Towards a New Definition of Blended Learning

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DOI: 10.34190/EJEL.20.18.2.001

Abstract: Most current definitions of blended learning refer to a blend of online and face-to-face instruction. It seems that few authors notice the irony that the definition of blended learning does not include the concept of learning at all. The problem with these definitions is that they are devoid of theory and thus lead to trial-and-error research. This paper argues that the definition of blended learning should be built around learning theory and should refer to a blend of direct instruction and learning-by-doing. The paper reports on research conducted to validate a model that puts behavioural and constructivist learning at right angles and considers if the two can occur simultaneously. The model is then placed in the context of a framework of knowledge management and from there a definition is derived that includes context, theory, methodology and technology.

Keywords: Blended learning; constructivism, behaviourism, objectivism, learning theory, context

1. Introduction

Arguably one of the most common definitions of the term Blended Learning is that of Graham who expresses it as learning systems that “combine face-to-face instruction with computer mediated instruction” (Graham, 2006, p.41). Variations of this definition abound also in papers published in this journal throughout the years (Charbonneau-Gowdy, 2018; Banditvilai, 2016; Soeiro, de Figueiredo and Ferreira, 2012; Onguko, 2014; Tshabalala, Ndeya-Ndereya and van der Merwe, 2014; Gynther, 2016; Nakayama, Mutsuura and Yamamoto, 2016; Kintu and Zhu, 2016; Nortvig, Petersen and Hattesens Balle, 2018; Uziak et al., 2018; Jakab, Ševčík and Grežo, 2017). Very few authors, however, explore any of the other elements that may form part of the blend in blended learning as defined in the earlier definition by Marcy Driscoll, who presents a much more refined definition that includes:

- To combine or mix modes of Web-based technology (e.g., live virtual classroom, self-paced instruction, collaborative learning, streaming video, audio, and text) to accomplish an educational goal.
- To combine various pedagogical approaches (e.g., constructivism, behaviorism, cognitivism) to produce an optimal learning outcome with or without instructional technology.
- To combine any form of instructional technology (e.g., videotape, CD-ROM, Web-based training, film) with face-to-face instructor-led training.
- To mix or combine instructional technology with actual job tasks in order to create a harmonious effect of learning and working (Driscoll, 2002, p.54).

This paper seeks to refine the common definition by specifically commenting on those pedagogical approaches that may be connected to learning theory. The problem driving this position paper is that the current definitions of blended learning concentrate on the blend and ignore the learning.

2. Background and literature survey

The origin of the term blended learning is generally traced back to a 1999 press release by EPIC learning in Atlanta (Friesen, 2012), who points out that, from the outset the term has been plagued by ambiguity, and concludes: “Blended learning, in other words, is almost any combination of technologies, pedagogies and even job tasks. It includes some of the oldest mechanical media (e.g., film) and theories of learning (e.g., behaviourism), as well as the newest” (Friesen, 2012, p.2). In 2006 Graham deplores the ambiguity of the term in that:

“these positions suffer from the problem that they define [blended learning] so broadly that they encompass virtually all learning systems. One would be hard pressed to find any learning system [or combination of methods] that did not involve multiple instructional methods and multiple delivery media” (Graham, 2006, p.4).
After an extensive analysis of the various definitions of the term Friesen proposes that “Blended learning’ designates the range of possibilities presented by combining Internet and digital media with established classroom forms that require the physical co-presence of teacher and students” (Friesen, 2012, p.1).

2.1 The missing ingredient

The problem with Friesen’s definition, however, is that it still does not acknowledge learning, unlike a definition in a previous issue of this journal which does, as it points out that: “The concept of blended learning is derived from two words, blend and learning. The word blend means combining things and learning denotes an assimilation of new knowledge” (Tshabalala, Ndeya-Ndereya and van der Merwe, 2014, pp.102–103).

The definitions of blended learning provided in this journal by authors who use the term in the titles of their work are equally diffuse. Table 1 provides an overview of definitions provided by such authors in the period from 2012 to 2018. The table has been arranged in order of pedagogical complexity, from no definition through technology-driven definitions, to pedagogical and strategic definitions.

Table 1 shows that a literature survey conducted in 2018 indicates that there still is very little consensus as to a universal definition of the term Blended learning (Nortvig, Petersen and Hattesen Balle, 2018). Another author (Charbonneau-Gowdy, 2018) simply refers to examples of what she considers to be blended learning. She requires the reader to develop an understanding of how she uses the term from a description of the project discussed in the article. The majority of authors rely on the classic combination of face-to-face and technology to frame their definitions, although there seems to be a taxonomy of complexity ranging from a simple statement of technologies to an acknowledgement of teaching and learning, context, pedagogy and finally value (Uziak et al., 2018; Nakayama, Mutsuura and Yamamoto, 2016; Kintu and Zhu, 2016; Onguko, 2014; Gynther, 2016). Some authors extend the metaphor of the blend to that of a recipe, by referring to ingredients and method(Banditvilai, 2016; Tshabalala, Ndeya-Ndereya and van der Merwe, 2014). Only one article goes as far as seeing blended learning as a strategy, although, ironically these authors do not provide a definition for blended learning at all (Soeiro, de Figueiredo and Ferreira, 2012).

From the analysis of articles in past issues of this journal it can be seen then that there is no clear definition of blended learning that places the focus on learning. What does become clear though is that, in their writing, the authors of these papers are fully aware that the complexities of blended learning go far beyond deciding between face-to-face and technology-mediated contact.

In considering the relationship between the blend and the learning, or the “combining of things (…and the) assimilation of knowledge” (Tshabalala, Ndeya-Ndereya and van der Merwe, 2014, p.102) it is necessary to consider two of the key arguments in our field – (1) the so-called “Clark-Kozma debate” (Clark, 1994; Kozma, 1994) and (2) the No significant difference phenomenon (Russell, 1999). Richard E Clark (1994) has argued since 1983 that the medium of instruction does not influence the quality of learning. He uses the now famous grocery truck analogy saying that the medium of instruction will no more influence the quality of learning than a delivery truck would influence the nutritional value of the food it delivers. Kozma (1994) however argues that certain affordances of technology may well enable forms of learning that others do not – in other words, you cannot drive a grocery truck to the moon. Tom Russell, in support of Clark, presents a bibliography of 355 academic works that indicate no significant differences (NSD) in student outcomes between various modes of delivering education (Russell, 1999).

Along these lines some authors argue that “despite the failure of some variables to show as significant factors to blended learning outcomes, learners showed a high affinity to engage in blended learning; which accounts for learner attitudes being contributors to learner satisfaction and intrinsic motivation” (Kintu and Zhu, 2016, p.192). Others draw specific attention to the affective domain. In a passionate conclusion Soeiro, de Figueiredo and Ferreira argue that “beyond what is often described as the coldness of technology, educators and students can help each other find technology-supported contexts that never existed and where people can learn (together) to listen with their hearts” (2012, p.348).

www.ejel.org 115  ISSN 1479-4403
<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Author</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>No definition</td>
<td>“there has not been complete agreement among researchers about the precise definition or meaning of the term ‘blended learning’”</td>
<td>(Nortvig, Petersen and Hattense Balle, 2018, p.47)</td>
<td>Authors conducted a literature survey based on a search for “e-learning” OR “online learning” OR “blended learning” OR “hybrid learning” and concluded that no clear definition existed.</td>
</tr>
<tr>
<td>Hybrid</td>
<td>“Massive Open Online Courseware (MOOC’s) or their hybrids, so-called Blended Learning Programs”</td>
<td>(Charbonneau-Gowdy, 2018, p.56)</td>
<td>Author uses MOOC as an example of what she means by Blended Learning and provides no formal definition.</td>
</tr>
<tr>
<td>Face-to-face and technology</td>
<td>“…platforms are also used for delivery and tracking of blended learning, i.e. a combination of traditional (face-to-face) and on-line resources”</td>
<td>(Uziak et al., 2018, p.1)</td>
<td>These two authors use the most basic definition that relies simply on the dimensions of contact and technology to deliver (and track) learning materials. No mention is made of the actual learning that may occur.</td>
</tr>
<tr>
<td></td>
<td>“…blended learning, which consists of face-to-face sessions and learning materials that are supported by information communication technologies (ICT)”</td>
<td>(Nakayama, Mutsuura and Yamamoto, 2016, p.43)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“The design in this study involves a transition from traditional face-to-face teaching-learning to blended learning with technology”</td>
<td>(Kintu and Zhu, 2016, p.181)</td>
<td>These authors include the terms teaching and learning.</td>
</tr>
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<td></td>
<td>“In this paper, blended learning is defined as a deliberate combination of self-directed study of offline content deployed on tablets, with occasional face-to-face meetings, moderated through instructor-led sessions. This definition takes into consideration access to offline professional development (PD) content on tablets combined with teachers’ face-to-face interactions with their peers and instructors referred to as professional development tutors (PDTs). JIFUNzeni blended learning approach emphasizes the use of appropriate technologies for each context based on the contextual realities”.</td>
<td>(Onguko, 2014, p.78)</td>
<td>In addition to a clear description of what was done this author adds the dimensions of appropriateness and context.</td>
</tr>
<tr>
<td></td>
<td>“Blended learning courses integrate online with face-to-face instruction in a planned, pedagogically valuable manner, and do not just combine but trade-off face-to-face with online activity (or vice versa)” ’(Vignare, 2007, p.38).</td>
<td>(Gynther, 2016, p.21)</td>
<td>This author recognises pedagogy and value.</td>
</tr>
<tr>
<td>Ingredients</td>
<td>“The article underscores the concept that many “ingredients” can comprise a blended learning model, including instructor-delivered content, e-learning, webinars, conference calls, live or online sessions with instructors, and other media and events, for example, Facebook, e-mail, chat rooms, blogs, podcasting, Twitter, YouTube, Skype and web boards”</td>
<td>(Banditvilai, 2016, p.223)</td>
<td>These authors list methods of delivery as well as platforms used for such delivery, much as a recipe would have “ingredients” and a method.</td>
</tr>
<tr>
<td></td>
<td>“the mixture of traditional delivery including: lectures, group discussions, apprenticeships and experiential learning, together with e-learning methods, which accommodate various learning needs of a diverse audience in a variety of subjects”</td>
<td>(Tshabalala, Ndeya-Ndereya and van der Merwe, 2014, pp.102–103)</td>
<td></td>
</tr>
<tr>
<td>Strategy</td>
<td>“…we were exploring pedagogical participatory strategies, personal and collaborative, in a blended- learning environment supported by Moodle”</td>
<td>(Soeiro, de Figueiredo and Ferreira, 2012, p.339)</td>
<td>Although these authors do not provide a clear definition of blended learning they refer to pedagogy as well as strategy.</td>
</tr>
</tbody>
</table>
More comprehensively though authors argue for a sensitivity to the context in which learning takes place: “thus in a context where there is lack of access to electricity, Internet is not guaranteed, and schools lack basic amenities including clean and safe learning spaces, learning materials such as textbooks and facilities such as desks, blended learning must be redefined with consideration of the contextual realities” (Onguko, 2014, p.78). In some contexts it could even be argued that technological solutions are better than face-to-face: “on the other hand, it illustrates how deaf students who do not want to expose themselves can benefit from the experience of community learning afforded by pedagogical strategies and tools that could never exist face-to-face” (Soeiro, de Figueiredo and Ferreira, 2012, p.347).

If there is to be no significant difference in learner performance, regardless of the mode of delivery then it holds that, in developing blended learning alternatives one should look rather at the theoretical underpinnings of teaching and learning than at the delivery mechanisms. One could therefore argue that a definition of blended learning needs not be too specific in defining exactly what delivery medium is used. It is the context, rather than the meaning, that makes a difference. A definition of blended learning should focus on learning.

### 2.2 Two dimensions of learning

Over time behaviourism and constructivism have evolved as two major, opposing dimensions of learning (Lowrey, 2013). The binary opposing nature of the two paradigms has been outlined by many authors, including Cronje (2006, p.390).

<table>
<thead>
<tr>
<th>Category</th>
<th>Objectivism</th>
<th>Constructivism</th>
</tr>
</thead>
<tbody>
<tr>
<td>The real world</td>
<td>has entities that can be categorized on the basis of their properties and relations.</td>
<td>is structured by our individual minds on the basis of our interactions (this limits what we can know about the real world).</td>
</tr>
<tr>
<td>Reality is...</td>
<td>fully and explicitly structured in a way that is shared by all who perceive it. Because of this commonality, reality can be modeled and shared with others.</td>
<td>local (personal) to ourselves in a universe of multiple realities. Our realities are modeled by the way in which we personally construct them.</td>
</tr>
<tr>
<td>Symbols are...</td>
<td>representations of reality, and are only meaningful to the degree that they correspond to reality.</td>
<td>products of culture that are used to construct reality.</td>
</tr>
<tr>
<td>The human mind...</td>
<td>processes abstract symbols and fashions them so that they mirror nature.</td>
<td>perceives and interprets the world by creating symbols.</td>
</tr>
<tr>
<td>Human thought is...</td>
<td>symbol-manipulation and is independent of the human organism.</td>
<td>is imaginative, and develops out of perception, sensory experiences, and social interaction.</td>
</tr>
<tr>
<td>Meaning...</td>
<td>exists objectively and independently</td>
<td>is a construction that is the end result of</td>
</tr>
</tbody>
</table>

**Figure 1:** Contrasting views of Objectivism and Constructivism (Cronje, 2006, p.390)

The view of behaviourism/objectivism and constructivism as opposites was particularly strong in the 1990s. There were various calls for a move towards constructivism (Jonassen, 1991; Davis et al., 1993). More recently these two “opposing” dimensions have been researched specifically as they contribute both to face-to-face and online learning (Weegar and Pacis, 2012). It has been shown that, while early computer-based training programmes were primarily behaviourist in their design, “the use of technology in online courses has slowly shifted the theoretical balance from behaviorism to constructivism due to the increased use of educational technologies” (Weegar and Pacis, 2012, p.17).

More recently there is an increased call for the integration of behaviourist and constructivist principles (Elen, 2017). The problem with a model of linear opposition between the two paradigms is that, as the one goes up, the other goes down. If the balance is shifting from the one to the other then, at some stage, there will be a position that is neither behaviourist nor constructivist. Nevertheless it is argued that “often instructors are
choosing to utilize a combination of these two learning styles in an effort to best meet the learning styles for all students” (Weegar and Pacis, 2012, p.17).

To overcome this problem of a false dichotomy Cronje (2006) proposed a two-by-two matrix plotting the two extremes at right angles as shown in Figure 2. The resultant matrix contains four quadrants, construction, which is high in constructivist and low in behaviourist/objectivist elements, injection which is high in behaviourism but low in constructivism, where the “combination of these two learning styles” (Weegar and Pacis, 2012, p.17) is highest, and the immersion quadrant, which is low in overt evidence of either, and where “it is safe to conclude that the majority of our learning occurs informally” (Shipley, 2017, p.118).

![Figure 2: The integration of two learning paradigms (Cronje, 2006, p.392)](image)

The model has subsequently been tested by Elander, (2012) who found that it was indeed possible to identify courses that were high in both behaviourist and constructivist elements, as is shown in Figure 3. Elander demonstrated that the majority of instructional designers worked mainly in an objectivist/behaviourist paradigm, but that there were substantially more designers who took an integrated, and therefore blended approach, than those who worked in the immersion or construction quadrants only.

![Figure 3: Four quadrants of blended learning demonstrated (Elander and Cronje, 2016, p.399)](image)
3. Discussion: Elements of the blend

In response to Clark (1994), Kozma (1994) and Russell (1999) the selection of a specific medium is subservient to context, and the dimension of face-to-face or at-a-distance is a sub-set of context. Thus I argue that it is context that drives the decision of what and how to blend. The Cynefin framework (Figure 4) provides a good initial point of departure to establish context.

For Known knowledge cause and effect are repeatable, perceivable and predictable and legitimate best practice and standard operating procedures have been established. In this case direct (behaviourist) instruction is the most appropriate. Using problem-based learning in this field would lead to frustration and a waste of time (Clark, Kirschner and Sweller, 2012) the blended learning model would therefore concentrate on Instruction. In a contact environment this would amount to lectures and demonstrations and in a distance environment books (physical or digital) or (instructional) videos.

For Complex knowledge cause and effect are only retrospectively coherent, and pattern recognition is required. Here a constructivist approach is appropriate. Learners learn how to make sense of complexity. It is important to recognise that constructivist learning is more about learning to learn than about learning to acquire skills – as was pointed out in an earlier issue of this journal: “knowledge construction is highly exhibited and significant factors in this include learner interactions and management of workload” (Kintu and Zhu, 2016, p.192). This is the quadrant of abductive reasoning.

![Figure 4: The Cynefin framework (Kurtz and Snowden, 2003, p.464)]

Construction tasks, problem-based learning and open-ended learning environments would be appropriate here. In a low-technology environment physical puzzles would be useful and in a high-technology environment spreadsheets and other information-processing tools would be recommended.

In the Knowable domain that calls for analytical and reductionist thinking with cause and effect separated over time an Integrated use of behaviourist and constructivist learning would be appropriate. This is the domain of puzzles rather than problems. Puzzles have solutions known to the instructor but not to the learners, while problems may have endless solutions. The aim in this quadrant is to teach systems thinking. In a contact environment this is where discussions and debates are likely and in a distance environment it is the domain of chat groups and bland discussion forums.
The Chaos domain is the domain of experience. There is no perceived cause and effect relationship and interventions are aimed at regaining stability. Traditionally this is known as “being thrown into the deep end” or Immersed. In this quadrant there is no evidence of planned intervention of either a behavioural or constructivist nature. Yet this is where Shipley (2017) argues that most learning takes place. This is the domain of the field-trip, the experiential learning and the apprenticeship. In this context teaching is notably absent and learning is incidental and serendipitous. The technology involved here is the logbook and the blog and the methodological focus should be on assessment rather than instruction.

4. Conclusion and recommended definition

Thus far this paper has shown that, although in the early uses of the term Blended learning, homage was paid to dimensions of learning theory and pedagogy, the majority of definitions are restricted to mentioning a mixture of face-to-face and web-based instruction. This paper argues that more attention should be paid to Driscoll’s second bullet point: “To combine various pedagogical approaches (e.g., constructivism, behaviorism, cognitivism) to produce an optimal learning outcome with or without instructional technology” (2002, p.54).

To this end Cronje’s (2006) integrated model is proposed as a framework for designing blended learning. The framework resonates strongly with Kurtz and Snowden’s (2003) Cynefin framework and in fact each quadrant can be mapped directly from the one model to the other. From this a blended learning decision matrix can be developed that would resemble Table 2.

Table 2: Blended learning decision matrix

<table>
<thead>
<tr>
<th>Context (Kurtz &amp; Snowden)</th>
<th>Theory (Cronje)</th>
<th>Methods</th>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known</td>
<td>Injection</td>
<td>Tutorial</td>
<td>Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drill</td>
<td>Book</td>
</tr>
<tr>
<td>Complex</td>
<td>Construction</td>
<td>Construction</td>
<td>Open-ended learning environments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exploration</td>
<td>Construction kits and tools</td>
</tr>
<tr>
<td>Knowable</td>
<td>Integration</td>
<td>Puzzle</td>
<td>Games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Discussion</td>
<td>Discussion tools</td>
</tr>
<tr>
<td>Chaos</td>
<td>Immersion</td>
<td>Experience</td>
<td>Blogs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Field trip</td>
<td>Logbooks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apprenticeship</td>
<td>Assessment tools</td>
</tr>
</tbody>
</table>

Table 2 is by no means exhaustive but serves as an example of how decision-making could take place around identifying an optimal blend of learning methodologies and technologies.

From the above discussion, it becomes clear a definition of blended learning that is based on the dimensions of face-to-face and technology-mediated instruction, does not provide an adequate theoretical underpinning for such decisions. A definition of blended learning should include context, theory, method and technology, which is why I propose the following definition of blended learning:

The appropriate use of a mix of theories, methods and technologies to optimise learning in a given context.

References


Peer Feedback in Learner-Learner Interaction Practices. Mixed Methods Study on an xMOOC

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DOI: 10.34190/EJEL.20.18.2.002

Abstract: Although xMOOCs have shown benefits due to their accessibility to expert knowledge, the quality of their pedagogical proposal remains contested. It has not yet been proven that online education’s learner-learner interaction practices in xMOOCs generate an improvement in the quality of learning and academic achievement. Peer feedback is a practice that can enhance learning in an environment with diverse student profiles and limited instructor participation. The present mixed methods study was devoted to identifying the perceptions of xMOOC participants regarding learner-learner interaction and feedback practices. In the Energy Saving course on MexicoX platform, 1,176 participants answered an initial survey, 486 participants answered a final survey and 14 participants were interviewed after completing the course. Results show that most of the participants are willing to interact with their peers and participate in peer feedback activities. Although, in practice its value for summative assessment is an important factor that may predict involvement. It is found that diversity of expertise level is not an obstacle for participants to interact. Rather, participants consider that they may benefit from diversity by assessing their peer assignments and learning different alternatives and strategies in which a problem can be solved. Further, it is identified that peer assessment activities are more adequate for providing feedback than discussion forums, since the first promotes an environment in which participants can observe the performance of their peers showed in a more complex assignment. The findings of this study allow us to analyse inherent and external factors that configure learner-learner interaction and that affect peer feedback in xMOOCs. It is concluded that more research is needed in order to understand the effect of some factors that may affect peer interaction and peer feedback in xMOOCs and to propose better strategies to improve peer feedback effectiveness.

Keywords: feedback, peer feedback, peer review, discussion boards, learner-learner interaction, formative assessment, MOOC

1. Introduction

Since their creation and first implementation, massive open online courses (MOOC) have provided an opportunity to gather the knowledge of many people and generate learning. They have afforded open access to content in several disciplines by experts from prestigious universities. That is why MOOCs, since their inception, have been considered promising for distance learning. In recent years, studies have assessed the intrinsic educational value of MOOCs and the advancements they offer in the field of e-learning (Gamage, Fernando and Perera, 2015; Martín, González and García, 2013; Sánchez, 2016).

Although these courses are an innovation in online education, some authors consider that it has not yet been proven that they have a strong enough foundation to represent a jump in pedagogical quality, in terms of generation of learning in comparison with other online training models (Aguaded and Medina-Salguero, 2015, Ramírez-Fernández, 2015). Therefore, it is necessary to know MOOCs’ deficiencies, so efforts can be oriented to focus on the dimensions that require the most improvements. Two of these areas is learning assessment and peer interaction.

Their massive scale and the diversity of their participants turn MOOCs into a unique learning environment that deserves to be studied. The diversity of the profiles of MOOCs’ participants includes their culture, education level, interests and experience concerning the course’s topics and objectives, among other aspects (Chuang and Ho, 2016). This diversity, in consequence, requires being considered to generate appropriate evaluation processes. Further, the students-teachers ratio makes it practically impossible for students to receive from the teacher individual feedback on their performance (Ashton and Davies, 2015). Therefore, two important characteristics that define MOOCs are the diversity of participants’ profiles and the inability by instructors to evaluate and guide work individually.
2. Literature Review

2.1 Learner-learner interaction

According to Moore (1989), there are three types of interaction required for effective learning: learner-content, learner-instructor and learner-learner. Learner-learner interaction can be achieved through group activities and peer feedback. Some studies suggest that learner-learner interaction is essential for a better online learning experience and can improve the learners’ learning achievements (Gunawardena, Linder-VanBerschot, LaPointe and Rao, 2010). Although, this type of interaction is the one that participants prefer the least as it does not fulfill the need for time flexibility required by them (Kurucay and Inan, 2017). In xMOOCs, the two most common peer interaction activities are discussion forums and peer assessment.

2.2 Feedback in MOOCs

Richards and Schmidt (2010) define feedback as any information that generates a report on the outcome of a behaviour. In online learning environments, students are interested to know if they will be able to succeed or fail according to the achievement of their educational goals (self-regulated learning) and would like to receive more feedback elements instead of more evaluations (Daradoumis, Bassi, Xhafa and Caballé, 2013). Although instructors can provide better feedback than students, it has been found that students can produce more effective feedback by providing explanations to their peers in terms they understand best and according to their level of understanding (Brookhart, 2017). Furthermore, when students provide appropriate feedback, both the receiving and the giving parties benefit from it. Some studies have found similar and even higher levels of effectiveness in peer feedback than in teacher feedback (Ashton and Davies, 2015, Eksi, 2012; Ruegg, 2015).

Automatic multiple-choice tests to assess knowledge and understanding in the course are commonly used on all platforms. However, there are well-known limitations to this type of mechanisms to measure high-level skills such as analysis, synthesis, and evaluation (Suen, 2014). Although new technologies allow scalable ways to implement discussion forums and review student progress, they remain limited when evaluating and providing feedback for complex tasks such as written work (Admiraal, Huisman and Pilli, 2015; Admiraal, Huisman and Van de Ven, 2014; Piech et al., 2013). Further, the limited capability of the teacher to evaluate individual performance has led to an increased interest in developing alternative automatic evaluation practices and in researching them in order to be more valid and reliable, as well as to improve peer evaluation practices (Daradoumis, Bassi, Xhafa and Caballé, 2013; Reilly, Stafford, Williams and Corliss, 2014; Spector, 2014).

2.3 Peer feedback in MOOCs

Peer evaluation has been used extensively in MOOCs due to two advantages that no other mechanism has: it allows the evaluation of large groups because the evaluation and feedback are carried out by other participants instead of the teacher. Further, it allows the evaluation of products that could not be evaluated automatically (Kulkarni et al., 2013). Yurdabakan (2016) points out that this technique has been used for decades, which highlights some benefits noted in the literature prior to the emergence of MOOCs: peer evaluation emphasizes skills, encourages participation, increases the focus of attention towards learning, provides feedback to students, increases attendance and teaches responsibility, develops critical thinking, increases student learning and encourages collaborative learning.

Peer evaluation also helps students see the work from an advisor’s perspective. Evaluating the work of their peers exposes students to solutions, strategies, and points of view that they would not see otherwise (Kulkarni et al., 2013). Najafi, Rolheiser, Harrison and Haklev (2015) point out that peer review is an opportunity for participants to reflect on the knowledge acquired and to apply it. The positive effect of peer feedback increases as the feedback is based on the meaning of the task on not on its surface characteristics. Thus, peer review is more effective when based on higher order writing elements, rather than relying on matters of lower order (Comer, Clark and Canelas, 2014; Cho and Cho, 2011). This effectiveness increases when incorporating rubrics with precise terminology that can adequately guide the participants (Kulkarni et al., 2013, Ashton and Davies, 2015).

Although students benefit both from giving and receiving assessments and feedback, they hold divided opinions regarding peer review. While some firmly believe that this benefits their learning, others do not
consider it useful and prefer to not participate in it (Meek, Blakemore and Marks, 2017. That is, while some believe that it improves their learning, increases their motivation and leads them to develop critical thinking, other students consider it difficult, uncomfortable and time-consuming (Mulder, Pearce and Baik, 2014; Yurdabakan, 2016). Bali (2014) reported less participation in peer review activities when these are non-mandatory.

Moreover, many students consider that their classmates do not possess the necessary abilities to evaluate their work nor provide adequate feedback (Johnston, 2015). Meek, Blakemore and Marks (2017) state that it is difficult to say that the participants of a MOOC have peers since some of them are not familiar with the same knowledge areas or even share the same language. The authors also point out that it is not realistic to expect every student to carry out peer evaluation when some of them are not actively engaged with the course or have another level of commitment in relation to it.

2.4 Discussion forums

As a means of social learning, MOOCs rely on interaction with others, as is the case in discussion forums, in which participants can provide valuable feedback for the student and for other classmates who read them. Lee and Rofe (2016) designed an evaluation mechanism that would enhance peer learning in MOOCs, so they changed the dynamics of peer evaluation in a way that privileged feedback. The students were asked to present in the discussion forums the assignments that would be evaluated by peers and to provide feedback. In this way, students perceived areas of opportunity on which they could improve their work and thus submit a better product for evaluation. Also, these forums became a space where they could find many examples of how others performed the task. In this way, using discussion forums, the socialization of peer learning was leveraged. Peer review can be a good mechanism to encourage interaction among peers in cases that generate discussion to improve performance (Johnston, 2015).

Discussion forums in xMOOCs are affected by MOOC characteristics, as well as peer assessment practices. It has been found that MOOC’s participants consider that dialog between peers is not fluid and does not facilitate a speedy exchange of ideas (Liu, Kang and Mckelroy, 2015). As in other online environments, it has been found that participants have different roles while participating in discussion forums. Further, Wang et al (2015) found that participants with the role of observers in discussion forums in MOOCs learn even when they do not type comments.

2.5 Factors that affect peer interaction

Some studies on peer interaction in xMOOCs focus on factors and strategies used for improving engagement and involvement. They suggest that by incorporating some of these elements peer interaction and peer feedback may be improved. Some elements are described below:

Social involvement. It is a factor that can be decisive in the achievement of the MOOC participants’ goals. A study by Kizilcec and Schneider (2015) showed that learners with the intention of taking the course with colleagues or friends were more likely to complete the course and obtain a certificate. These learners were more involved with the course materials (watch videos and perform the required tasks) than those who did not sign up with someone else.

Level of expertise. Mackness, Mak and Williams (2010) pointed out that the difference in the levels of expertise of the participants in a MOOC can hinder their openness, connection and interactivity. In their study it was identified that 8% of the participants who decided to stop participating in the forums gave as a reason the difference in the levels of expertise among the novices and the participants familiar with the concepts and technologies.

Anonymity. Peer review can be a good mechanism to encourage interaction among peers in cases that generate discussion to improve performance. This also considers that students will be more likely to accept feedback if their peers are like them in terms of knowledge of the subject and if the students know the name of their reviewers, even if they do not know each other outside the course (Johnston, 2015; Lu and Bol, 2007).

Training. Training videos are an effective alternative to promote more participation and better engagement in MOOCs (Ashton and Davies, 2015; Luo, Robinson and Park, 2014). Other types of trainings prepare participants...
to offer accurate scores by asking them to grade an assignment evaluated previously by an instructor (Ashton and Davies, 2015; Kulkarni et al., 2013).

**Scoring the feedback.** In a study, students who received a grade on their feedback given to a peer offered more extensive and detailed feedback (Neubaum, Wichmann, Eimler and Krämer, 2014). By increasing the complexity and degree of responsibility of the participant, peer evaluation is one of the most challenging and promising types of evaluation instructors can include in a MOOC.

### 2.6 Approach

Although the advantages and benefits of the learner-learner interaction are recognized in virtual learning environments, there is not enough evidence from research to recognize these benefits on xMOOCs. Moreover, some suggestions and proposals have been made to improve peer interaction, but these do not usually consider the participants’ perceptions. Thus, there is a need to delve deeper into the experiences of these participants to identify the most appropriate conditions for xMOOCs in which participants could enhance their learning through interaction with their peers.

The learner-learner interaction processes proposed by xMOOCs are very limited by their learning model. Their instructional model tends to place greater emphasis on the learner-content interaction, ignoring the kind of learning that can occur in the learner-learner relationship and collaborative work. It is necessary to know more about the experiences of the participants to identify what are the favourable conditions in which they can improve their learning from the interaction with their peers.

Feedback has been considered an educational process with important benefits in learning, which can have a positive impact on its effectiveness. In addition, the benefits for participants of engaging in peer interaction and feedback activities in xMOOC have not been sufficiently explored. Based on this approach, the following research question was established: What perceptions do participants in xMOOCs have concerning the factors that affect peer interaction and peer feedback?

### 3. Method

#### 3.1 Context

The context in which the research was carried out was the first implementation of an xMOOC called Energy Saving, using the MexicoX platform. The theme of energy saving is incorporated into the current need for sustainable development and care of resources. Thus, it attracts a diversity of learners interested in knowing new and alternative measures to reduce and make more efficient the energy consumption in their home, in industry, in transport and, even, from within infrastructure.

In the first implementation of the Energy Saving course, 4,402 registered participants had enrolled. These are all those who have an account in the MexicoX platform and chose the Energy Saving course to access and receive information by e-mail about it. Of these, 1,459 completed at least one course activity, that is, they received a grade in at least one course activity. The duration of the course was six weeks and every week corresponded to a different theme.

The Energy Saving course included both typical peer interaction practices in xMOOCs, discussion forums and a peer review activity. A different discussion forum was attended by participants every week of the course. Every discussion forum started with three activating questions or sentences that participants would use to share their opinions and impressions. They were not explicitly asked to give feedback but to look over their peers’ comments and contribute to the discussion.

Further, the course included a peer review activity. During the third week students were asked to elaborate a three-action plan to save energy at home, in which they should include energy measurements and economic savings. Then, during the fifth week they shared a link with their plan. Participants had one week to review their peers’ assignment. They used a checklist to indicate whether required assignment elements were included or not. It was ensured that each assignment would be reviewed by five peers and every participant would review five assignments. Only those participants who reviewed their peers’ assignments received a grade on their assignment.
3.2 Design

To answer these research questions, a Mixed Methods design was chosen, with dominant and sequential status. Quantitative research was carried out first, followed by qualitative research. The dominant status focused on the qualitative part (Johnson and Onwuegbuzie, 2004). Given the mixed nature of this study, when defining the instruments, it was sought that the quantitative approach would allow knowing the general perceptions of the participants. On the other hand, the qualitative approach would allow capturing in detail the experience and beliefs that the MOOC’s participants have about the formative evaluation processes presented in them.

Within this Mixed Methods study a descriptive method was considered for the quantitative research. Regarding the qualitative part of the study, a phenomenological approach was chosen (Tójar, 2006) to conduct the study. A phenomenological approach focuses on understanding the meaning that events have for people as a centre of study. The main objective is the attempt to understand the object of the experience of the phenomenon (Wilding and Whiteford, 2005), which in this case is the learner-learner interaction in a MOOC.

3.3 Participants

Most of the course participants were Mexican (97%). The rest of the participants reside in Spanish-speaking countries such as Colombia, Ecuador and Argentina. 35% of the participants had a high school degree and 36% had an undergraduate degree, as the highest level of studies; 11% had a technical degree, and 11% had a master’s degree. Regarding the discipline of studies of their technical career, undergraduate or graduate, 39% said that Engineering or Computer Science was their area of knowledge, while 15% indicated Business Administration and 8% indicated Natural Sciences. As their main occupation, 35% of the participants indicated that they were an undergraduate student, and 35.8% indicated that they were full-time employees. Additionally, 52% indicated that it was the first time they participated in a MOOC.

From the 486 participants who answered the final survey, 272 participants agreed to be contacted by e-mail to share their experience in the course. All these participants were contacted to request an interview. Interviews were conducted with those participants who replied the e-mail and agreed to have a meeting by video conference. In total, 14 were conducted.

3.4 Instruments

For the quantitative research, surveys at the beginning and the end of the course were conducted. The survey at the beginning of the course included five multiple-choice questions related to the dispositions and beliefs of the participants for peer interaction and feedback (see Appendix 1). The survey at the end of the course included eight questions, six of multiple choice and two open-ended, related to their participation and satisfaction in activities of interaction and feedback between peers in the Energy Saving course (see Appendix 2).

For the qualitative research, a semi-structured interview and an instrument for participant observation were designed. The semi-structured interview consisted of 15 questions designed with the intention of knowing the participants’ experience in the learner-learner interaction activities and the automatic and peer feedback activities (see Appendix 3). In addition, a participant observation guide was designed to keep track of the interactions in the discussion forums of the course and thus be able to demonstrate the experiences, relationships and constructions of knowledge that arose among the participants of the course. The observation in the discussion forums was made considering the characteristics of feedback presented by Shute (2008) and Nelson and Schunn (2009).

3.5 Procedure

The initial survey was conducted at the beginning of the course. It was one of the first activities that the participants carried out for the course, alongside the general instructions and the agenda of the course. The final survey was added in the last lesson of the course, so it was answered by the participants after concluding all the learning activities.

In the final survey of the course, a final question was included in which the participants indicated if they were willing to be contacted via e-mail to comment on their experience throughout the course. In this way, by e-mail, all participants were requested to attend a virtual interview with an approximate duration of 30 minutes.
Once their acceptance and confirmation were received, they were given a link to a virtual room to be interviewed at a time convenient to the participants.

3.6 Data analysis

First, a descriptive analysis of the quantitative data obtained from the initial and final surveys was carried out. This data also guided the orientation of the interviews conducted later. After observing the discussion forums and transcripts of the interviews, the analysis of the data obtained through the interviews and the discussion forums continued. The names of the participants interviewed were coded to protect their identity.

For the process of data analysis, the steps indicated by Apps (1991, cited by Tójar, 2006) for phenomenological studies were followed. This author follows the epistemological proposal of Husserl (1965), who considered the phenomenological reduction, and the imaginative variation to capture the essence of the phenomenon. The directions of Merriam and Tisdell (2015) to build and name the categories (or topics) were also considered.

4. Results

With the quantitative study, the dispositions and general beliefs of the participants were analysed, along with information on their participation in the interaction activities. For the qualitative study 14 interviews were conducted. The following categories emerged, which refer to factors both inherent to and external to the participants that configure the learner-learner interaction that have an impact on the feedback between peers in MOOCs: 1) Dispositions and interest to interact, 2) Instructional mediators, 3) Utility of peers, and 4) Utility of peer feedback.

The quantitative and qualitative results that describe each category of analysis are presented below.

4.1 Peer interaction

4.1.1 Interaction interests

Below are some results obtained from the exit survey. Concerning participation rate in discussion forums, 44% of the participants indicated that they participated in all or some of the units. Further, 70% of the participants indicated that they agreed or strongly agreed with perceiving an improvement in their knowledge on the course’s subject by participating actively in the discussion forums.

![Figure 1: Participation in the discussion forums](image1)

![Figure 2: I improved my knowledge on the course’s subject by participating in the discussion forums](image2)
Regarding discussion forums, 64% of the participants indicated that they agreed or strongly agreed that they found the answers to their questions about the course’s subject by participating in the discussion forums. In addition, 28% indicated that they helped other participants with their questions through the discussion forums. However, the comments in the final survey indicate that some of the participants did not find answers to their questions in the discussion forums and that they could hardly establish a conversation, that is, an exchange of ideas.

![Figure 3: I solved my questions on the course’s subject in the discussion forums](image)

![Figure 4: I solved the questions of other participants in the discussion forums](image)

Based on the qualitative results, it was possible to study the interaction interests of the participants. It was identified that participants develop different roles and types of activities during interaction (analyse, reflect, share, etc.) The diversity of profiles presented in the sample of this study also reflects the diversity of purposes and roles during an interaction. While some participants access the discussion forums only as observers, there are others who prefer more active participation.

Those participants that consider their selves as novices opt for only to read comments rather than to bring answers to peers. A participant [P11] indicated: “I asked many questions, because it was a new theme for me. I opted to use it to solve my doubts.” So, roles of participation in discussion forums are determined for participants’ self-perception of expertise.

### 4.1.2 Dispositions to interact

Most of the participants (92%) indicated that they agreed or strongly agreed that they would be willing to dedicate at least one hour a week to provide feedback on the work of other participants. Also, 96% of the participants indicated that they agreed or strongly agreed that they thought providing feedback on the work of others helped them to improve their knowledge on the study subject.
Time disposition and perception of feedback efficacy are not factors that hinder their participation in learner-learner interaction and feedback activities. It is important to point out that, even when most of the participants that concluded the course showed disposition to participate in discussion forums and peer review activities, some participants could prescind from participation in these activities and still obtain the course certification. From 733 participants who obtained an approving grade, 178 participants obtained a grade different than zero (0). Those participants submitted their assignment and assessed at least three other assignments.

### 4.2 Instructional mediators

One instructional mediator that was used in the course to improve the feedback practice was to include a video explaining how to evaluate the work of other participants, in preparation for peer review activity. Several participants, 82%, indicated that they watched this video. Through the interviews, other instructional mediators could be found in these courses, carried out through technological elements.

Regarding the clarity of the assignment instructions, there were some participants who considered that in the practice of peer evaluation some instructions were a bit ambiguous, so they were limited as to how to provide better feedback. Moreover, participants needed to use another service as Slide Share or Google Drive to upload the assignment and then copy the link in the MOOC interface, this condition was an obstacle for some participants that had not used this type of service.

In the interviews, participants suggested some improvements to facilitate participation in discussion forums. Participant [P8] said: "I think there could be a notification that can take you to an e-mail and let you know when someone replied to your comment. Otherwise, you need to keep checking the website." In addition, participant [P14] indicated: "I think the forums should include a point, which would be 'give your opinion on the subject or whatever, and do some research on the subject,' and that would give you the opportunity to contribute something else".

### 4.3 Participants’ expertise

When asked about their willingness to participate with others according to their level of experience, 91% of the participants agreed or strongly agreed that they would be willing to participate in discussion groups with participants with the same level of experience as theirs on the course’s subject. In addition, 96% of the participants agreed or strongly agreed to be willing to share knowledge or experience with participants who have less experience on the subject. Of these participants, 24% had previously reviewed written works by other participants in MOOC courses.
Although the participants indicated a willingness to collaborate with participants with different levels of mastery on the subject, it is important to indicate that they acknowledged the diversity in the levels of knowledge and mastery on the course subject and the degrees of responsibility of the participants. This was expressed by [P11] by declaring "The amount of knowledge that people had in the topics discussed in the forums was very noticeable. And in the practice part, I think some took it very seriously and some did not. There was a noticeable difference in the quality of the work of our classmates."

The expertise of the participants not only makes them more capable of providing more informed and precise comments. The participants also take advantage of their previous experiences to generate strategies that help them to advance successfully in the course. Some interaction strategies carried out in the course were started by initiative of the participants, who reported having previously acquired this type of experience. The participant [P4] commented: "What I did was to look up my partner's e-mail in the welcome forum and I shared the link I had told him about in the forum ... During my online master's program, that was something we were asked to do."

### 4.4 Utility of feedback

By asking the participants if they had been provided feedback in the discussion forums, participant [P10] mentioned: "The forums had very simple comments such as 'I agree with the subject and I think it's a good strategy for saving energy' and there were people who answered like that, obviously that is not a contribution". In addition, participant [P2] noted: "Yes, there is some feedback, but more like 'I agree with what you're saying.' Nobody really refuted anything, nobody told me: 'Hey, but look, there's also this...’" Through observation in the discussion forums, comments such as: "You are correct" and "Good point" could be found.

On the other hand, participants found benefits when reviewing the work to provide feedback. Participant [P9] said: "A lot of those comments from your classmates are very valuable, you have a point of view according to the way you are. Because other classmates think differently. They have a different experience, so they can exchange different ways of solving a problem, of arriving at different solutions." In addition, participant [P6] commented: "I think you can see other points of view, that is important, what each person is focused on, the strategies they implement and above all the way in which they work. That gives you a lot, how everyone thinks differently and presents their work in a different way. It gives you knowledge in terms of points of view, how everyone analyses the information and how the information is presented. Not all of us think of water, electricity and gasoline, for example; there are some people who thought of additional things. For example, solar water heaters, things that had not occurred to me, and maybe they are good options for energy saving, which was the main theme of the course".

The diversity of profiles of the participants allows them to get to know different perspectives or approaches to contextualize, understand and solve a problem. This represents an opportunity to acquire new knowledge at different levels. Diversity is considered by the participants themselves as an advantage of these courses because they have multiple experiences that contribute to their own understanding. Participant [P12] said: "The advantage is that they are not people from your own area. My way of seeing the problem is different. It helps you to be more global. For example, if you work in a company that distributes in Mexico, you can get to know different ways of how the processes of production, marketing, etc. are carried out in other places." Also, when asking participant [P9] what kind of advantages he finds when interacting with other participants, he commented: "Because people from different states and countries participate. I can get different points of view. There is a cultural exchange that is important to me."
When asked about the separation by groups of collaboration according to the characteristics of the participants, they did not consider it convenient, as that would eliminate these benefits provided by diversity. When asking if it would be convenient to make subgroups in the forums to improve the interaction, the participant [P3] commented: "It would be difficult to assign them because maybe I could tell you, I know of sustainability but maybe I’m not very immersed in the issue of energy saving. And maybe some would see it as a kind of discrimination."

5. Discussion

The results of this study support the discussion regarding the convenience of integrating working groups in MOOC courses and the criteria for integrating these groups. This is a recent debate, for which there are still few studies devoted to finding better proposals (Kızılce, 2013). In this regard, it is worth mentioning that participants disagree on separating according to their level of expertise. Participants consider that by integrating working groups in MOOC the opportunity to know the experiences of other participants is reduced. In the present study, it is evident that the participants consider diversity an enriching learning opportunity, as it allows them to know different ways in which the same problem can be contextualized, understood and solved.

Furthermore, Mackness, Mak y Williams (2010) had reported that differences in expertise level of participants may hinder their openness, connection and interactivity. In contrast, results of the present study show that participants are willing to interact and provide feedback to participants with different levels of expertise. In the present study we found that limitations to interact and provide feedback are not due the differences in participants levels of expertise. Rather, some conditions that limit these processes refer to participants’ perception of their capacity to evaluate and to the relevance of the activities for obtaining knowledge that may be applied in their professional activities. These results are consistent with Meek, Blakemore y Marks (2016) results, which identify that participants have divided opinions about the benefits of feedback. While some believe that it improves their learning and increases their motivation, other students find it difficult, uncomfortable and time-consuming.

In the present study we found that participants identify other benefits of peer feedback in xMOOCs with respect to other virtual environments. Bali (2014) had identified that participants describe examples of their own country of origin in the discussion forums. Further, we found that the participants associate the usefulness of the feedback to the diversity of participants, since they receive different solutions to the problems presented. In this course, it was also identified that by providing feedback in peer evaluation practice, participants see products from their peers and recognize the characteristics of good practices. These results coincide with Kulkarni et al. (2013) who pointed out that feedback helps the student see the work from an advisory perspective. They also coincide with what Meek, Blakemore and Marks (2016) marked out, that evaluating the work of their peers exposes students to solutions, strategies and points of view that they would not otherwise see.

Results of the current work agree with those from Bali (2014) who reported that participation in peer review activities was affected by the non-mandatory character of these activities in the MOOC. It is shown that summative value of peer interaction and peer review activities is associated with the level of participation on these activities. This occurs even when most of participants indicate high disposition to interact and review. Further, these results agree with previous findings about the importance of training videos as an effective alternative to promote more participation and better engagement in MOOCs (Ashton and Davies, 2015; Luo, Robinson and Park, 2014).

Regarding peer feedback in discussion forums, the students criticized that some of the received feedback only stayed in the agreement or disagreement of what was proposed. This type of feedback was considered less effective by participants. These results agree with what Cho and Cho (2016) pointed out, the positive effect of feedback on performance increases as it is based on the meaning and not on surface characteristics of homework.

6. Conclusions

Results of the present study permit a better understanding of factors that affect learner-learner interaction in MOOCs. In order to promote peer interaction and peer feedback in MOOCs it is important to consider this learning environment’ conditions, thus to propose ideas that may counter its disadvantages and leverage its benefits. For instance, while massivity and diversity in online courses may be conceived as impediments to an appropriate interaction that promotes learning, benefits in participants’ learning can be found. Moreover, some suggestions from MOOC participants should be considered to improve their interaction in this learning environment.

These results allow to understand the importance of performance observation to improve the quality of peer feedback. It is known that feedback provided from one student to another is based on the observation of their performance. Peer review activities have the virtue of presenting to the reviewer a complete elaborated product that show student progress. That facilitates the opportunity to evaluate participant competences. Moreover, in discussion...
Within the framework of these theories, MOOC designers create learner-learner interaction dynamics. However, the implementation of MOOCs is usually based on models of direct instruction and cognitive-behavioural theories. Interactions that arose from these dynamics could be designed and described based on theories that are related with social construction of knowledge. Additionally, the technological functions of the platform should be supported formative process of social learning in online education that could facilitate feedback processes.

6.1 Future research

The implementation of MOOCs is usually based on models of direct instruction and cognitive-behavioural theories. Within the framework of these theories, MOOC designers create learner-learner interaction dynamics. Interactions that arose from these dynamics could be designed and described based on other theories that are related with social construction of knowledge. Additionally, the technological functions of the platform should be supported formative process of social learning in online education that could facilitate feedback processes.

Future studies are suggested in order to verify which factors of socialization practices among peers are linked to better performance of the participants and an improvement in the quality of feedback comments. In addition, studies devoted to measuring the effectiveness of working groups in xMOOCs for collaborative learning and their relationship with the quality of feedback and learning achievements are encouraged.

Acknowledgements

This research has been done with the support of the Project 266632 “Laboratorio Binacional para la Gestión Inteligente de la Sustentabilidad Energética y la Formación Tecnológica” [Binational Laboratory for the Intelligent Management of the Energy Sustainability and the Technological Formation], with funds from the energy sustainability fund CONACYT-SENER (Agreement: S0019-2014-01).

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## Appendices

### Appendix 1: Survey at the beginning of the course

**Interest and motivations to evaluate and interact with classmates**

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Statement</th>
<th>Scale</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction</td>
<td>Peer discussion</td>
<td>1 I am willing to participate in discussion groups with participants that share my own level of experience on the course’s subject.</td>
<td>* Strongly agree * Agree * Disagree * Strongly disagree</td>
<td>Martín-Monje, Bárcena-Martin, and Read (2014) Johnston (2015)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 I am willing to share my knowledge or experience with participants who have less experience on the course’s subject.</td>
<td>* Strongly agree * Agree * Disagree * Strongly disagree</td>
<td></td>
</tr>
<tr>
<td>Feedback</td>
<td></td>
<td>3 I am willing to dedicate at least one hour a week to provide thoughtful commentary (feedback) on the work of other participants.</td>
<td>* Strongly agree * Agree * Disagree * Strongly disagree</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 I think that providing thoughtful comments (feedback) on the work of others helps me to improve my knowledge on the subject.</td>
<td>* Strongly agree * Agree * Disagree * Strongly disagree</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 I’ve evaluated works from other participants at previous MOOC courses.</td>
<td>* Yes * No</td>
<td></td>
</tr>
</tbody>
</table>

### Appendix 2: Survey at the end of the course

**Interest and motivations to evaluate and interact with classmates**

<table>
<thead>
<tr>
<th>Category</th>
<th>Questions</th>
<th>Answer choices</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction</td>
<td>1 I participated in the discussion forums in:</td>
<td>All the units, Most units, A few units, None of the units</td>
<td>Martín-Monje, Bárcena-Martín, and Read (2014)</td>
</tr>
<tr>
<td></td>
<td>2 I solved my questions on the course’s subject in the discussion forums.</td>
<td>Strongly agree, Agree, Disagree, Strongly disagree</td>
<td>Johnston (2015)</td>
</tr>
<tr>
<td></td>
<td>3 I solved the questions of other participants in the discussion forums.</td>
<td>Yes, No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 I improved my knowledge on the course’s subject by participating in the discussion forums.</td>
<td>Strongly agree, Agree, Disagree, Strongly disagree</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 Write a brief comment regarding your experience participating in the discussion forums.</td>
<td>Open answer</td>
<td></td>
</tr>
<tr>
<td>Feedback</td>
<td>6 I watched the video on Methodology in the Opening section, which explains how to evaluate the work of other participants.</td>
<td>Yes, No</td>
<td>Daradoumis, Bassi, Xhafa and Caballé (2013)</td>
</tr>
<tr>
<td></td>
<td>7 I provided thoughtful comments (feedback) on the work of other participants and pointed out whether the work complied with what was requested.</td>
<td>Yes, No</td>
<td>Johnston (2015)</td>
</tr>
<tr>
<td></td>
<td>8 Write a brief comment on your experience receiving thoughtful comments (feedback) made by other participants.</td>
<td>Open answer</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3: Interview guide

In how many MOOC courses have you participated? What were your motivations to take the course?

Interaction
1. What has been your experience participating in MOOCs' discussion forums?
2. What are your interests in participating in discussion forums? Which role do you prefer to take in the MOOC discussion forums? (observe, write, debate, solve questions, etc.).
3. How do you feel about participating as a novice or expert? Is it easy to identify in the contributions if the participant is an expert or a novice?
4. Would you be interested in interacting personally with other participants with the same interests as yours?
5. What would you improve in the discussion forums to improve interaction?
6. In what way did you receive feedback in the course? What about the interaction with your colleagues made you feel your received feedback?

Feedback
7. What has been your experience giving and receiving feedback on written work in a MOOC?
8. What is your interest in providing and receiving feedback from your colleagues? What do you expect when receiving feedback?
9. How capable do you consider yourself to give feedback to your classmates' work?
10. Why would you or wouldn't you be willing to give feedback to your colleagues' work, for one hour a week?
11. What benefit did you get from the feedback of your classmates? Do you think that providing feedback on your classmates' work improves your knowledge on the subject of study?
12. Can you tell when an expert participant gives you feedback? Do you think that the benefits of the contributions are any different when they come from an expert?
13. Which characteristics would you prefer in a person with whom you will participate in processes of feedback or collaborative work?
14. Did the quizzes, the questions at the end of the videos, and the multiple-choice question in the challenge help you in your learning? What benefit did you get from those activities?
15. What's the difference between this kind of feedback and the one you can receive from your classmates?
Highlighting E-learning Adoption Challenges using data Analysis Techniques: University of Kufa as a Case Study

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DOI: 10.34190/EJEL.20.18.2.003

Abstract: Electronic learning (e-learning) plays a significant role in improving the efficiency of the education process. However, in many cases in developing countries, technology transfer without consideration of technology acceptance factors has limited the impact of e-learning and the expected outcome of the education process. Therefore, this shift in learning method has been met with low enthusiasm from academic staff and students owing to its low perceived usefulness and perceived ease-of-use. The University of Kufa (UoK) in Iraq is considered a good case study because it has implemented the e-learning platform since 2013. The UoK platform is based on open-source Moodle owing to the latter’s advantages, such as low implementation cost, open community for support and continuous update and development. To identify and evaluate the challenges, this study uses a questionnaire survey that targets the level of adoption, implementation, familiarity and technology acceptance of staff and students. A total of 242 educators participate in the survey, and the data are subsequently analysed. Important information is extracted using data mining techniques, namely clustering and decision trees. One of the main crucial factors extracted from the analysis results is the perception that social media is easier to use compared with a dedicated e-learning platform such as Moodle. This factor may also discourage educators/learners from adopting an offered e-learning platform, regardless of actual usefulness, motivation and training programs. Therefore, this paper offers practical information regarding the main issues and a guideline to fully utilise e-learning for policy makers and e-learning developers, particularly in newly established institutions or developing countries.

Keywords: e-learning, technology acceptance model, Educational data mining, Moodle, social media, Facebook, clustering, decision trees

1. Introduction

Some educators have considered electronic learning (e-learning) as the most remarkable leap in the education process since the invention of writing (Tan, Chew and Mellor, 2016). This set of education means is believed to be the newest method of passing knowledge and expertise as a supplement and/or replacement to traditional classrooms owing to their flexibility and efficiency. Moreover, the need and importance of e-learning have grown because the education process and outcome expectancies have changed. For instance, modern institutions have realised that education is no longer the memorisation of knowledge but rather the ability to solve problems with novelty, developing independent and long-life learning and communication skills (Atanda and Ahlan, 2014). Traditional classes, which are limited by space and time, can also no longer satisfy the growing demands for knowledge. This entire set of new requirements has driven the development of e-learning tools.

E-learning has been a standard technique of education in developed countries for many years (Koponen, Tedre and Vesisenaho, 2011; Tan, Chew and Mellor, 2016). However, developing countries continue to struggle in reaping the benefit of such techniques (Atanda and Ahlan, 2014; Ansong, Boateng and Boateng, 2017; Canedo, Santos and Leite, 2018). This situation may be due to numerous reasons, such as lack of technical infrastructure, service availability, staff readiness and experts to build and manage such infrastructure, which has been the case for e-learning in many institutions including those in Iraq (Mahmod et al., 2017). However, the infrastructure or technology may not be sufficient for learners and educators to fully adopt e-learning and accept e-learning technology, thus remaining a major concern in many developing and developed countries (Kanwal and Rehman, 2017; Ansong, Boateng and Boateng, 2017; Haron and Sahar, 2010; Almazroi et al., 2016; Cidral et al., 2017). Therefore, determining the factors that play a crucial role in e-learning adoption and technology acceptance is an active research area. Student motivation, perceived usefulness, perceived ease of use, policy making and the method to break traditional outdated concepts of the education process or its expected outcomes are factors that may need to be tackled on different levels. Thus, experts are in dire need
for crucial information to redirect resources by identifying the main challenges/factors and their impact on the education process and determining how these factors are connected to one other.

Educational data mining techniques have been introduced to answer these questions and visualise, analyse and/or extract useful and accurate information from the extensive data of education (Romero and Ventura, 2010; Castro et al., 2007; Yang and Li, 2018). Moreover, numerous studies have employed questionnaires to evaluate e-learning utilisation or usefulness (Ansong, Boateng and Boateng, 2017; Kanwal and Rehman, 2017; Almazi et al., 2016; Mahmoud et al., 2017; Kalediğlu, 2017; Canedo, Santos and Leite, 2018). However, these studies either seem to focus on one factor that leads to the underutilisation of e-learning or require further study to confirm their findings and/or discover new factors given the different educational environment.

This paper mainly aims to offer insights into the main factors and challenges that influence the full adoption of a dedicated learning management system (LMS), which is Moodle in this case study. In particular, the study investigates the effect of perceived usefulness and ease of use of social media in education compared with those of Moodle. To analyse the educators’ responses to the questionnaire survey, which is conducted in the University of Kufa (UoK), accomplished data mining techniques are used. The UoK is considered a good case study for the status of e-learning adoption in Iraq and developing countries as well as institutions that suffer from the underutilisation of e-learning worldwide. This selection is due to the fact that e-learning, as a supplemental means to traditional classrooms, has been established in this university for over five years. The e-learning system is designed to have separate e-learning platforms for each faculty. There are 22 UoK faculties that comprise more than 40,000 unique users (staff/student) and 3,800 online blended courses. This number of users makes the UoK case study optimum for the early stages of e-learning implementation. This study’s main contributions are as follows:

- Measuring the status and the challenges currently faced by e-learning through designing and conducting a questionnaire for academic members
- Hypnotizing and investigating a new technology acceptance model
- Using data analysis techniques, such as clustering and decision tree, to analyse, highlight and discuss the role of each factor that causes low e-learning adoption
- Proposing possible solutions for researchers, policy makers and/or e-learning platform developers to address the identified main challenges

The rest of the paper is organised as follows. Section II reviews the background theory and related work. Section III presents the background and current status of the UoK e-learning platform in detail. Section IV describes the designed questionnaire and highlights its main results. Section V presents the use of data mining techniques to analyse and discuss results. Section VI discusses the main challenges and suggested solutions. Section VII drafts conclusions and suggestions for possible future work.

2. Background and Related work

2.1 Technology acceptance

Technology acceptance model (TAM) is a well-established model that links personal beliefs regarding a technology with its usage. Figure 1 illustrates the TAM (Fishbein and Ajzen, 1975). This model posits that the determining factors for technology acceptance or adoption include perceived usefulness, perceived ease of use and/or other external factors. In e-learning, perceived usefulness refers to the technology user’s (educator/student) evaluation of the level of their performance improvement if they use the technology. For an educator/student, this improvement includes reducing the required effort for the education process that yields to an enhanced positive outcome. The educator’s and the student’s perceived ease of use of e-learning will depend on their level of personal technology background and training.

Numerous studies in literature have been dedicated to evaluating either a partial or full aspect of this model. Table 1 shows a list of these studies that explain or predict e-learning acceptance through the relationship amongst TAM factors. For instance, regarding the relationship between external factors and attitude, Baturay, Gökçearslan and Sahin (2017) show that the educator’s attitudes regarding use of e-learning may vary based on the environment, atmosphere and culture. Dudaije and Prakapas (2017) investigate the merits of an e-exam system by analysing students’ questionnaires and find that these merits include helping them remain attentive, active and curious. A fair number of these studies have likewise focused on Moodle’s perceived usefulness and/or other factors that impact the students’ intention to use the e-learning material. For
example, Marikar and Jayaratne (2016) show that 61% of sampled students in a Sri Lankan university improved their results. Furthermore, Costa, Alvelos and Teixeira (2012) reveal that most students perceive that Moodle is good for downloading materials, delivering assignments and checking course news.

![Technology acceptance model (TAM) (Fishbein and Ajzen, 1975)](image)

**Figure 1:** Technology acceptance model (TAM) (Fishbein and Ajzen, 1975)

On other hand, Sánchez and Hueros (2010) investigate an adjusted hypothesis of TAM by analysing students’ questionnaires and find that technical support is directly linked with perceived usefulness and perceived ease of use. This finding translates into high usage by improving students’ attitude regarding Moodle. Uziak et al., (2018) also reveal that a correlation exists between students’ attitude and use of blackboard in presenting the materials and features of the offered courses.

Ansong, Boateng and Boateng (2017) explore technology organisation environment (TOE) factors that affect e-learning adoption in Ghana. By analysing the responses of 417 educators/students, they highlight a number of factors that impact adoption, including IT infrastructure, perceived ease of use, expected benefits, organisational compatibility and competitive pressure.

Kalelioğlu (2017) and Petrovic et al. (2013) try to investigate a social media website, namely Facebook, as a learning management system. They conclude that Facebook exhibits high technology acceptance because the perceived ease of use and usefulness of social network websites amongst young students may overcome any merits offered by other e-learning tools.

<table>
<thead>
<tr>
<th>The study</th>
<th>Aim</th>
<th>Sample size</th>
<th>Targeted Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kalelioğlu (2017)</td>
<td>Acceptance based on perceived usefulness</td>
<td>18 students</td>
<td>Facebook</td>
</tr>
<tr>
<td>Dudaïté and Prakapas (2017)</td>
<td>perceived usefulness</td>
<td>60 teachers</td>
<td>Interactive Evaluation System</td>
</tr>
<tr>
<td>Marikar and Jayarathe (2016)</td>
<td>perceived usefulness</td>
<td>31 students</td>
<td>Moodle</td>
</tr>
<tr>
<td>Costa, Alvelos and Teixeira   (2012)</td>
<td>perceived usefulness</td>
<td>278 students</td>
<td>Moodle</td>
</tr>
<tr>
<td>Petrovic, <em>et al.</em> (2013)</td>
<td>perceived usefulness</td>
<td>30 students</td>
<td>Moodle and Facebook</td>
</tr>
<tr>
<td>Sánchez and Hueros (2010)</td>
<td>TAM model</td>
<td>226 students</td>
<td>Moodle</td>
</tr>
<tr>
<td>Ansong, Boateng and Boateng   (2017)</td>
<td>The Technology Organization Environment (TOE) framework</td>
<td>417 student/ educator</td>
<td>Ghana university e-learning system</td>
</tr>
</tbody>
</table>

**Table 1:** Questionnaire studies explaining and/or predicting e-learning technology acceptance levels

2.2 Educational data mining

Data mining techniques have been effectively utilised in e-learning applications for behaviour analysis amongst learners or in predicting e-learning process outcomes (Calders and Pechenizkly, 2012; Castro et al., 2007; Romero and Ventura, 2010; Hanna, 2004; Kaur, Singh and Josan, 2015; Yang and Li, 2018). For instance,
Classification and clustering algorithms are used to perform those tasks based on collected data from access operations, assignments, exams, voting and/or survey.

Decision tree is an effective and easy to comprehend classification technique that uses recursive binary splitting to build a predictive or descriptive model (Han, Pei and Kamber, 2011; Tan, Steinbach and Kumar, 2005). Despite the decision tree’s benefits, its size can dramatically increase, thereby causing overfitting problem. Pruning certain parts of the decision tree can overcome overfitting without affecting the accuracy of the classification technique (De Ville, 2006; Tuffery, 2011). Therefore, the present study adopts the reduced error pruning tree (REPTree) because this method utilises the pruning concept to produce a simple and accurate decision tree.

Clustering methods can be categorised into three main types: partitioning, hierarchical and density based (Han, Pei and Kamber, 2011; Tan, 2007). K-means is a partitioning method that produces K partitions, each of which is considered a cluster. This method starts with an initial partitioning and is subsequently applied with an iterative procedure to enhance the partitioning by relocating the objects’ position from one partition to another. K-means has exhibited high goodness, given that objects in a cluster are closer than those in multiple clusters, whereas objects in multiple clusters are farther from one another (Han, Pei and Kamber, 2011). Moreover, from a computational view, k-means can be faster than hierarchical clustering when a dataset has a large number of features. Therefore, k-means clustering and REPTree classification are used in the present study to analyse survey responses gathered from the academic faculty members of the UoK, see section V.

2.3 University of Kufa Platform for E-learning

The UoK was founded in 1987. This public institution is funded by the Ministry of Higher Education in Iraq and has expanded to 22 faculties, including engineering, science, medical, dental, education, linguistic, nursing, business and arts, since its establishment. These faculties are distributed over seven campuses located in the cities of Kufa and Najaf south of Iraq (University of Kufa, 2018). With the exception of its night courses, all undergraduate and postgraduate courses in UoK are free.

The UoK LMS was established in 2013 with the support from UNESCO in Iraq (Anon., 2010). Since then, the faculty members and students have been offered training (at least two workshops for educators and one workshop for students per year per faculty). The training for the faculty members aims to help them design their own e-courses, highlights the benefits of e-learning services and enables them to use the LMS to supplement their classroom activities, also known as blended courses (Nortvig, Petersen and Balle., 2018). Furthermore, each new faculty member must undergo intensive training courses in pedagogy that include utilising e-learning skills to improve education process efficiency and outcome. However, limited infrastructures are available to record lectures inside/outside class. For instance, only two studios are available in the whole university to video record lectures. In terms of technical support, at least one e-learning site manager is available per faculty who also acts as technical support.

The online ecosystem of the university includes separate e-library, website and registration systems. However, the LMS export users’ data from the registration system. Although the in-campus Internet service is available only to faculty members, the LMS is openly accessible for students through the campus network and in their homes through the internet.

This LMS is open-source-based, with advantages such as low implementation cost, open community for support and continuous update and development. This platform includes Linux operating system, LAMP (Linux, Apache, MySQL, PHP PERL and PYTHON), Moodle, performance and theme plugin. Firstly, Linux is a Unix-like operating system that is considered the most popular open-source operating system. Its availability and continuous updates motivate the technical community to adopt it for their platform. Ubuntu is one of the most widespread Linux distributions for the server environment. Thus, an Ubuntu server has been utilised to operate and manage the web server of the e-learning system. Secondly, the LAMP platform contains the requirements to implement a web server’s services, including virtual hosting and database managements. Thirdly, Moodle, the core of our platform is a popular and widely adopted e-learning management system (Quesada et al., 2013; Moodle statistics, 2018). This system is an e-learning platform developed to provide students, teachers and administrators with a secure and integrated system.
Figure 2 shows that the utilisation of this platform is continuously growing. However, the UoK still has not reached the point of full adoption of e-learning techniques. This study attempts to define the challenges faced by the full utilisation of this platform by analysing the experience of its users, who are the academic members.

3. Hypothesized Acceptance Model

As previously mentioned in Section II.a, TAM states that perceived usefulness and ease of use influence the attitude of users towards a new technology and, therefore, its utilisation. However, the perceived ease of use and usefulness may occasionally be influenced by an existing technology, based on which the user will evaluate and compare any new technology. Based on this assumption, the following hypothesis is proposed:

\[ H_1: \text{Perceived ease of use of a new technology is inversely proportional to the user's familiarity with an existing technology.} \]

Therefore, the proposed model introduces a variable to the TAM related to existing technology that offers some or all services offered by the new technology. This variable is familiarity, also known as perceived ease of use of an existing technology (Fig. 3). The existing technology in this study is represented by Facebook, which is widely used in UoK for sharing course materials and communicating with students.

Figure 3: Proposed Technology acceptance model
4. The Questionnaire

4.1 Questionnaire design

A questionnaire survey is designed from scratch and conducted to convey the personal experience and impression of current educators regarding the status and challenges faced of full e-learning adoption. Specifically, the questions target the perceived usefulness and perceived ease of use for the educators. Several questions also focus on the perceived usefulness for their students.

Table 2: The questionnaire and the range of each question response

<table>
<thead>
<tr>
<th>Question</th>
<th>Short term</th>
<th>Answer scale</th>
<th>Scale type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 1 faculty member information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In which faculty you are currently teaching?</td>
<td>Faculty</td>
<td>22 faculty</td>
<td>Categorical</td>
</tr>
<tr>
<td>What is your position as a faculty member?</td>
<td>S title</td>
<td>(A. lecturer: 4, Lecturer: 3, A.prof: 2, Prof.: 1)</td>
<td>Categorical</td>
</tr>
<tr>
<td>What is your qualification degree?</td>
<td>Degree</td>
<td>Master, PhD</td>
<td>Categorical</td>
</tr>
<tr>
<td>How long has been a faculty member?</td>
<td>Experience</td>
<td>1-35</td>
<td>Numeric</td>
</tr>
<tr>
<td>Section 2 Usage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you aware of the e-learning platform services?</td>
<td>Aware</td>
<td>0-1 (No-yes)</td>
<td>Categorical</td>
</tr>
<tr>
<td>Do you have an account in the e-learning platform?</td>
<td>Account</td>
<td>0-1 (No-yes)</td>
<td>Categorical</td>
</tr>
<tr>
<td>How many e-learning services you are using?</td>
<td>e-learning tools</td>
<td>Listing of 6 services</td>
<td>Categorical</td>
</tr>
<tr>
<td>What other technology tools you are using in your courses?</td>
<td>Other tech</td>
<td>(Powerpoint, word, email, none)</td>
<td>Categorical</td>
</tr>
<tr>
<td>Do you use social network websites as a replacement for e-learning platform?</td>
<td>Social network</td>
<td>0-1 (No-Yes)</td>
<td>Categorical</td>
</tr>
<tr>
<td>As an educator, have the e-learning tools been important for your job?</td>
<td>Need</td>
<td>0-10(10: very important)</td>
<td>Numeric</td>
</tr>
<tr>
<td>Section 3 Challenges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How easy is the use of e-learning platform?</td>
<td>Using easy</td>
<td>0-10 (10: very easy)</td>
<td>Numeric</td>
</tr>
<tr>
<td>How easy is the access of e-learning platform?</td>
<td>Access easy</td>
<td>0-10 (10: very easy)</td>
<td>Numeric</td>
</tr>
<tr>
<td>Have you attended any training in e-learning?</td>
<td>training</td>
<td>0-1 (No-yes)</td>
<td>Categorical</td>
</tr>
<tr>
<td>How do you rank the availability of training on e-learning tools in your department?</td>
<td>Training availability</td>
<td>0-10 (very available)</td>
<td>Numeric</td>
</tr>
<tr>
<td>How well do the students accept and benefit from existing e-learning tools?</td>
<td>Student acceptance</td>
<td>0-10 (10: high acceptance)</td>
<td>Numeric</td>
</tr>
</tbody>
</table>

Table 2 shows the three sections of the survey. The first section is concerned with faculty members’ personal information that reflects his/her field and experience. The second section focuses on the level of Moodle usage. For instance, the participant is asked whether he/she has a Moodle account, about what services are used and whether he/she uses social media instead of the e-learning platform. The final section focuses on the challenges for the perceived ease of use and usefulness, such as easy access, ease of use, training availability and the process of how educators perceive the students’ acceptance of the technology and benefits from the e-learning system. In particular, this section aims to measure the variables related to Hypothesis H1.

Most of the questions are multiple-choice ones with a numerical or categorical scale for easy and fast survey accomplishment, thus encouraging many educators to participate in the study.

4.2 Sample and data collection

The electronic survey participants are UoK academic members across a wide range of disciplines. Table 3 shows the demographic characteristics of the participants, who belong to 22 faculties in the UoK, such as engineering, science, medical, law and business. The responses of the 242 academic members (out of 2,144) are collected through voluntary electronic survey using Google forms sent to their official emails. This sample accounts for 11.2% of the total university academic members. The participants also range from newly hired assistant lecturers to experienced professors with more than 20 years of experience. Their identities are authenticated using their official email address.

Although the questionnaire is limited in terms of excluding students, this study assumes that experienced educators exhibit more accurate impressions with a low acceptable margin of errors in evaluating e-learning usage than do less experienced educators. That is, the survey questionnaire is designed to reflect the academic
members’ experience and impression and the challenges that they or their students face. Meanwhile, the electronic survey ensures a high level of clean and valid data collection because it avoids digitization errors and over/under scale responses and offers identity authentication.

Table 3: The demography characteristics of the questionnaire participants

<table>
<thead>
<tr>
<th>Specialty (%)</th>
<th>Engineering and science</th>
<th>43.2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humanitarian sciences</td>
<td>35.3</td>
</tr>
<tr>
<td></td>
<td>Medical sciences</td>
<td>21.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Qualification (%)</th>
<th>PhD</th>
<th>59.8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Master</td>
<td>40.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experience (%)</th>
<th>0-10 years</th>
<th>52.4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11-20 years</td>
<td>39.6</td>
</tr>
<tr>
<td></td>
<td>21 years or more</td>
<td>8.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position (%)</th>
<th>Assistant Lecturer</th>
<th>27.4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lecturer</td>
<td>34.4</td>
</tr>
<tr>
<td></td>
<td>Assistant Professor</td>
<td>30.9</td>
</tr>
<tr>
<td></td>
<td>Professor</td>
<td>7.3</td>
</tr>
</tbody>
</table>

4.3 Results

In terms of the existing status of e-learning utilisation, the responses show that approximately 94% of the faculty members are aware of the existing capability of the e-learning platform in the UoK; in addition, 93% already have an e-learning system account. Figure 4 reveals that 47.3% of the faculty members use social network websites rather than the UoK platform for e-learning. According to face-to-face interviews with several participants, Facebook groups and Viber groups are the most adopted social media used by educators in UoK to communicate and share course materials with students.

Figure 4: The responses from faculty members whether they are using social network as a replacement for the existing e-learning platform

These findings are evident despite the fact that 77.6% perceive that e-learning training is fairly or very available, ranking 5 or more out of 10 (Fig. 6). Amongst the participants, 78% have already attended a training workshop on how to use the e-learning platform (Fig. 7.b). Moreover, 73.2% of the participants believe that e-learning has an important or very important role to play in the education process, ranking 6 or more out of 10 (Fig. 7.a). By contrast, less than 7% perceive that e-learning is not relevant in elevating their teaching outcomes, ranking 4 or less out of 10 (Fig. 7.a).

On the other hand, in terms of challenges, approximately 29.7% of the participants think that the existing e-learning platform is inaccessible, and 31.8% believe it is difficult to use (ranking it as 5 or less out of 10 in both cases) (Figs. 7.c and 7.e, respectively). However, when educators are asked regarding the students’ reaction,
64.8% of them think their students are not reaping the benefits of e-learning tools, given that the educators rank it 5 or below out of 10 (10 being excellent in accepting and benefiting from e-learning), see Figure 5. These contradicting responses raise a number of questions that the present study attempts to address by using data analysis techniques in the next section.

![Figure 5: The academic members’ assessment to students’ acceptance and benefiting from the e-learning platform](image)

![Figure 6: Responses regarding the e-learning training availability at the University of Kufa](image)
Figure 7: Summary of the main responses to the questionnaire
5. Data Analysis and Discussion

Cronbach’s coefficient alpha is used to check the internal consistency of the questions, as shown in Table 4 (Churchill, 1979). All the questions’ values are around 0.6 or above, which proves acceptable levels of internal consistency. In addition, the calculated squared multiple correlation shows that the social network question is the most independent amongst other questions, see Table 4.

Figure 8 shows the clustering of responses into two main groups as obtained using k-means clustering technique, as discussed in Section II. In contrast to the initial assessment, logical expectations and literature review (Chow, Tse and Armatas, 2018), training exhibits extremely little influence in shaping participant responses on the survey (Fig. 8.a). This finding is particularly true in our case study given the availability of training courses that already exist in the UoK (see Section 2.c). However, Fig. 8.b demonstrates that the use of social media seems to shape and divide all the responses of the survey participants into two groups. This result is attributed to the high familiarity and popularity of existing technology, including Facebook, which reflect on the users’ perceived usefulness and ease of use for Moodle. Specifically, competition with social media in terms of perceived ease of use and usefulness is difficult, particularly for faculty members who have already been using social media to load course learning materials and communicate with their students.

**Table 4:** The use of Cronbach’s Alpha test to check internal consistancy of the developed instrument questions

<table>
<thead>
<tr>
<th>Omitted Variable</th>
<th>Squared Multiple Correlation</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree</td>
<td>0.5</td>
<td>0.683</td>
</tr>
<tr>
<td>S title</td>
<td>0.506</td>
<td>0.684</td>
</tr>
<tr>
<td>Aware</td>
<td>0.134</td>
<td>0.677</td>
</tr>
<tr>
<td>Account</td>
<td>0.111</td>
<td>0.678</td>
</tr>
<tr>
<td>Training</td>
<td>0.142</td>
<td>0.677</td>
</tr>
<tr>
<td>Social network</td>
<td>0.0564</td>
<td>0.689</td>
</tr>
<tr>
<td>Need</td>
<td>0.132</td>
<td>0.668</td>
</tr>
<tr>
<td>Access easy</td>
<td>0.734</td>
<td>0.583</td>
</tr>
<tr>
<td>Using easy</td>
<td>0.73</td>
<td>0.589</td>
</tr>
<tr>
<td>Training availability</td>
<td>0.319</td>
<td>0.617</td>
</tr>
<tr>
<td>student acceptance</td>
<td>0.282</td>
<td>0.619</td>
</tr>
<tr>
<td>Other tech</td>
<td>0.148</td>
<td>0.67</td>
</tr>
<tr>
<td>E-learning tools</td>
<td>0.228</td>
<td>0.669</td>
</tr>
</tbody>
</table>

**Figure 8:**
a. Distribution of cluster instances based on training question responses.
b. Distribution of cluster instances based on social media question responses.

**Figure 8:** Clustering of questionnaire responses using k-means

Moreover, Figure 9.a shows the decision tree built by using the REPTree technique, as discussed in Section II, to answer the use of social media as a target. This tree demonstrates that the use of social media is related to the impression of educators whether the use of the Moodle is perceived as very easy compared with familiar social media. A total of 72 participants (29.7% of the total participants) do not use social media because they believe the existing platform is very easy to use and access (on a scale of 1 to 10, they selected 8 or above). Moreover, even if the student reacts high to e-learning (answer range ≥ 7.5), an academic member may still use social media as a means of e-learning. However, if the students’ reaction to the e-learning platform is average or low, adopting social media becomes linked to the e-learning training, academic member position (newly employed faculty members are more willing to use e-learning) and accessibility. In conclusion to all these extracted links among the questionnaire variables, hypotheses H1 is accepted in the proposed e-learning TAM.

**Figure 9:** Decision tree is generated using REPTree based on a specific target response (a) use of social media instead of e-learning? (b) Level of student acceptance. Note that the value inside terminal nodes represents the answers; value associated with branches represents answer range; values above internal/terminal is the number of responses

On the other hand, Figure 9.b presents the second decision tree with student acceptance as a target. Academic members seemingly reflect their own personal impression as their own students’ impression regarding e-learning tools. This assumption is confirmed by existing literature from the developing country (Cidral et al., 2017). That is, if the academic member (61 participants) perceives that e-learning platform is easy to use,
accessible and subject to training, then his/her average response regarding student acceptance will be high (around 6.5). This confirms the outcome of Sánchez and Hueros (2010) and shows that attitude towards e-learning technology, namely Moodle, may be influenced and is not directly linked to the actual user experience. Meanwhile, other branches in the tree show that if the academic member uses a variety of e-learning services (e.g. lectures’ handout sharing, e-exam, assignments, forums, chats) and had access to the training, then the student acceptance is high (around 6.5). This finding is due to the full employment of e-learning services in their academic courses.

6. Challenges and Suggested Solutions

The questionnaire-obtained results, statistics and information extracted and presented in previous sections reveal that the challenges in our case study, which are also confirmed by other studies, can be classified into the following main categories.

Firstly, technical issues include infrastructure, technical support, extensive student accounts management, reliable bandwidth connection to the servers and server capability to handle scalable demands. These technical issues can be categorised as external factors in the TAM, which studies show have great influence on perceived usefulness and perceived ease of use (Mahmod et al., 2017, Sánchez and Hueros (2010). These challenges are normal in developing countries because of low investments or lack of consistent maintenance.

Secondly, the analysed results suggest that a nontrivial percentage of faculty members and students use social media as an e-learning platform. This phenomenon is reasonable given that they are more familiar with social media and perceive these as extremely easy to use. In addition, the use of social media may have certain benefits for the education process, such as accessible information for students and for students to easily communicate with their teachers and their peers (Kalelioglu, 2017, Petrovic et al., 2013). Therefore, although e-learning specialised platforms may offer more services than does social media, educators and students are reluctant to use them. Thus, seeing trained academicians who prefer to use social network websites instead of the official e-learning platform is becoming less surprising. Some studies have suggested using both Moodle and Facebook because of their merits in terms of e-learning (Kalelioglu, 2017, Petrovic et al., 2013). However, several negative issues have been discovered when Facebook is used as e-learning platform, such as difficulty in finding old uploaded files, lack of time limitation for submissions, confidentiality of student submissions and their grades and distractions (Kalelioglu, 2017, Petrovic et al., 2013). Therefore, the following suggested solutions should be considered. (1) Improve the training program and incentive policy to motivate the targeted students and educators to use e-learning platforms. (2) Develop a specialised version of social networks to be appropriate for education purposes. For example, Facebook could develop an e-learning platform similar to Workplace, which is appropriate for a working environment. Edmodo is another example of an e-learning environment that resembles typical social media websites (Edmodo, 2018). (3) Existing e-learning platforms, such as Moodle, can be modified similar to social media websites.

Thirdly, publicity should be considered. The statistics imply the consistently negative attitude towards e-learning in the UoK. A large portion of the academic members lack the motivation to actually use e-learning tools because they are sceptic of whether this platform will assist in their current education tasks or if it is just another routine layer to be added, which is a common attitude amongst educators in developing countries. This issue can be tackled by designing policies and starting a publicity campaign that aims to highlight the impact of e-learning on the education process as well as the possible savings in time and resources it might offer for the academic members and the students. For example, promoting and motivating students have shown significant impact on the e-learning outcome in developing countries (Maldonado et al. 2009).

7. Conclusion and future work

This study shows that despite the availability of the e-learning technology, such as the case of UoK, e-learning utilisation may not reach the planned target and impact. This finding is assumed to be caused by the transfer of e-learning in developing countries, which focuses on technological infrastructure while ignoring the crucial factors that influence technology acceptance and the full adoption of e-learning. Critical information obtained from the faculty members’ questionnaire responses through data analysis techniques shows that the main factors and challenges faced by the full adoption of e-learning include lower perceived usefulness and ease of use compared with social media websites and the absence of planned promotions. Moreover, the findings confirm the proposed TAM, which posits that new technology usage and acceptance is relative to the user’s
(educator/student) attitude, experience and beliefs, particularly in case of an existing technology. Consistent with previous research, this study proves that social media, despite some of its merits for e-learning, is a negative influential factor that discourages educators from fully utilising any custom education management system platforms that offer enhanced learning capabilities. This outcome is attributed to the fact that the perceived ease of use and usefulness of Moodle fall short compared with those of familiar social media tools. Therefore, the proposed outline of possible solutions to handle these challenges includes modifying learning platforms to be similar to the social media environment and/or introducing new e-learning services to social media. Consequently, the study draws a new horizon for policy makers, researchers and e-learning platform developers. Recommendations for future work include further studies to confirm our finding through a student survey and implementation of the proposed solutions.

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e-Learning Challenges Faced by Universities in Kenya: A Literature Review

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DOI: 10.34190/EJEL.20.18.2.004

Abstract: Some institutions of higher education in Kenya have adopted e-Learning with the aim of coping with the increased demand for university education and to widen access to university training and education. Though there are advantages that accrue from adopting e-Learning; its implementation and provision has not been smooth sailing. It has had to contend with certain national, organisational, technical and social challenges that undermine its successful implementation. This paper therefore aims to present a literature review of the challenges faced in the implementation and provision of e-Learning in universities in Kenya. The scoping review method was used to identify and analyze the literature of the e-Learning challenges. Some of the challenges revealed include: lack of adequate e-Learning policies, inadequate Information and Communication Technology (ICT) infrastructure, the ever evolving technologies, lack of technical and pedagogical competencies and training for e-tutors and e-learners, lack of an e-Learning theory to underpin the e-Learning practice, budgetary constraints and sustainability issues, negative perceptions towards e-Learning, quality issues, domination of e-Learning aims by technology and market forces and lack of collaboration among the e-Learning participants. These challenges need to be addressed to minimise their impact on implementation and delivery of e-Learning initiatives in institutions of higher education in Kenya. This analysis of the e-Learning challenges forms the basis for the ongoing research that seeks to explore and establish possible strategies to address some of these challenges.

Keywords: ICT, Distance Education (DE), e-Learning, e-Learning Challenges and Kenya

1. Introduction

In the last 20 years or so, more than ever before, we have witnessed a high demand for university education in Kenya which was necessitated by the increased number of high school graduates and working class students (Nyerere, Gravenir and Mse, 2012). This demand has in turn led to an increased number of universities and middle level colleges. According to the Commission of University Education (CUE) by November 2017 there were 31 state sponsored universities with six constituent colleges, 18 private sponsored universities with five constituent colleges, and 14 universities functioning with letters of interim authority (CUE, 2017). However, even with this increased number of institutions of higher education it is still not enough to cater for the increased demand for education. This is because Kenyan institutions of higher education have not expanded at the same rate to match this demand hence further widening the educational access gap. Some universities in Kenya have therefore embraced e-Learning with a view to bridge this gap while at the same time improve learning flexibility especially for the employed learners. Eight state sponsored and five private sponsored universities have e-Learning programs (Nyerere, 2016).

The Kenyan universities’ e-Learning departments grew through the various key developmental generations to having well tested and running e-Learning platforms (Wambugu and Kyalo, 2013). University of Nairobi (UoN) pioneered Distance Education (DE) in Kenya in the 1960s, with its teacher training correspondence programme. This programme was supplemented by regional and on-campus face-to-face tutorials coupled with seminars. Learner-tutor interactions included [and still do] brief meetings for induction, counseling, tutelage and learning at the learner support centres (formally known as extra-mural centres) which were [and still are] located in Nairobi, Nakuru, Nyeri, Kisumu, Mombasa, Kakamega, Kisii, and Garissa. Under the supervision of these learner support centres, weekend sessions were [and still are] organised to take place one day per month in selected teacher training colleges or high schools with amenities such as classroom, laboratories and libraries (Wambugu and Kyalo, 2013). By 2004, the UoN had developed its own Learning Management System (LMS) christened the Wedusoft (Omwe nga and Rodrigues, 2006; Ssekakubo, Suleman and Marsden, 2011). The university then adopted and implemented the Chisimba LMS in collaboration with their development partners before moving to Claroline LMS (Ssekakubo, Suleman and Marsden, 2011).
Kenyatta University (KU) is another institution that has a mature e-Learning department which was recently rebranded “digital school”. KU follows the same model of e-Learning and has support centres in many parts of the country offering the same services as the UoN (Nyerere, Gravenir and Mse, 2012).

2. Research Problem

e-Learning has many benefits that include: widening access to the reach of many learners in a flexible manner, improving the effectiveness of learning and teaching via technology, increasing efficiency in e-Learning administration, reducing public spending in education and training, and increasing quality of research among others (Arkorful and Abaidoo, 2014). However, despite the numerous e-Learning benefits, promises and opportunities, e-Learning initiatives in institutions of higher education in Kenya are faced by a number of challenges that leave the stakeholders dissatisfied when they fail to meet their expectations. According to Wright, Dhanarajan and Reju (2009) and Ssekakubo, Suleiman and Marsden (2011), most of the e-Learning projects in third world countries either fail partly or wholly thus failing to deliver on their promise. Nyerere, Gravenir and Mse (2012) revealed that most of the e-learners (90.8%) were dissatisfied with the delivery of e-Learning and 85.6% of the e-tutors indicated that they were demotivated in executing their e-Learning responsibilities. These drawbacks in turn have led to a slow uptake of e-Learning in institutions of higher education in Kenya (Nyerere, 2016). This literature review therefore seeks to unearth the key challenges that are hindering the delivery of e-Learning in the Kenyan context.

3. Literature Review Method

This review employed the scoping review method; which is a broad and comprehensive approach to reviewing literature that quickly matches the main variables and key terms behind the review to the key sources of the literature (Dijkers, 2015). The review sought to compare and integrate findings from past studies using content analysis with the aim of identifying the major themes or constructs running across the available body of literature (Booth, Papaioannou and Sutton, 2012). The identified materials were then synthesised and a thematic narrative of the findings was made. According to Stepanyan, Littlejohn and Margaryan (2013) scoping review is useful in studying trends in a contemporary area such as e-Learning where concepts are still evolving. The reviewed papers were obtained from Google Scholar using the English language. Some other materials specific to the Kenyan context were obtained from specific websites. The search was restricted by use of the key terms presented in the Table 1 in conjunction with “AND” to identify materials published between the year 2000 and 2019. Though the queries returned a huge amount of papers and materials we narrowed the focus to the specific e-Learning challenges experienced in the Kenyan context. Some materials were discarded in favour of more current publications as well as on the basis of content and context relevance. In total 48 documents were reviewed as shown in Appendix I. The review followed the steps of the scoping review approach as stipulated by Arksey and O’Malley (2005) and summarised the results of every step as shown in Table 1 below.
Table 1: Scoping Review Steps, Activities and Outcomes

<table>
<thead>
<tr>
<th>Step/Activities</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify research question(s)</td>
<td>What are the challenges faced by universities, e-learners and e-tutors in the implementation and delivery of e-Learning in Kenya?</td>
</tr>
<tr>
<td>2. Identify key terms and use them to find pertinent studies</td>
<td>The following are the strings of key terms used for the primary search of materials. 1. e-Learning opportunities and challenges 2. e-Learning successes and failures 3. e-Learning advantages and disadvantages 4. e-Learning benefits and challenges 5. e-Learning in Kenya 6. e-Learning challenges in Kenya 7. e-Learning challenges in developing countries</td>
</tr>
<tr>
<td>3. Select the related studies</td>
<td>The literature review was conducted from a total 47 documents. The following is the breakdown: - 1. 28 Journal articles 2. 13 Official publications 3. Four conference papers 4. Two books 5. One book chapter NB: An extra four journal articles were used to inform the scoping review approach.</td>
</tr>
<tr>
<td>1. Extract the major themes and constructs</td>
<td>The major themes that were running throughout the available literature include: - 1. There are some opportunities and benefits that accrue from e-Learning and hence the impetus for its adoption. 2. There are specific challenges that face e-Learning in Kenyan universities context.</td>
</tr>
<tr>
<td>2. Integrate, summarise and report the findings</td>
<td>The study integrated and summarised the finding in step 4 and made a narrative report that is presented in this paper</td>
</tr>
</tbody>
</table>

4. Results and Discussion

This section presents the major challenge categories that are recurrent in the implementation and delivery of e-Learning in universities in Kenya as found from the literature.

4.1 ICT and e-Learning Policy Implementation Issues

Policy frameworks play a crucial role in guiding the implementation and provision of e-Learning (Nyerere, 2016). The presence or absence of such a framework determines whether or not e-Learning initiatives will fail or succeed. In the Kenyan context the initial government policy that dealt with DE in institutions of higher education was anchored on the Act of Parliament of 1966, that created the Adult Education Board. Over time, many other educational commissions and reports have underscored DE and e-Learning as a substitute method of delivering education (Farrell, 2007). The Sessional Paper No. 1 of 2005 contained another government policy initiative, which suggested the creation of a National Open University [not yet established] and the use of e-Learning to develop human resource capacity (Republic of Kenya, 2005). Similarly, the Government of Kenya Sessional Paper of June 2012 on Policy Framework for Education and Training also admitted that; although the Sessional Paper No. 1 of 2005 mentioned an e-Learning policy; such a policy framework was still absent seven years later. However, the 2012 Sessional Paper drew up an e-Learning policy framework to guide the practice in the country from the year 2012 going forward; though these guidelines have largely remained unimplemented at the national level to date.

The National ICT Policy of 2006 that had guided ICT implementation in Kenya for 10 years, was inadequate to address the e-Learning practice, since in itself it lacked a strategy on e-Learning. This inadequacy was later addressed in the National ICT Policy of 2016 which saw the inclusion of an elaborate section on e-Learning policy strategies. One such strategy states that the government will establish educational databases for sharing learning and teaching resources. The policy also advocated for e-Learning inclusion at all levels of education with the aim of increasing the quality of learning and training. It further stated that the government will advocate e-Learning and virtual campuses implementation particularly in universities and colleges. The policy also included other related strategies that are meant to promote the growth and expansion of e-Learning.
capacity. Such strategies included expediting the public and private partnerships (PPP) with the aim of marshalling resources needed to fund e-Learning implementations and the designing of a unified e-Learning curriculum that will back the use of ICTs in learning and teaching.

However, even with these e-Learning strategies in the new National ICT Policy of 2016, we still don’t have a clearly defined national e-Learning policy framework to guide the practice. In the absence of a national e-Learning guiding policy the practice in Kenya had been driven by individual organisation’s policies. A study by Nyerere (2016) entitled “Open and Distance Learning in Kenya” showed that 11 out of the 12 universities surveyed have e-Learning policies; however, the problem is in operationalisation of these organisational policies in the absence of a national policy framework for e-Learning. The importance of national e-Learning policy is to offer a shared framework for the design, deployment and delivery of e-Learning in which individual organisations can base their organisational policies. It would also be instrumental in e-Learning resource deployment and quality assurance. Research by Tarus, Gichoya and Muumbo (2015), reported that the absence of operational e-Learning policies was a key impediment to the effective deployment of e-Learning in some of the Kenyan state sponsored universities. Furthermore, the study observed that, although some institutions had e-Learning policies they were unable to implement them due to financial limitations and lack of the relevant ICT infrastructure. In some universities the e-Learning policies were still in the draft version for years without being operationalised.

4.2 Lack of and/or Inadequate ICT Infrastructure

The Government of Kenya Sessional Paper of June 2012 on Policy Framework for Education and Training recognised ICTs as the main conduit for e-Learning. The delivery of e-Learning depends on a flourishing ICT infrastructure which is far from satisfactory in Kenya. The country is characterised by a large digital divide between the urban and rural areas when it comes to key ICT infrastructure and internet access which averages to 69% (Ndungu, Lewis and Mothobi, 2019). The Kenya Digital Economy Blueprint, 2019 report also observed this divide reporting that there are 580 sub-locations in Kenya with below 50% GSM (Global System for Mobile communication) coverage while about 160 sub-locations do not have a mobile signal whatsoever. It further says that there are about 2,000 sub-locations with below 50% 3G network coverage, half of which are out of reach of the 3G services completely. Moreover, it goes on to say, that broadband network services cover a small geographical area equivalent to 17% of the landmass leaving 83% of the country without broadband coverage. The same was noted for the fibre optic cables that equally has a landmass coverage of 17%. However, the report observed that the digital divide has been diminishing, albeit very slowly. Earlier on Nyerere (2016) reported that universities in key urban areas had good ICT infrastructure; for example, University of Nairobi, United States International University, Jomo Kenyatta University of Agriculture and Technology, Nazarene University of Africa, St Paul’s University, Kenyatta University, among others. While universities in suburban or medium sized towns such as Maseno University, Karatina University and Egerton University had moderate ICT infrastructure and universities in rural settings such as Moi University, Garrissa University and Masinde Muliro University of Science and Technology among others had low ICT infrastructure.

This digital divide has been slowly diminishing with public and private sector initiatives such as the laying of the fibre optic infrastructure that has increased Internet bandwidth causing faster communications and enhanced use of e-Learning (Communication Authority of Kenya, 2018). Further, since ICTs are powered by electricity; the rural electrification programme (REP) and the last mile electricity connectivity initiative are other government effort geared towards the expansion of the national ICT infrastructure. For example, by the end July 2015, the government was seeking to connect 314,200 non-commercial customers, primary and secondary schools on the national power grid during the first phase of the programme (Kenya Power and Lighting Company, 2017). The number of connections under the REP increased from 1,269,500 customers in 2016/17 financial year to 1,332,100 customers in 2017/18 financial year (Kenya National Bureau of Statistics Economic Survey, 2019, p.160). Internet Service Providers’(ISPs) penetration in the country is another consideration to make when reviewing the country’s ICT infrastructure; the July-September quarterly Communication Authority’s report of the 2018/19 financial year entitled “Public Sector ICT Survey Report”; indicated an increase in mobile phone subscription to 46.6 million users up from 45.5 million users in the previous year. This growth was attributed to the market expansion by the ISPs as well as availability of affordable mobile phones. In the same period the report indicated that mobile data [Internet] subscription stood at 42.2 million users, an increase from 41.1 million users in the previous year. This increase was attributed to the continued fall of smartphone prices (Communications Authority of Kenya, 2018). However, even with these initiatives, the coverage and accessibility of ICT infrastructure and services in the country is
still not satisfactory and there is need to bridge the digital divide further in the wake the geographical and economic disparities observed so far in the deployment of ICT infrastructure in the country (Awour and Kaburu, 2014; Mutisya and Makokha, 2016; Ndungu, Lewis and Mothobi, 2019).

At the institutional level some universities are characterised by low levels of ICT and e-Learning infrastructure as a result of the high costs associated with acquiring, implementing and sustaining the ICT infrastructures needed for the provision of a thriving e-Learning environment (Nyerere, 2016). This in turn limits access to e-Learning since the available ICT infrastructure is not scalable to accommodate the ever-growing number of e-learners seeking university education as well as to accommodate the high number of ICT resources needed (Sabi, 2014). Kashorda and Waema (2014) in their study entitled “E-Readiness Survey of Kenyan Universities” conducted in 30 universities, found out that there was a low ratio of personal computers (PC) to students. The study reported that there were only 16,174 computers in the laboratories to serve a population of 423,664 students enrolled in those universities. Though this challenge inhibits access to e-Learning; the same study however observed that it was compensated [though not eliminated] by the large number of students (200,000 = 53%) who owned laptops. The same study argued that the internet is needed for a vibrant e-Learning environment, which was measured by use of two indicators: availability and affordability. Their study therefore recommended that individual institutions should take up the responsibility to draw up policy strategies to increase Internet access to the increased learner enrolment rates, in order to take advantage of the efforts by the Kenyan government aimed at continuously improving the ICT regulatory framework. The study also recommended that, because the universities are already connected to the national fibre backbone network, they should adequately invest in local area networks (LANs) and Wireless LANs to allow learners connect their mobile devices and access learning services (Kashorda and Waema, 2014).

4.3 Lack of ICT and Pedagogical Skills/Training on the Part of e-Tutors and e-Learners

The Government of Kenya Sessional Paper of June 2012 on Policy Framework for Education and Training noted that there is inadequate ICT capacity for e-tutors which is a challenge to the delivery of e-Learning. To address this challenge, the sessional paper proposed the following policy actions: compulsory ICT training for all teachers and education managers by 2015, ensuring ICT competencies are acquired by all pre-service teacher trainees, continuous training of teachers to maintain the ICT competencies and developing and implementing ICT Education and Training Strategic Plan. Unfortunately, as noted earlier; the policy strategies and recommendations of this sessional paper largely have remained unimplemented.

With respect to the specific institutions, there were two aspects to capacity building: technical training and pedagogical training. The National ICT Policy (2016) also recognised the need to develop the capacity of various institutions providing ICT related training with the aim of increasing trained personnel and improving the quality of their technical skills. Nyerere, Gravenir and Mse (2012) and Tarus, Gichoya and Muumbo (2015) in their respective studies also reported the lack of e-Learning technical competencies as well as the e-content creation skills on the part of the e-tutors as a key hindrance to the enactment of e-Learning in state sponsored universities in Kenya. They further observed that even where there is training on the part of e-tutors, the focus is on the technical functionalities of the system as opposed to the e-Learning pedagogical training which is the real challenge. However, Isaacs & Hollow (2012) in their e-Learning Africa (2012) Report; argued that there is a pessimism and an aversion encapsulated in Kenyan e-tutors that ICTs will replace them in their jobs. Thus, ICT training and integration of ICTs in provision of education has been misunderstood by some e-tutors as opposed to arousing the desired interest. Elsewhere Tarus and Gichoya (2015), emphasised the need for the e-learners to also be inducted and trained in ICT and e-Learning skills in order for them to learn in this entirely new setting.

Finally, in the 2013 E-Readiness Survey of Kenyan Universities the ICT human capacity showed a slight improvement from stage 2.9 in the 2008 survey to stage 3.0 (Kashorda and Waema, 2014). This is one stage below the highest achievable stage of 4.0 which means there is room for improvement on e-tutor ICT skills and training.

4.4 Financial Constraints and Sustainability Issues

Manro, Sighn and Joshi (2012) and Sabi (2014) in their respective e-Learning studies noted that costs are a major challenge in implementing and delivering e-Learning in third world countries. They observed that the implementation and sustainability costs for a dependable ICT infrastructure is very high for many universities in the developing countries [Kenya included] causing them to trail the developed countries when it comes to
technological developments. On the other hand, Kashorda and Waema (2014) argued that a high degree of ICT implementation and use enhances learning, teaching, and research. It also supports universities in achieving their academic and managerial objectives. Nonetheless, a higher level of ICT implementation implies increased costs for universities which mainly work under tight financial constraints. Tarus, Gichoya and Muumbo (2015) also reported that many state sponsored universities find themselves constrained by financial resources, which sometimes, among other reasons, causes e-Learning not to be prioritised in their budgets as a main investment.

According to a study of e-Learning practitioners in Africa, it was reported that among the immediate priorities for action was funding (Hollow, 2009). Some cost impediments reported were: initial, maintenance, training, e-content development and bandwidth costs. Complicating the issue of cost further is the ever-changing technological innovations and their varying costs, thus making it difficult for the institutions to keep up with these changes. However, according to the e-Learning Africa (2012) Report it is worth to note that bandwidth costs have been reducing since the laying of the undersea fibre optic cable in Kenya and with the new ISPs joining the market. However, while this may be true for some institutions; the bandwidth costs remain significantly high for some institutions.

### 4.5 e-Learning Quality Issues and Negative Attitudes Towards e-Learning

Quality is seen as the degree of excellence and in the e-Learning context Njoroge and Kibaru (2012) viewed it as the outstanding, excellent, valuable and positively impactful service to the e-learner. According to Gaskell and Mills (2014) the quality of e-Learning delivery has at times been challenged and questioned; where e-learners and e-tutors have had to contend with negative perceptions from their conventional learning counterparts and prospective employers regarding the general quality of the e-Learning programs undertaken as well as qualifications achieved. Njoroge and Kibaru (2012) noted that e-Learning quality in Kenyan Universities is hard to measure because it has many stakeholders each with conflicting interests; who range from; e-learners, e-tutors, institutions, CUE, the government and the employers. The other challenge with quality is that it is evaluated against the e-Learning technologies, courses and programmes as opposed to the inputs, processes and educational objectives. As observed earlier; e-Learning benchmarking remains a key challenge in universities in Kenya in the absence of adequate guiding national e-Learning policy. Thus the matter of e-Learning benchmarks and standards was left to the individual universities. Previously the state sponsored universities were autonomous and hence they defined their own standards for operation. The private sponsored universities were regulated by the then Commission for Higher Education (CHE) whose mandate ceased with the enactment of the Universities Act 2012 which brought both the state and private sponsored universities under the regulation of CUE in 2013 (Republic of Kenya, 2016). Even with CUE in charge, there still lacks a comprehensive national quality assurance (QA) strategy to drive the e-Learning agenda. Besides, the inadequate QA policies are not specific to e-Learning but are more generally applicable to conventional learning programs (Nyerere, 2016). Further, Hadullo, Oboko and Omwenga (2017) pointed out that although there are e-Learning models and frameworks for assessing e-Learning quality, some of them work well in the developed world as opposed to the Kenyan context and hence the need for customised quality framework.

### 4.6 Domination of Educational Aims and Goals by Technology

e-Learning has been argued to be technology-led, a fact that has led to the observable trend whereby institutions overemphasise the technologies used to deliver e-Learning as opposed to the learning process and outcomes. Such an ideology of e-Learning is described as *techno-positivist* by Njenga and Fourie (2010). It is the compulsive enthusiasm and euphoria about the possible promises, benefits and opportunities that e-Learning purports to deliver, while disregarding the concerns of the intended users and the negative impacts of technology on users. It also ignores the current research findings about e-Learning use and the associated inventions. This techno-positivist ideology denies the e-Learning practitioners and researchers alike the opportunity to interrogate the intentions, capabilities, advantages and constraints of ICTs. It also denies them the opportunity to study and assess the implications of these new technologies on the e-pedagogy. This ideology is mainly propagated by technology vendors (Shank, 2015) and sold to education administrators with a view to increase the sales of their technologies. This in turn leads to the domination of educational aims and institutional development strategies by technology and market forces; thus forcing the attention in e-Learning to be on the ‘e’ as opposed to the ‘learning’. Technologies by themselves cannot improve learning but appropriate choice of such technologies and how they are used is what changes the learning process. This is perhaps better captured by Cuban (2001) in his book "*Oversold and Underused Computers*", where he argues
that many universities in the 1990s [to date] acquired new technologies and fitted them in old universities for which the tutors and learners did not use to deliver on educational aims and goals.

This problem is replicated in universities found in the third world countries; where most of the e-Learning technologies in use have been borrowed from the developed countries. These technologies were designed following the needs and requirements based on developed countries’ contexts which are clearly very different from the third world’s contexts. Trying to fit these borrowed technologies to universities in the third world contexts causes further challenges. This borrowing has been necessitated to a certain extent by the high financial resources and ICT infrastructural requirements needed to run top e-Learning solutions; which remain elusive to many universities in third world countries as observed earlier. Thus institutions do not develop their own e-Learning platforms but instead use open source software for which they don’t have to pay license fees (Ssekakubo, Suleman and Marsden, 2011). The commonly used e-Learning software in Kenya include Moodle, WebCT (Web Case Tools) and Blackboard. Njenga and Fourie (2010) advised that prior to investing in e-Learning, universities should undertake their own feasibility studies to establish how their e-Learning technological choices will further their academic objectives in respect to their intended users while at the same time maintaining their competitive advantage.

4.7 Lack of Adequate e-Learner Support and Collaboration

Khetan and Gupta (2013) observed that learners learn more effectively and efficiently by taking part in the learning process, interacting amongst themselves, discovering ideas and facts on their own and by experiencing knowledge firsthand. However, this is not the case with most present-day e-Learning systems; since they are content-centred and they fail to offer an individualised learning context based on learners’ cognitive capabilities and interests. They further argued that, the most outstanding common characteristic of many e-Learning systems is that they encourage an inert e-learner; a fact attributed to the lack of synchronous interactive capabilities that are the trademark of learner-tutor and learner-learner interaction.

Further, Wu, Tennyson and Hsia (2010) observed that many e-Learning environments lack campus-based interaction and flexible tutorial support leading to learner isolation, frustration, confusion as well as low enthusiasm on the subject matter. Muuro, et al. (2014) also found out that many e-Learning initiatives in Kenya are characterised by lack of e-tutor’s feedback, learner collaboration and campus social context. Their study further found out that e-tutors failed to initiate collaborative activities among the e-learners with 41.3% of e-learner respondents citing that their e-tutors did not engage them in collaborative tasks. In situations where the e-learners were engaged in collaborative activities 47% cited lack of e-tutor feedback as a great challenge, a problem that Nyerere, Gravenir and Mse (2012) attributed to lack of e-tutor training and low motivation on the part of the e-tutor. Nyerere, Gravenir and Mse (2012) further noted that e-Learning systems in use today in universities in Kenya only employ asynchronous modes of delivery and interaction where most e-tutors upload the course content in form of lecture notes, tests and assignments on the universities’ e-Learning portals. E-learners in turn download these notes, tests and assignments from the institutions’ e-Learning portals. They study the lecture notes and attempt the assignments individually because the systems are not designed for collaborative group working. These asynchronous systems are characterised by inadequate interaction, communication and collaboration. According to Gaskell and Mills (2014), one of the performance measures in the online teaching and learning process is e-learners’ feedback and e-tutors’ feedback. When this feedback is lacking the possible result is e-learner isolation which leads to other problems like high dropout rate, unmet pedagogical needs, and negative perceptions among peers and employers who consider e-Learning as second-rate education.

4.8 Lack of a Guiding e-Learning Theory(ies)

Theories play a crucial role in guiding practice across all disciplines. An analysis of the existing e-Learning literature reveals a theoretical gap in e-Learning, what is available are only extensions of the classical learning theories (CLTs) that include the application of ICTs to learning (Mayes and de Freitas, 2004; Kibuku and Orwa, 2018). There is also a lack of a sufficient body of academic literature specially related to e-Learning theory(ies). According to Andrews (2011), Pange and Pange (2011) and Ruth and Kaspar (2017), most of the existing e-Learning literature and papers presented in conferences are descriptions of practice (pedagogy), experiences, successes and challenges in e-Learning. As Peraton had remarked earlier in 1981; that “DE had managed very well without a theory”, close to four decades later we still don’t have one despite the observed growth in DE from early generations to the present-day e-Learning practice (Nichols, 2003, p.1).
World over, including in Kenya, the CLTs that include behaviorism, cognitivism, and [social] constructivism have been borrowed and applied in the practice of e-Learning under the guise that e-Learning is learning just like conventional learning with the only difference being the ‘e’; where the ‘e’ is argued to be a conduit or a vehicle for delivering learning (Kibuku and Orwa, 2018). Andrews (2011) also argued that e-Learning has been seen to represent just another site for learning; however, a blanket use of CLTs in e-Learning is not fair since conventional learning is different from e-Learning. Serdyukov (2015) underscored the key differences between the two which include: the course structure, content format, content presentation, learning context and processes, instructional tools, e-learner objectives, e-learner perceptions, cognitive learning styles, interaction and communication amongst e-Learning participants, team collaboration, e-learner autonomy, motivation and interest as well as e-learner relations with team members, with the e-tutor, and the society in which he/she exists. Furthermore, these CLTs were stipulated in the 20th Century; long before we had e-Learning with its modern technologies of the 21st Century. Thus there is need for a theory specifically developed to underpin e-Learning (Pange and Pange, 2011). Most recently in 2005 the connectivist theory was stipulated to address learning in the 21st Century with its digital technologies (Foroughi, 2015). Unfortunately, connectivism just like the CLTs has certain gaps and shortcomings and as such cannot adequately address all that happens in e-Learning. For example, it heavily emphasises technology at the expense of the e-tutor, the e-learner and the learning outcomes (Kibuku and Orwa, 2018). Suffices to say that the application of technology in learning and teaching has always been “technology-led rather than theory-led” (Ravenscroft, 2001, p.134). This was perhaps best captured by Watson (2001, p.252) in a study entitled Pedagogy Before Technology who stated that “the cart has been placed before the horse”.

The pedagogical models of e-Learning that have been in use in the delivery of e-Learning include: open learning, learning communities and distributed learning (Dabbagh, 2005). Suffices to say that these e-Learning pedagogical models were designed to match the needs and resources of institutions in the developed countries, which were already enjoying the full benefits of mature ICT infrastructures and technological advancements. To borrow them and try to fit them in the Kenyan context will pose further problems since it is characterised by the afore mentioned challenges of ICT infrastructure, inadequate policy frameworks, limited funding and lack of and/or limited ICT capacity.

5. Conclusions, Recommendations and Future Research

From the foregoing review of literature, it is apparent that these challenges inhibit the implementation and provision of e-Learning in Kenya’s institutions of higher education and thus influence the full realisation of the benefits and opportunities that can arise from the adoption of e-Learning in the country’s higher education sector. However, not all challenges are experienced by all the universities in Kenya and where we have common challenges between universities, the experience is not uniform. That is to say that the degree to which they hinder the implementation and provision of e-Learning varies from one institution to the other. According to the e-Learning Africa (2012) Report; in Kenya, the following challenges to e-Learning rank high in this order: limited bandwidth, lack of appropriate ICT training, lack of priority in ICT funding, ICT sustainability and pressures due to poverty. However, each of the identified challenge presents an improvement area in e-Learning and as such need to be addressed. This research recommends that these challenges should be addressed so as to minimize their impact on the implementation and provision of e-Learning in Kenya. National and organisational e-Learning players and researchers need to rise to the occasion and seek ways to address these challenges. The review of these challenges forms the basis upon which further research is underway to solve some of these challenges. This paper is therefore part of an ongoing PhD research; that seeks to establish how the interplay of these problems impacts the implementation and provision of e-Learning in Kenya. It is exploring the extent to which lack of a guiding theory in e-Learning may have contributed to [some of] the identified challenges especially the inadequate/lack of learner support, interactivity and collaboration in e-Learning. The research is also seeking to establish the contributions and shortcoming of the CLTs as applied to e-Learning. The main aim of the research is to develop an e-learning theory for interaction and collaboration using the Constructivist Grounded Theory (GT) Methodology proposed by Charmaz (2014), and it is now in the data collection and analysis stage.

Acknowledgements

This research acknowledges the funding received from National Research Fund (NRF) Kenya and KCA University towards the PhD research.
References


## Appendix I: Literature Review Materials

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<tr>
<th>Key Word(s)</th>
<th>Title of Reviewed Material</th>
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<tr>
<td>e-Learning in Kenya</td>
<td>Towards an Education Framework: Synchronous and Asynchronous e-Learning Cases</td>
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<td>Open and Distance Education as a Strategy of Improving Higher Education in the 21st Century in Kenya - A Case Study of University of Nairobi</td>
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<td>e-Learning, Opportunities, Benefits, Advantages, Successes, Challenges, Disadvantages and Failures in Kenya</td>
<td>e-Learning in Public Institutions in Kenya: Implementation Challenges</td>
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<td>Challenges Affecting Adoption of e-Learning in Public Universities in Kenya</td>
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<td>Challenges of Implementing e-Learning in Kenya: A Case of Kenyan Public Universities</td>
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<td>e-Learning in Kenyan Universities: Preconditions for Successful Implementation</td>
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<td>The Role of e-Learning, the Advantages and Disadvantages of its Adoption in Higher Education</td>
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<td>e-Learning, Opportunities, Benefits, Advantages, Successes, Challenges, Disadvantages and Failures in Developing Countries</td>
<td>Recurring Issues Encountered by Distance Educators in Developing and Emerging Nations</td>
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<td>Issues of Adoption: Have e-Learning Management Systems Fulfilled their Potential in Developing Countries?</td>
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<td>e-Learning in Africa: Challenges, Priorities, and Future Direction</td>
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<td>A Conceptual System Architecture for Cloud-Based e-Learning Systems for Higher Education in India</td>
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<td>Opportunities and Challenges for Adopting Cloud Computing at Universities in Developing Countries</td>
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<td>Sustainable e-Learning: Towards a Coherent Body of Knowledge</td>
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<td>e-Learning Pedagogical Issues in Kenya</td>
<td>Pedagogical Models of E-Learning</td>
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<td>Delivery of Open Distance and e-Learning in Kenya</td>
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<td>Does Online Education Need a Special Pedagogy?</td>
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<td></td>
<td>Pedagogy Before Technology: Rethinking the Relationship between ICT and Teaching</td>
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<td>The Theory of Connectivism: Can It Explain and Guide Learning in the Digital Age?</td>
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<td>Formulating an e-Learning Theory: A Grounded Theory Approach</td>
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<td>A Theory for e-Learning</td>
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<td>The e-Learning Setting Circle: First Steps towards Theory Development in E-Learning Research</td>
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<td>ICT and e-Learning policy in Kenya</td>
<td>A Policy Framework for Education and Training</td>
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<td>Economic Survey 2019</td>
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<td>Universities Authorized to Operate in Kenya</td>
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<td>Implementing Quality e-Learning: Which Way for Higher Education Institutions in Kenya?</td>
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<td>Technology Issues in e-Learning in Kenya</td>
<td>The Myths about e-Learning in Higher Education</td>
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<td>The e-Learning Handbook: Past Promises, Present Challenges</td>
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