Participants were ready to apply the information directly to their dissertation work rather than simply completing a course requirement. Developing a sense of shared responsibility and commitment is key to building an effective relationship between the dissertation committee and the distance doctoral student. The tools and strategies shared in this section are used by faculty to focus the conversation with students, cultivating the student's capacity for the dissertation journey.

Effective Communication between Researchers

Isolation is a normal challenge for scholars, but it is a challenge that is particularly intense for the distance doctoral student (Ali & Kohun, 2006; Deem & Brehony, 2000). Effective communication between researchers can prevent problems that may otherwise emerge due to working in isolation. Manathunga (2005) found that experienced research supervisors identified: (1) changing the topic, (2) avoiding communication, (3) isolating themselves, and (4) not submitting work, as key warning signs that students were experiencing difficulties. Kearns, Gardiner, and Marshall (2008) recognized seven self-handicapping behaviors impeding graduate student work: overcommitting, busyness, perfectionism, procrastination, disorganization, limited effort, and the choice of performance-debilitating circumstances. These warning signs can be viewed through the lens of ineffective communication. An intentional focus on planning and

implementing effective communication includes strategies of availability, effective feedback, trust, and humor.

Availability

Students working on dissertations express concern regarding the availability of their supervising faculty (Harrison, Gemmell, & Reed, 2014). Availability begins with the supervising researcher and the distance doctoral student negotiating communication methods and response times. Understanding and teaching may go both ways, with the distance doctoral student sometimes taking the lead by asking for communication methods and modeling adaptability themselves. Faculty can respond quickly to emails with information regarding when detailed feedback will be forthcoming, providing the student with a sense of faculty immediacy (Baker, 2010; Kumar et al., 2011). Regularly scheduled meetings can bridge the distance, generating continuity and productivity. Faculty can also assist students in breaking up the project into smaller parts, which can overcome procrastination due to statistics anxiety (Onwuegbuzie, 2004). Tools such as phone, videoconference, e-mail, and even texting for very quick questions, can decrease the distance.

Effective Feedback

Short, frequent feedback is essential for effective communication and teaching (Berry, 2017; Walters & Henry, 2016). Some faculty may struggle to give regular feedback because they believe they must read the whole manuscript first. Shorter feedback allows for quicker turnaround and paces students with limited corrections to handle quickly. For example, faculty should ensure students have a tight consistency between title, problem, purpose, and research questions early in the process (Newman & Covrig, 2013). Tools such as the form in Figure 2 assist students in focusing faculty feedback.

Dissertation Topic Guidelines		
Use this outline to develop your dissertation topic and facilitate the conversation with your prospective chair and as you recruit other committee members. You will be expected to attach the completed dissertation topic prospectus to your completed Dissertation Topic and Committee Form. The prospectus should be succinct, about 1-2 pages.		
Area	Evaluation Scale	Score
1. Title	1. Reflects something about the main topic 2. Includes a few: key variables, population/sample, or research design 3. All variables, sample, research design issues evident in title	
2. Committee	1. Identifies chair 2. Methodologist secured 3. Complete committee agreed, vita of non-home-institution faculty included	
3. Problem	1. Mentions area of problem without much focus	

(2-3 sentences)	2. Described problem 3. Compelling problem / need stated	
4. Purpose (2-3 sentences)	1. Vague explanation of purpose 2. Clearer description of purpose (explore, describe, correlate, etc.) 3. Identifies major goal of study and the proposed product(s)	
5. Research Questions (1-3 listed)	1. General question about a general area of inquiry 2. Specific questions 3. Feasible, clear and researchable specific questions	
6. Methods (2-3 sentences)	1. Type of research design is apparent 2. Design, sample, data collection and analysis clearly listed 3. Readiness level to use the chosen research methodologies is indicated	
7. Bibliography (topics/ areas listed)	1. Vague topical areas listed but not clear 2. Added details are given 3. Specific topical areas, authors and resources are briefly listed	
8. Consistency / Logic / Alignment	1. Title, problem & purpose, and research questions are stated, but do not align consistently to reflect the logic of your study. 2. Title, problem, purpose, and research questions reflect an emerging logic but some elements are still not well aligned. 3. Title, problem statement, purpose and research questions are thoughtfully stated to reflect a consistent logic of your study.	
9. Connection to work / program	1. Study is not embedded in work nor connected to program parameters. 2. Study is embedded solidly in your work 3. Study is connected well to program parameters.	
10. Timeline & Budget	1. Vague or unrealistic timeline evident 2. More realistic timetable with enumeration of key components to work 3. Realistic timeline with possible contingencies noted	
	Total Points	/ 30

*Figure 2***.** Dissertation topic guidelines.

Brief, frequent, actionable feedback, specific reading material, or explicit problem-solving advice all help students progress appropriately (Walters et al., 2015). Manathunga (2005) suggested "framing supervision as a collaborative problem-solving exercise, where students receive the message that they are not alone" in the dissertation process builds confidence (p. 230). Asking, "is that helpful?" can focus feedback for both faculty and student. Honest, formal, constructive feedback, without overreaction, can inspire trust and improvement. The annual Leadership Conference provides a venue where participants and faculty meet, update one another on research progress, and set the agenda for the coming year. In addition to faculty feedback, students need feedback from a community of practice with other students experiencing the same research process (Terrell et al., 2009), in the context of the Leadership and Learning Groups. Sometimes students need specific, detailed feedback; other times they need broad strokes. Faculty should discern when students need each type. Faculty should model thinking about research for the students, while keeping the responsibility for learning on the students. Students should establish, in writing, clear takeaways from feedback conversations and realistic expectations for moving forward with their research.

Trust

Trust is at the core of the communication process (Faranda, 2015). Listening to students' fears, needs, and wants indicates deep listening, and thus contributes to the building of trust between supervisor and student. When faculty share previous dissertations and published articles and show students they are committed to the whole journey, trust in faculty dissertation competence is established. Meeting with other students in a group can help new students trust the faculty member, as here, students can experience criticism as dialogue and watch other students receive feedback without defensiveness (Kumar & Coe, 2017).

Humor

Finally, humor and stories can set students at ease (Goodboy, Booth-Butterfield, Bolkan, & Griffin, 2015; Violanti, Kelly, Garland, & Christen, 2018). The authors find the use of humor useful to create receptiveness to the tightness and precision of language necessary to explain statistics. Sometimes students are overwhelmed by lack of knowledge or direction. Humor, asking a simple question about the methods, or telling a story all work to mentally rest students, lessen their fears, and bring more positive emotions to the work.

Effective communication between researchers involved in the dissertation process can reduce the likelihood of dropout. Negotiating availability, providing feedback, building trust, and using humor and stories are strategies emphasized in this program.

Services and Technologies for Students and Faculty

Capacity development can be defined as a systematic and organic accumulation of resources and structures that strengthen participants' abilities to effectively complete research (Ross et al., 2013). Building capacity can enable students to feel closer to faculty members throughout the dissertation journey (Ross et al., 2013) Capacity development addresses several institutional factors affecting retention in doctoral programs including: the use of online and library resources, campus-wide use of research software, writing and research services, and departmental processes (Manathunga, 2005).

Libraries and Literature

Student literature searching, reading, management, and reviewing starts with library orientation and continues with in-library services. Skills in critiquing and citing literature are developed through required courses.

Software

The search to identify better ways to serve distance doctoral students is constantly leading to new technological tools to support the PhD process (Aghaee et al., 2016). Multiple tools have been implemented at the authors' institution for managing the distance dissertation process, including online editing tools and technology useful at each student work phase. These tools allow for file exchange, e-mail, progress tracking, content sharing, and viewing of learning object repositories.

Endnote or other bibliographic software (EasyBib, Mendeley, Zotero, etc.) enhance the citation of references with features to search, organize, collaborate, curate full text, and connect socially around research. Such software must be introduced to students by educators, and educators are also responsible for teaching students how to use the software. Next, students must then follow through with actually making use of the software for their research. Distance doctoral students increase their odds of successful completion as they learn to use technology to support their development from the start to the end. Deliberately introducing useful technology tools early during orientation, and repeatedly reminding students of their usefulness in e-mails and newsletters increases utilization.

Synchronous communication tools such as AdobeConnect, FaceTime, GoToMeeting, Skype, and Zoom are essential for supporting the distance doctoral student, especially visual learners (Oregon, McCoy, & Carmon-Johnson, 2018; Wagner, Enders, Pirie, & Thomas, 2016). Document sharing tools allow faculty members to monitor student work – reviewing how students are coding their interviews, listening to interviews students are analyzing, and reviewing how students are displaying their data. Using videoconferencing allows the faculty to assess the student's reception of the feedback (Naughton & Redfern, 2002). Communication tools and conference calling can make meetings easier for dissertation committee members in diverse locations.

Document sharing tools and workspaces also support the dissertation process (Ames, Berman, & Casteel, 2018). In the early stages before formatting is critical, a peer editing tool such as GoogleDocs provides opportunity for editing and commenting. The Microsoft Word review tools afford the ability to highlight sections and write comments and feedback. Some faculty prefer to use Adobe Acrobat or iPad apps for marking up, highlighting, and providing feedback to students. Document sharing, though, can quickly cause confusion and frustration with multiple versions of files. Using a tool like DropBox to keep each file revision creates a development history of the research document. Project management tools like Zoho Projects can keep versions of files, deadlines, tasks, and milestones of the project.

Doctoral students in the program have experienced varying success with these tools. Listening to student experiences enables growth for both faculty and students. Analysis of the use of tools has sometimes redirected students and faculty to additional choices. Many times, participants initiate the use of various tools to facilitate their own work. Regular communication between committee members and students

provides opportunity to learn how to use specific tools and troubleshoot problems throughout the dissertation process.

Writing and Research Services

Courses in research and writing are essential. In 2007, the department hired a full-time instructor to facilitate writing instruction and writing retreats giving distance students focused tutoring and writing time. Online and intensive face-to-face research courses are augmented with research "bootcamps" where a talented methodologist works with students struggling to articulate their methods or develop findings.

Writing Retreats

Offering writing retreats has become essential for distance doctoral education (Nerad & Miller, 1997; Williams & Todd, 2016). Writing retreats help many students clear their minds, reset their goals, and complete large chunks of writing. All writing is essentially "creative" and can be enhanced by the right environment. The most often-used environment has been a retreat center about an hour from the university. The center has nine bedrooms situated on three levels, as well as a kitchen, dining room, bathrooms on each level, a prayer room, a communal sitting room, and quiet nooks for use during the day. Trails through the forest allow guests to wander freely, enjoying the quiet sounds of the forest. Other venues used for retreats included cabins, the library, a boarding academy, and a beach house.

The typical retreat involves nine or ten participants, in a space with separate rooms and common study and meal areas. This setup allows students to engage with others or spend time alone. The participant schedule includes mealtimes, optional daily prayer ritual, and two meetings per day. In the first meeting, groups share daily goals, providing accountability and clarity of purpose. In the evening meeting, participants share accomplishments and hear expert presentations on topics such as managing procrastination, psychological writing blocks, and maintaining motivation and creativity. Participants request one-on-one with a writing coach as desired, and short hikes offered after lunch get participants ready for the next round of work.

Department Support for Research

Funding and promoting presentations at conferences has motivated many doctoral students in this program toward the completion of their dissertation. Encouraging a student to publish a book review, write a literature review, or present data at a conference helps the student stay motivated and connect to the scholarly community (Kirkpatrick, 2019). Both ad-hoc and systemic focus on capacity development can create better student services.

Conclusion

The three clusters of strategies described in this article (shared responsibility and commitment, effective communication, and developing departmental and institutional services and technologies for faculty and students) promote student self-regulation. Kelley and Salisbury-Glennon (2016) reported that "incorporating self-regulated learning strategies within doctoral curricula has the potential to improve doctoral candidates' rates of dissertation completion" (p. 97). Because of the individualized, customizable nature of the program, self-regulatory aspects of learning are featured from the start. Participants must

develop their own learning plans after reflection and narrative writing. They also write substantial reflection papers for each of the 15 competencies required in the program. Throughout the program, four phases of self-regulation are cultivated, as the program requires: a) forethought, planning, and the activation of action; b) monitoring of effort and time; c) control and selection of cognitive strategies; and d) reaction, judgments, reflection, and evaluation (Pintrich, 2000).

Over time faculty have learned how tools and services help participants and fellow faculty stay engaged and progressing in research. Some strategies were arrived at suddenly; others a result of incremental change. Many have been derived from suggestions and pressure from faculty or participants. The strategies reported here have been discovered from more of a trial and error process than strategically planned reengineering of the program. Even through old patterns may seem hard to change, the way in which faculty handles various situations has in fact evolved. One big aspect of this evolution has been the infusing of a network of adjunct faculty into the offered dissertation services. Sharing solutions to help other faculty and students is the next step in growing the program network.

Further research is required to understand and communicate the unique aspects of this competency-based program. For example, how do the Leadership and Learning Groups and Annual Roundtable Conference influence dissertation completion? Further research could explore the effectiveness of methods to provide instruction concerning various research methods – classes, boot camps, sessions during the Roundtable Conference, or individualized and small group help when the dissertation requires it.

Cassuto (2010) stated well that "watching someone tread water in Lake Dissertation (as one clear-eyed student aptly put it) is one of the more painful sights in academe" (p. 1). While Cassuto suggested one way to remove the stigma of an unfinished dissertation would be to create better ways for more students to bow out gracefully, using the strategies suggested in this paper, more can be done to teach students better ways to swim. At a time when doctoral education proliferates in this nation, teaching strategies such as these can help universities and faculty foster the student skills necessary to complete quality dissertations.

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