Editorial for EJEL Volume 15 Issue 5

The papers in this volume originate from various parts of the world and touch upon different subjects and different aspects of education. Four of the contributions in this issue share a focus on barriers for successful implementation of digital learning environments and e-learning, such as: the lack of competencies among vital players (teachers and subject advisors); cultural issues and the need for clear institutional implementation strategies; active support from the organisational management; and in-service teacher training. The contributions from Sadeck and Cronjé, Arnold and Wade, and Li and Hew share some of the same focal points, but from the practice of a teaching and learning perspective; while Chiappe and Lee in their literature-based study show how a technology-centred understanding of Open Teaching tends to ignore the pedagogic dimensions of Open Teaching.

Mirzamohammadi investigated the feasibility of implementing e-learning in an Iranian university, concluding that the university was not prepared for e-learning. Human, infrastructural and cultural factors were found to be moderate- to low-level barriers, while pedagogical and support factor barriers were found to be at a low level. Mirzamohammadi suggests generally applicable strategies like training courses, including e-learning in university strategic plans, monitoring the activities of teaching and research in e-learning environments for students and faculty, and allocating and spending an appropriate budget. Mirzamohammadi also found that e-learning had been implemented as “non-physical presence of teachers and students”, thus substituting the traditional face-to-face instruction, which has a long history in Iran’s higher education, civilisation and religious teachings. The lack of impact of the master’s presence on the student would have no other outcome than failure. Therefore, Mirzamohammadi suggest a gradual replacement of face-to-face training through blended learning in order to inspire students towards independent learning without the current sudden removal of faculty members and students’ presence from the teaching and learning scene.

In their study, Sánchez-Mena and Martí-Parreño explored teachers’ main drivers and barriers to using gamification in their courses. The main drivers encouraging teachers in Higher Education institutions to use gamification were found to be the belief that gamification produces attention-motivation, entertainment, interactivity and easiness of learning. The main barriers were found to be lack of resources; students’ apathy; subject fit; and classroom dynamics. The results suggest that teachers perceive the use of gamification as both beneficial, and as a potential risk. In addition, teachers tend to believe that gamification can be applied only to a limited number of subjects. Some teachers seem to believe that if they are not carefully controlling gamified activities, a potential conflict with colleagues may emerge. The authors suggest that institutional management could offer Teacher Training Programmes to broaden the teachers’ perspective and the applications of gamification, and provide resources in the shape of classroom settings suitable for gamification activities.

The Western Cape government (WCG)’s current broadband strategy aims to ensure that all schools are connected to a broadband service within a reasonable time-frame, thus removing the digital divide and enhancing curriculum delivery in schools. Subject advisors are appointed to assist teachers to integrate digital resources into classrooms. Chigona contributes to this issue with a study that explores how the subject advisors perceive of their preparedness to embrace new technologies in their advisory job. The results show that most subject advisors perceive their complex knowledge as inadequate. Therefore, they are hesitant to advise teachers on effective technology integration into classrooms. Chigona argues that in order for the broadband strategy to succeed, the Western Cape Education Department must facilitate the development of the subject advisors’ skills, so their training should be subject specific, and the trainers should have adequate knowledge of the content and pedagogies of the specific subjects, and of how technology can be integrated for effective teaching and learning of the subject advisors.

Olaniran Duma and Nzima explored pre-service distance learning teacher trainees in South Africa and their utilisation of e-learning resources. The results revealed a significant gap between the level of access to e-resources and the utilisation of these resources by the respondents. While the electronic resources are available and accessed, the majority of the distant pre-service teacher trainees did not utilise the e-learning resources in the classroom. The study found that the respondents did not have the knowledge and skills to effectively utilise e-resources for classroom teaching, and that there is little transfer between using e-resources for their own learning and incorporating e-resources into their teaching learning activities. Olaniran
Duma and Nzima provide a set of recommendations: adequate training of pre-service teacher trainees in information technology; and establishment of radio stations at institutions providing open and distance learning, as radio provides a common, cheap and powerful means of simultaneously communicating ideas and disseminating information to a large group of people. In addition, distance-learning institutions should collaborate with telecommunication companies and negotiate subsidised and affordable Internet services for distance learners. Finally, due to the spread of mobile phones, the institutions should take social media as one of the major channels of sharing learning resources among learners.

In their study Sadeck and Cronjé look into how teachers in South Africa approach and are using technology with regard to the extent of use and actual e-learning practices. The study is based on 76 survey respondents and 15 interviews among teachers in primary and high schools, who had received ICT training, and that were known to be using technology in their classrooms. The study has highlighted patterns in the use and practice of technology integration in school education, mapped to continuums of use and practice along a continuum from personal use, through administration, to teaching and learning. The study found that teachers used social networking progressively less along the continuum from personal to teaching to learning. Also, teachers maintained some traditional ways of doing their work and were progressively advancing their practice when it made sense to them in a progressive, incremental and transformative way.

Chiappe and Lee present a literature study on Open Teaching that combines meta-synthesis and content analysis of research published over the last twenty years in major peer-reviewed databases. The study finds that Open Teaching is associated with various concepts over the years, and holds no consensus on its meaning in the academic community. They find especially that the current trends equate Open Teaching to free access to educational content through the use of Open Educational Resources (OER) and via Massive Open Online Courses (MOOCs). Chiappe and Lee argue that this trend tends to ignore important pedagogic “openness” attributes, such as adaptation, sharing, remixing or collaboration and prioritising the learning power of content to the learning power of practices. Chiappe and Lee do not reject ICT in relation to Open Teaching, but e-learning via Open Teaching should be oriented towards creating better spaces, resources and opportunities to learn, which are equally accessible and fruitful, while remembering the social function and grounds of education that are expected in 21st century education.

In their contribution to this issue, Arnold and Wade argue that the notoriously high failure rate of the U.S. defence industry’s system development projects partly stems from the engineering education, which does not provide the time for students to acquire the skills which are generally considered the key to successful development of large-scale systems. Taking at the outset that in recent research and theory these years can be reduced through the use of simulation software, Arnold and Wade present Project Robot, a defence systems engineering simulator designed to facilitate the acquisition of systems engineering skills such as engineering- and systems-thinking at an increased rate. So far, Project Robot has been tested by 12 players who stated that they felt they had gained Systems Engineering insight through the game. In the future the authors suggest applying the simulation to a larger group of subjects as a more formalised research effort, as well as applying an evaluation method that formally assesses learning outcome. Based on the initial test, the authors suggest that the game may be developed further to allow learners to experience engineering projects in accelerated time according to specific learning objectives, and to encompass advanced levels of progression in various ways.

Li and Hew take at the outset the proved learning effectiveness of storytelling. Their study aims to compare and differentiate the feasibility of traditional storytelling and multimedia storytelling for non-native novices’ learning of Chinese idioms. A Chinese idiom test and survey questionnaires were distributed among one group of students learning in a conventional setup, and one group of students learning in an experimental setup. The results showed that the students in the experimental multimedia group scored higher and had greater satisfaction towards the Chinese idiom learning than the learners from the conventional group - despite the fact that both groups expressed motivation and satisfaction with their Chinese idiom learning. The findings support the thesis that the prototype, which was developed based on cognitive theories of multimedia learning, has assisted the students to learn better; and the multimedia approach is accordingly feasible to be served up as a self-learning tool and be used by the non-native novices to learn Chinese idioms.

Collectively these papers provide a snapshot of research in a vast and widespread domain of e-learning, adding to the evidence that e-learning can provide effective methods of learning in many different content areas. The
papers also show that there are still many issues to address, especially with respect to how e-learning is implemented, supported and designed; and how learning outcomes can be supported by awareness of the pedagogical dimensions, rather than the sole focus being on the technology.

Journal Editors

Karin Tweddell Levinsen and Rikke Ørngreen
Open Teaching: a New Way on E-learning?

Andres Chiappe\textsuperscript{1} and Linda L. Lee\textsuperscript{2}
\textsuperscript{1}Centro de Tecnologías para la Academia, Universidad de la Sabana, Cundinamarca, Colombia
\textsuperscript{2}Facultad de Educación y Ciencias Humanas, Universidad de Córdoba, Montería, Colombia
andres.chiappe@unisabana.edu.co
llee@correo.unicordoba.edu.co

Abstract: Open Teaching is currently considered an ambiguous and polysemic concept but has nevertheless become a growing global trend in ICT-based education. To identify key issues on the subject, this article presents a study on Open teaching that combines meta-synthesis and content analysis of research published over the last twenty years in major peer-reviewed databases. Six main analytical categories emerge from data, conforming six groups of findings. Those findings show that Open Teaching has been associated with various concepts over the years and that there is no consensus on its meaning in the academic community. The current understanding of Open Teaching, that it is merely related to distance education, thwarts important practical and conceptual possibilities by prioritizing access as its main feature and ignoring important “openness” attributes, such as adaptation, sharing, remixing or collaboration. Moreover, the findings note that the most common means to implement Open Teaching as an ICT-based practice are derived from the use of Open Educational Resources (OER) and via Massive Open Online Courses (MOOCs) which represents not only a major challenge for active educational practitioners but a new way of conceiving and implementing e-learning in higher education.

Keywords: Open Teaching; Open Educational Practices; Open Educational Resources; MOOC; Information and Communication Technologies; Open Education; E-learning.

1. Introduction

Today’s education occurs in the presence of a diverse range of challenges, which are framed in complex social, economic, scientific and cultural dimensions. One of the current and foremost educational challenges has to do with balancing equality in access and quality in educational services (Dobele, 2015). Regarding the above, the use of Information and Communication Technologies (ICT) emerges as a high potential alternative to overcome such a challenge (Unesco, 2009).

In that sense, educational staff must face complex pressures related to their daily work. They must sustain the continuous creation of pedagogical strategies that are aimed at widening and improving their educational potential (Robinson, 2008) while addressing a growing and complex mediascape and a technological avalanche of tools and content that they are not trained to manage (Cook, 2001; Houghton, Miller and Foth, 2014; Schibeci et al., 2008).

Immersed in such a globalized and ICT-intensive environment, today’s teachers encounter an ever-changing professional territory with a persistently fast-paced evolution, which rapidly make their knowledge and skills obsolete and transform the entire educational context inadvertently (Fullan, 2007). An example of this is e-learning, which has become an educational alternative that responds to the current needs of flexibility and use of ICT but at the same time it defies the capacities of teaching staff and their role in the educational process.

In an ICT-based educational context like this, Open Teaching (OT) emerges as a topic in rapid development and associated with other topics of growing interest such as the use of Open Educational Resources (OER) and Massive Open Online Courses (MOOC). Being an emergent subject in education, the understanding of its potential and implications is still very superficial. What is known about OT at the moment is that, although it has been known for over half a century, its current meaning lies far from its mid-twentieth-century use (Holt and Thompson, 1995); also, that is an educational practice characterized by the application of some attributes of “openness” such as adaptation, sharing and collaboration and that is defined as:

[...] a process of knowledge sharing among educational stakeholders (teacher-student and student-student) that can be carried out anytime, anywhere, using freely available tools, either asynchronously or synchronously. Being open, it welcomes a third actor in educational activity: the community, the world. Open Teaching extends formal towards informal education in a context of collaboration and interaction where learners work as peer-partners (Chiappe, 2012).
Regarding this definition, OT can be considered as a concept that requires validation both in conceptual and practical ways. Part of this validation was conducted as a literature review, whose purpose was to broaden the OT’s level of understanding. The method used, beyond a systematic literature review, was conducted as a meta-synthesis of the written production of studies related to OT. The focus of this study was to identify the transformation of its meaning over the years and the key ideas associated with that meaning. In this process, it was also necessary to extend OT’s scope for higher education and specifically for e-learning, so, reviewing the current research on this topic became an effective and comprehensive means to achieve this.

Because e-learning in higher education is the field in which more educational institutions are moving from traditional to more challenging ICT-based ways of teaching and learning (Bates and Sangra, 2011; Keengwe and Kidd, 2010; Simkins and Maier, 2010), fostering “openness” is considered as a pertinent educational strategy that could transform faculty practices (Ehlers, 2011) into something new, something that is able to provide formative experiences pursuant to the needs of 21st century learners. It is noteworthy that this particular kind of learners not only have high IT skills but “have continuing technology-enhanced opportunities to create and share new, original, and valuable information with others” (Lambert and Cuper, 2008, p.2) which is actually an open-oriented feature.

Given the aforementioned, due to the pertinence of e-learning as an educational modality especially relevant for higher education, our research problem included an exploration of the possibilities of OT as a way of making e-learning an educational practice with more suitable features to our changing and uncertain times. As we will see across this paper, studies on OT show it has what it takes to respond to this challenge.

2. Review of the literature

The review of literature in a study plays an essential role in allowing conceptually delimiting the research problem and recognizing the research landscape within which it is situated (Walsh and Downe, 2005). However, when the research is a literature review itself, as in the case of a meta synthesis, its role changes significantly so that neither its utility nor its level of detail are the same and its purpose is focused on contextualizing the reader about the review process that will be to perform.

The literature shows that few texts explicitly explain or describe in detail the particularities and complexities of Open Teaching. Under a communitarian approach, Dalziel (2005) and Laurillard (2008) understand OT as a work environment that allows educators to freely share their best teaching practices. A slightly similar approach was proposed by Sharifi et al. (2014) when focus the attention on open knowledge transfer.

In a different way, Couros (2010) presents OT as a challenge to move beyond the limits of traditional distance education to foster learning in a collaborative environment. Moreover, Rodríguez (2016) supports this approach based on the use of open educational resources and Harland (2012) proposes something similar but focused on open access.

In contrast, Marland (1997) and Thorpe (1988) asserts that the very act of teaching via distance education is equal to Open Teaching. In this same direction, Hencke (1976) and McCowan (2012) situate OT as an alternative solution to much people to enter to higher education from an institutional perspective. Otherwise, Li et al. (2014) also analyze OT in higher education context but from an equality and social concern. As those approaches strongly diverge, no coherent conceptual framework can be derive from them, which makes OT a polysemic concept.

Regarding the definition of OT postulated in the previous section of this paper, it is noteworthy that there is currently growing interest in “openness” in the context of higher education (Peter and Deimann, 2013; Wiley, 2010). Moreover, there is much talk regarding the present and potential importance of open education practices (Hilton III, Wiley, Stein and Johnson, 2010; Yuan, Powell and CETIS, 2013) as disruptive modalities (Acemoglu, Akcigit and Celik, 2014; Conole, 2013) or as being complementary to traditional education (De Waard et al., 2011; Li, 2010).

Whatever perspective was considered, it is clear that there is insufficient understanding regarding how this type of teaching should be conducted in higher education. Certain authors refer to this phenomenon as a transition period in which both teaching and learning appear to have entered into a process of transformation.
from “e” to “o”, from e-learning (referred to electronic or digital) to o-learning (referred to open) (Garrison, 2011; Mott, 2010; Peter and Deimann, 2013). This implies a process of evolution that is still very unexplored and is understood in terms of its potential and limitations, which justifies prudence (perhaps in excessive quantity) for higher education institutions regarding their implementation on a large scale (Martin, 2012).

The literature review shows that Open Teaching is an emergent concept within the context of Higher Education and that there is no academic consensus to what “openness” currently means (Dos Santos, 2013). Hence, a study like the one described in this article proposes itself useful to clarify OT theoretical aspects and practical issues in the field of higher education and e-learning. In the results section of this paper, we describe some OT conceptions found in literature that provide clues about the complexity of implementing Open Teaching in higher education and e-learning.

3. Method

Meta-synthesis is a well-established technique for examining qualitative research to find new or fresh insights from a group of research-derived texts (Walsh and Downe, 2005). According to Peterson et al. (2001), meta-synthesis, also called qualitative meta-analysis, differs from other types of literature reviews because of its qualitative approach, which differentiates it from meta-analysis, by overcoming the mere data combination and description, which differentiates it from a simple or critical review and by the nature of its sources of information (research results), which makes it particularly different from a systematic literature review, in which different types of documents can be reviewed.

For this study, the meta-synthesis was conducted in three stages: data collection, arranging-coding and interpretation.

The purpose of the review, declared by its scope and aims was determined through the formulation of guiding questions to literature (Green and Bowser, 2003), so that it may be possible to make appropriate decisions in subsequent processes and generate pertinent and interesting results. For this study, guiding questions were formulated seeking to identify relevant key ideas in literature related to Open Teaching, the main issues that have been linked to this subject over time and the most important concerns facing its implementation on higher education and e-learning.

Methodological framework for this review is shown in Figure 1 and indicates the steps and sequence of the meta-synthesis.

![Figure 1: Methodological framework for meta-synthesis](image-url)
3.1 Data collection

The purpose of the first stage was to identify and collect the texts on which to generate a further process of analysis and interpretation.

As mentioned by Boell and Cezec-Kecmanovic (2011) and Cué Brugueras et al. (2008) once the purpose of the literature review was determined, the next step was to choose appropriate searching descriptors, which for this study were built as a combination of “open teaching”, “open education” and “open and distance education”.

Regarding the above, in addition to proper selection of search descriptors, a good selection of reference sources determines initially the quality of the literature review (Guirao-Goris, Olmedo Salas and Ferrer Ferrandis, 2008). Thus, a non-automated online searching process was conducted in three well-established peer reviewed databases: Scopus, ISI (including, SciELO Citation index) and DOAJ, within which proceedings and major journals on education and educational technology were chosen.

Because of the database searching showed numerous and potentially duplicated records and some of them does not belong to an appropriate context for this study, the next step of data collection stage was defining the criteria of inclusion and exclusion of texts. This process is recommended by Meca (2010) not only to limit the number of items to consider in a literature review but also with regard to their relevance and closeness to the review topic.

For an initial searching, papers with research findings that include “Open Teaching” either in the title, abstract or keywords, were primarily considered. Thus, for a later reading-in-depth process, only those papers performed in a higher education or e-learning context were selected. Also, for preventing duplicate records the whole data set was processing using a text mining software called VantagePoint.

The preliminary dataset covers a twenty-one year period from 1994 to 2014 (the massive use of internet began about mid-nineties and is considered highly relevant for Open Teaching) and was composed by 1247 peer-reviewed papers that fulfill the criteria mentioned before. Then, the results were ordered by source according to the number of items by journal, and the top 50 sources were selected for conducting a further process of abstracting and later reading in-depth. The final filtering process by source provided 399 texts, which are arranged in table 1. It should be noted that this list is composed by proceedings and journals and, of the 35 journals included in this list, 17% of them are part of the top 20 List of journals with the highest H5 Index provided by Google Scholar and, 46% correspond to quartile Q1 and 31% to Q2 in SJR.

Table 1: Top 50 sources selected containing 399 texts (items in Google Scholar H5 index –with an *).
### 3.2 Arranging and coding

Once the first stage was finished, the selected papers were read in depth, searching for evidence of Open Teaching key ideas. The evidence (units of analysis) correspond to meaningful text segments that were selected and extracted directly from the papers and then coded and arranged into a mind map to allow a subsequent interpretation process. These segments were coded according to the central topic of each segment with the following information: year of publication, reference, central idea and quoted segment of the text.

It is noteworthy that two researchers made the mind map independently and both revised the entire map to verify its consistency. To strengthen this process and reduce personal bias, a Cohen’s Kappa coefficient was then calculated $K= 0.821$, which guarantees a reliable review, as stated by Sim & Wright (2005) and Vieira, Kaymak & Sousa (2010).
The last process of this stage consisted of an array of diverse sets of records that share certain important features or codes. The set of evidence were organized in the same mind map; those based on the year of publication are shown in table 2, and those based on emerging categories are shown in table 3. The emerging categories were not previously defined but emerged as part of the main trends of the literature, ie, the data allowed to group them according to similarities, coincidences or direct relationships.

**Table 2: Evidence per year**

<table>
<thead>
<tr>
<th>Year</th>
<th>#Items/evidence</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>8</td>
<td>2.0%</td>
</tr>
<tr>
<td>1999</td>
<td>12</td>
<td>3.0%</td>
</tr>
<tr>
<td>2000</td>
<td>10</td>
<td>2.5%</td>
</tr>
<tr>
<td>2001</td>
<td>16</td>
<td>4.0%</td>
</tr>
<tr>
<td>2002</td>
<td>18</td>
<td>4.5%</td>
</tr>
<tr>
<td>2003</td>
<td>18</td>
<td>4.5%</td>
</tr>
<tr>
<td>2004</td>
<td>22</td>
<td>5.5%</td>
</tr>
<tr>
<td>2005</td>
<td>20</td>
<td>5.0%</td>
</tr>
<tr>
<td>2006</td>
<td>24</td>
<td>6.0%</td>
</tr>
<tr>
<td>2007</td>
<td>28</td>
<td>7.0%</td>
</tr>
<tr>
<td>2008</td>
<td>25</td>
<td>6.3%</td>
</tr>
<tr>
<td>2009</td>
<td>30</td>
<td>7.5%</td>
</tr>
<tr>
<td>2010</td>
<td>32</td>
<td>8.0%</td>
</tr>
<tr>
<td>2011</td>
<td>35</td>
<td>8.8%</td>
</tr>
<tr>
<td>2012</td>
<td>29</td>
<td>7.3%</td>
</tr>
<tr>
<td>2013</td>
<td>34</td>
<td>8.5%</td>
</tr>
<tr>
<td>2014</td>
<td>38</td>
<td>9.5%</td>
</tr>
</tbody>
</table>

**Table 3: Evidence per emerging categories**

<table>
<thead>
<tr>
<th>Categories</th>
<th>#Items/evidence</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility and Access</td>
<td>188</td>
<td>47.2%</td>
</tr>
<tr>
<td>ICT</td>
<td>249</td>
<td>62.3%</td>
</tr>
<tr>
<td>Autonomy</td>
<td>155</td>
<td>38.9%</td>
</tr>
<tr>
<td>OER</td>
<td>229</td>
<td>57.5%</td>
</tr>
<tr>
<td>MOOC</td>
<td>302</td>
<td>75.6%</td>
</tr>
</tbody>
</table>

It should be noted that in certain papers, text segments alluded to more than one group of emerging categories. For example, of the 57.5% analyzed papers, 28% contained evidence of conceptions related both to MOOC and the use of ICT. To a lesser extent, 5% of the analyzed papers present evidence of conceptions related both to flexibility and access.

### 3.3 Interpretation

The final stage of the meta-synthesis was structured as a qualitative content analysis.

It is recognized that content analysis, besides being a usually quantitative approach, it is also a proper qualitative method to interpret meaning derived from text data (Hsieh and Shannon, 2005), which was an essential component of this study. In fact, certain processes of an inductive qualitative content analysis were conducted in the previous stage of the meta-synthesis, such as coding and arranging. However, other processes were conducted later, such as the interpretation of the information documented in the mind map.

To perform this process, conceptual networks were developed for the purposes of identify patterns and relations between data. This operation is useful in this stage because it is possible to detect or develop
semantic constructs from the data patterns (Muhr, 1991). The conceptual networking was performed using online tools to create semantic maps, word clouds, such as tagxedo and wordle and graph platforms like Gephi. The segments of the texts of each category were processed through the word cloud tools, and the main words of each cloud were then inserted into a conceptual map to find their main relations. As noted by Elo and Kyngäs (2008), the final step in this phase enables the reporting of data analysis results in the form of a conceptual map of categories. Such categories were subsequently converted into six (6) groups of findings described in the results section of this article.

4. Results: key issues on Open Teaching

The meta-synthesis show a wide and diverse range of key issues related to Open Teaching. Albeit different but not exclusive, each one of this issues provide new elements to support a comprehensive and better understanding on the subject of this study.

Approaching the conceptual complexity of Open Teaching will allow for advancement in the construction of practical knowledge on this subject, which enables the design of more flexible and personalized teaching/learning experiences in higher education. The key issues presented below may be used as a documented reference for higher education literature and specifically on that related to e-learning to provide active practitioners in higher education some elements of reflection that motivates them to move their practices to a more open way of approaching teaching.

Six categories emerged from the meta-synthesis as follows:

4.1 Open Teaching: a diverse and increasingly relevant topic.

This study shows that ‘Open Teaching’ has represented different concepts over time. Certain of those concepts have endured and added to the current meaning of the term. First and foremost, Open Teaching (OT) has long been conceived as a modality of education, a means of teaching not to be confused with a learning modality. Learning modalities or learning styles are elements of a model that classifies students by their preferred means to receive and process information (Felder and Silverman, 1988), whereas Open Teaching is a social approach that may help teachers “to learn how to adapt to the new challenges for education and to exploit technology in the process” (Laurillard, 2008, p.14).

Originally, OT’s features were solely related to Distance Learning (Bermeo and Sempertegui, 2004; Cookson, 2012; Fejoo, 2004; Reyes Escamilla, 2002) but overtime those features are increasingly linked to complementary elements (included ICT) in education.

Conceptualizations of Open Teaching that involves complementary elements to distance learning were found in: (Arias and Vanegas, 2013; Castillo, 2005; Conde, 2003; Duart, Salomón and Lara, 2006; Hernández, 2006; López de la Madrid, Flores, Rodriguez and De la Torre, 2012; Marquina, 2007; Montoya, Solano and Araya, 2013; Oliva and Banno, 2006; Rodríguez-Ardura and Ryan, 2001).

In addition, Figure 2 show that the academic interest in Open Teaching has grown substantially over the years. We found that 42% of papers that addressed OT have been published in the last five years, and 5% were published from before the end of the century with an increasingly growing curve that points research work on this topic strongly began after 2000.

Figure 2: Published papers on Open Teaching over time
It is interesting to note that, as shown in Figure 3, the production of research on e-learning although it is still large is presenting now a decreasing curve. Moreover, if we consider the OT as a new way of e-learning and on the other hand, some of the issues relating to OT as the use of OER or MOOC are high growth educational issues, we could infer that Open Teaching could become a factor of revitalization of e-learning into the near future.

Figure 3: Published papers on e-learning in Scopus

4.2 Open Teaching: between flexibility and access.

As we noted earlier, the meaning of Open Teaching has evolved over the years. Determining the different meanings that Open Teaching has had would lead us to its better understanding as a theoretical construct and as an educational practice.

Literature shows us that an initial characterization of OT is related with access and flexibility. When teaching becomes ‘open’, it creates the possibility of broadening access opportunities to formal learning spaces by managing time and location in a flexible manner (Unesco, 2009).

In the domain of higher education, flexibility means that options are provided to a more mature learner regarding how to learn (Rodríguez-Ardura and Ryan, 2001); based on the learner’s needs, he or she may select from a set of choices and arrange a specific configuration of the different intervening factors to the learner’s own training process, i.e., pick the topics, place, pace and/or method (Castaño, Redecker, Vourakari and Punie, 2013). Other elements can be added to enhance flexibility, such as time management tools and different teaching resources. From that perspective, Open Teaching can be partially understood to be a process that is aimed at providing flexibility to students.

Moreover, access implies that all interested learners received educational services equally, and those lacking certain economic conditions (Dos Santos, 2013) or who have a significant social or spatial impairment (Cookson, 2012) will find no hindrance in entering, completing and verifying their learning process.

We found samples of the foregoing in: (Castillo, 2005; Cookson, 2012; López de la Madrid et al., 2012; Marquina, 2007; Reyes Escamilla, 2002; Rodríguez-Ardura and Ryan, 2001).

4.3 Open Teaching: an ICT affair

An interesting outcome of the meta-synthesis lies in the recent literature that shows a direct linkage between Open Teaching and ICT. In fact, 76% of the papers published in the last 5 years describe the digital environments as the appropriate ecology for Open Teaching.

It is noteworthy that the attributes of “openness” become in a change factor for active practitioners in Higher Education. Apply some of this attributes like adaptation, re-mixing, free access or redistribution to a way of teaching means that learning activities must be quite different than attend a lecture or simply collaborate in classroom. In that sense, teacher must provide diversity in instructional design that conducts to an open way of doing things in class. Notwithstanding is possible to address Open Teaching without ICT, it is not a good idea at all. For example, if a teacher wants students to adapt another student’s work, and then share it with the
rest of the class with the purpose of debating in an open forum, it is easier, faster and more practical to do this using ICT tools, overall those who are based on the use of Internet.

Certain Internet-based tools that underpin the development of Open Teaching as an educational practice include virtual classrooms, virtual learning environments, learning and content management systems, chat rooms, forums, mobile apps, learning communities/networks as well as social networks and collaboration and content sharing platforms like Google Drive or Dropbox.

Papers that relate OT with this kind of tools were found in: (Aguirre Gamboa, Casco Lopéz and Laurencio Meza, 2011; Arias and Vanegas, 2013; Belmonte and Camón, 1999; Bermeo and Sempertegui, 2004; Bidarra and Mason, 1998; Feijoo, 2004; Kuklinski and Balestrini, 2010; Pérez, 2013; Spoelstra, Van Rosmalen and Sloep, 2014).

According to Berrocoso (2010), the ultimate purpose of Open Teaching is to “get anybody in the world with an Internet connection to freely and unrestrictedly access all of the scientific, academic and cultural information comprising the human knowledge with no economic, technical or legal hindrance.” This renders all technological tools extremely important, particularly those granting free and open access.

4.4 Open Teaching as a driving strategy in autonomous learning

E-learning students are quite more autonomous than they used to be in face to face education (Leese, 2010) and this is one of the reasons why Autonomy is one feature that sets it apart from another educational scenarios (Blaschke, 2012; Stephenson and Yorke, 2013).

In addition of what’s been said so far in this study, some of its results show another way to understand Open Teaching as a strategy aimed to create autonomous learning. Such strategy is based in concepts like “anytime-anywhere” as well as considering different paces in learning rhythms, communication and student’s interaction constraints or as educational processes based upon self-management (Mejías Rodríguez, 2013).

This self-driven conception of Open Teaching leads to changes not only in the teaching process but also focus the attention in the availability of resources, communication systems, methodologies and management of educational institutions (Esparragoza, Betancur and Rodríguez, 2012). Viewed from this perspective, Open Teaching provides the students with personalized attention (Anaya-Rivera, 2004), adapts to individual workflow and gives importance to the design of quality educational materials (Campos, 2003).

Indeed, Open Teaching’s definition deems students capable of self-steering their learning paths by making their own decisions (Hashemi, 2007) and being independent to find a pace of their own (Castelán, 2011; García and Ruiz, 2009).

Other authors relate Open Teaching to another modalities of teaching, such as tutored self-learning, synchronized virtual classrooms, and networked collaborative modalities (Ciurea and Pocatilu, 2012; De la Iglesia, 2009; Esparragoza, Betancur and Rodríguez, 2012; Pun, 2012), and some of them applied basic principles from active school (Guanina and Francisco, 2013). Also, other researchers remark the relation between teaching in open environments and the student-centric constructivist paradigm (Geser, 2007) as well as the Didactic and Collaborative Learning model (Ciurea and Pocatilu, 2012; Gonzalez, García, Sonsoles and Alvarez, 2013).

4.5 Does Open Teaching mean teaching with Open Educational Resources?

One of the most common and recent ways to understand Open Teaching is concerned with the use of Open Educational Resources (OER). Over half of the research papers reviewed, covering the last decade, reveal a close relationship between OER and OT. Thus, the research review has shown that incorporating OER into an educational practice appears to be a sufficient reason to confer it the status of “open”. Although that is a questionable assertion because the “open element” in this idea is just the content but not the teaching practices, the literature shows that it is a widely accepted concept among the academic community.

Although OER is indeed a closely related tool used in Open Teaching, this is conceptually broader than its deployment instruments and should not be conceived in a merely instrumental manner. Instead, OER should at least be understood as part of “extensive collaborative exercises involving reuse, remix, redistribution,
and inclusion, adaptation, free access and many other concepts and processes related to the current notion of what "open" means for education" (Chiappe, 2012).

Examples of Open Teaching that are considered to be “use of OER” can be found in: (Fini, 2009; Glasserman Morales, 2012; Montoya, 2011; Montoya and Burgos, 2012; Montoya and Aguilar, 2012; Ponti, 2014; Schmidt, Geith, Håklev and Thierstein, 2009).

4.6 MOOCs as a trace of Open Teaching

One final group of results shows an interesting and consistent presence of the term “MOOC” when researchers refer to OT. The MOOC (Massive Open Online Courses) currently have a high impact on higher education and surely deserve a detailed and sensible reflection because of their relevance (Mackness, Waite, Roberts and Lovegrove, 2013; Sandeen, 2013).

We found that 75% of the reviewed studies published in the last 5 years report a direct relation between Open Teaching and MOOC. Regarding the above, it is noteworthy that a direct relation with OT depends on the MOOC design. When the learning activities in the MOOC include “open attributes” far beyond free access, e.g., adaptation, sharing, collaboration, remix or reusing, the underlying pedagogical framework can be clearly related to Open Teaching.

The above tenet is consistent with the perspective of Mackness, Waite, Roberts, and Lovegrove (2013), when they consider that the stated relation between MOOCs and OT is based upon the defining features previously noted. Adding to this, Mancera and Saldaña (2014), assert that this relation is based on their common pedagogical foundation of social learning through community interaction which can be understood under a connectivist approach (Gea, Montes, Rojas and Bergaz, 2014).

Regarding the close relationship between OT and MOOC, active practitioners in higher education should be starting to face some issues that affect their way of teaching. It is a different practice when you have to interact, assess and give feedback to a group of hundreds or thousands of students that move fluidly over Internet, with divers interests and backgrounds.

Examples of such understanding of Open Teaching’s linkage to MOOCs can also be found in: (Aguaded, 2013; Al-Atabi and DeBoer, 2014; Bragg, 2014; Conole, 2013; Kellogg, 2013; McAuley, Stewart, Siemens and Cormier, 2010; Pappano, 2012).

5. Discussion

As we observed in the previous section of this article, there are a wide variety of studies addressing Open Teaching. The review process produced diverse analytical categories as key issues within OT’s incipient framework. Each category approaches OT from a different angle and provides to educational researchers and practitioners elements of reflection and practical issues to deal with.

Although lack of consensus within the academic community is something expected and, to a certain degree, encouraged, ambiguities both empirical and conceptual around Open Teaching are now a critical issue. The crucial point in this matter is avoiding the trend that equates Open Teaching to free access to educational content. Regarding the above, the transformative power of content is not as strong as the power of practices (Ball, 2000; Smith, Sheppard, Johnson and Johnson, 2005), so, “openness” should engage in teaching as a process that fosters self-awareness, reflection, self-development and a healthier individuation within a social context (Dirkx, 1998; Pea, 1993).

However ICT is a structural feature of Open Teaching, at the same time entails a significant risk concerning its integrality as an open educational practice, by overweighting technological aspects over educational ones. Most of the documented Open Teaching experiences were focus on the implementation of technological tools but just a few of them report adjustments in teaching practices or strategies.

Although Open Teaching can be said to be ICT-based and subject to the convergence of online tools and educational needs, (Baranuik, 2008), it should not necessarily be confined to a digital-only environment. Open Teaching is also possible within the framework of blended learning in which technological devices could be used as support tools for accessing distributed resources (Egbert, 2000). Although it is inconvenient to
eliminate digital interaction because it is a fundamental part of the OT ecology, the social and communitarian dimensions (Laurillard, 2008) should remain as central foundations for Open Teaching.

In formal education, teaching and learning are two separate processes that are inextricably linked, similar to two sides of a coin; their interdependence implies that changing one side modifies the other. Moreover, current education needs lifelong learners who can be in control of their education (Lowe and Gayle, 2016), which means they should have the capacity to change and adapt and thus the ability to nimbly navigate an ever-changing networked environment. Therefore, to achieve that, teaching as an open educational practice, should provide the way to transform itself in an open manner and thus transform its learning counterpart, with the objective of providing the proper conditions for empowered learners to thrive.

Regarding the above, Open Teaching is an increasingly relevant topic that is viewed as an opportunity to offer flexibility and access as a driver of more autonomous and social e-learning. Teaching by means of ICT-based strategies, using OERs, MOOCs, or any other pedagogical instance, is a means of enhancing existing structures through innovative educational processes. Improvement in e-learning via OT should be oriented towards creating better spaces, resources and opportunities to learn, which are equally accessible and fruitful, while remembering the social function and grounds of education.

Some recommendations that are derived as reflection on the results of this meta synthesis would focus on the application of the attributes of "openness" as the fundamental factor for the achievement of e-learning experiences with open characteristics. This is possible, for example, when designing learning activities or content for e-learning. Instructional designers or curators of educational content have such attributes as adaptability, sharing, collaboration or free access as ingredients to make these learning experiences something more similar to what is expected for 21st century education.

Fostering Open Teaching is not an easy task. Doing so requires activating processes of change in the way to conceive both teaching and learning to gain more personalized and flexible processes that take advantage of not only the potential to learn from others and with others but also to enable the creation of personal and individual learning paths.

References


Bermeo, V.C. and Sempertegui, E.C., 2004. Equidad en el acceso al conocimiento a través de las TIC, la experiencia de la modalidad abierta ya distancia de la UTPL a través de la red de aulas virtuales. RIED. Revista Iberoamericana de


Assessing the Utilization Level of E-Learning Resources among ODL Based Pre-Service Teacher Trainees

Sunday O. Olaniran¹, M.A.N Duma² and D.R. Nzima³
¹Doctoral Candidate, Department of Social Sciences Education, University of Zululand, RSA
²Associate Professor, Department of Social Sciences Education, University of Zululand, RSA
³Deputy Dean - Research, Faculty of Education, University of Zululand, RSA
olaniransundayo@gmail.com

Abstract: Electronic resources have become a dominant feature of higher education, both traditional and distance learning based. Unlike in the past when universities relied majorly on the physical library and hard copy of books, e-books accessible through e-libraries are the dominant features of this century's institutions of higher learning. This study investigated pre-service teacher trainees by distance and the utilization of e-learning resources. A survey research design was used to carry out the study. One hundred and forty four (144) pre-service teachers by distance from three institutions offering teacher training programmes by distance in South Africa completed the anonymous web based survey designed to gather data which provide answers to the five (5) research questions in the study. The results revealed a high utilization of e-resources to learn but a low utilization of e-resources to teach among the respondents. The study recommends institutional based training on the techniques of accessing and utilizing e-learning resources for pre-service teacher trainees in ODL institutions.

Keywords: E-Resources, e-learning, open and distance education, pre-service teachers.

1. Introduction

The use of open and distance education for teacher training is increasing in Africa and electronic resources are widely used by many ODL based institutions on the continent, both to teach and receive feedback from learners. A range of studies (Tait, 2000, Shin 2003, Selim, 2007, Sun et al 2008, Olaniran, Duma and Nzima 2016) that investigate what makes open and distance education effective have identified common features that accounts for effectiveness of open and distance learning programmes. These studies have reached similar conclusions. Some of the main features they highlighted include:

- Flexibility of e-learning course and technology, e.g. is there any technical knowledge or skill required in accessing or using them
- Quality and relevance of the available electronic resources to learners, e.g. are the e-resources have significant effect on their learning
- Perceived usefulness and ease of use, e.g. how useful are these e-resources and are they easy or difficult to use
- Affordability of the resources by the learners, e.g. will learners buy, subscribe or use free of charge
- Level of availability of support staff/facilitator to provide timely feedback to learners, e.g. are there help desk or support staff available in case learners encounter any difficulty while accessing or trying to utilize the e-resources.

Going by the aforementioned features, one can conclude that the level of success of any distance learning programme depends largely on the commitment of institutions in ensuring enabling environment for their learners in accessing and utilizing e-resources for teaching and learning engagement. Moreover, one of the key features of effective teaching today lies in the ability of teachers to make use of electronic instructional materials that meet the needs of students and prepare them for this ICT driven 21st century (National Research Council, 1997). The thrust of this study is to investigate the level of utilization of e-learning resources among those studying to become classroom teachers by distance in South Africa. The major objectives of this study are:

1. To inquire about the rate at which pre-service teachers are accessing e-resources
2. To investigate the most accessed electronic resources by the pre-service teachers
3. To find out the types of device through which the electronic resources are being accessed
4. To investigate how the e-learning resources accessed are being utilized in the classroom
5. To find out the challenges facing pre-service teacher trainees in accessing and utilizing electronic resources.

2. Literature Review

2.1 Teacher Training By Distance in South Africa

South Africa is one of the countries in Africa that is using open and distance mode of learning to train teachers, at both initial and professional development levels. A report by the Mathematics, Science and Technology Ministerial Task Team, drafted in 2013, found that the country had a serious lack of qualified, skilled and experienced teachers in all levels of education, especially in key subjects like mathematics, sciences and technology. Studies (Pityana 2007, Biao 2012 and Samkange 2013) have revealed that conventional institutions have their limitations and cannot adequately cater for the huge number of teachers needed to meet the 21st century educational needs of both developed and developing nations of the world. Because of the limitations of space and location that comes with traditional education system, open and distance learning, therefore, becomes an alternative to train new sets of teaching personnel and also to give professional development training to the in-service teachers. Similarly, open and distance education could be described as an educational process in which a significant proportion of learning takes place remotely and flexibly beyond the formal learning environment (Aderionye and Ojokheta 2004, and Alkali 2015). It comprises organized educational activities in which constraints on learning are minimized in terms of access, time and place as well as pace and method of study.

In South Africa, the Department of Higher Education and Training supports learning by distance for those who cannot or who chooses not to attend traditional campus-based institutions (DHET 2014). The operation and delivery of Open and Distance Education in South African Institutions is hinged on the belief of access which was one of the prioritized points in the policy for the provision of distance education in South African Universities as set out in the Section 3 of the Higher Education Act, 101 of 1997. The key provisions of this policy are:

- Providing a system wide definition for what constitutes distance education provision.
- Supporting well-managed growth in quality distance education provision, including in institutions other than UNISA.
- Ensuring that distance education provides not only opportunities for access but also a reasonable chance of success.
- Ensuring that distance education provision is funded based on empirical evidence of relative costs of different modes of provision.
- Strengthening capacity to evaluate distance education provision and hence to regulate who can offer accredited distance programmes.
- Promoting the development and use of Open Educational Resources (OERs)
- Creating an enabling environment for appropriate integration of ICT to enhance distance education provision in both public and private universities as well as other post-schooling institutions (DHET 2014).

Moreover, it is important to note that initial teacher education programme by distance in South Africa is largely provided by the University of South Africa (UNISA), the only government funded ODL based university in the country. Apart from the operations of UNISA which are purely by distance, some of the conventional universities in the country also operate distance learning programmes to train teachers, although, these conventional institutions created autonomous units to manage their distance learning programmes. In addition, there are few numbers of Further Education and Training (FET) Colleges in all the nine Provinces of the country which also provides teacher training programmes by distance, as well as a number of private teacher training institutions that are approved by the Department Of Higher Education and Training (DHET).
Figure 1: Providers of Distant Teacher Training Programmes in South Africa

2.2 Teacher Training By Distance in UNISA

The thriving of open and distance education in South Africa could be traced to the year 1946 when the University of South Africa was established (Pityana 2007). The University of South Africa has a long and respected history in teacher education by distance in Africa. The College of Education of UNISA is initiating relevant teacher education programmes aimed at strengthening the education sector of the country. The college offers the major courses/disciplines in the school curriculum and the Further Education and Training phase with a particular focus on language education, mathematics, science, inclusive education, technology and environmental education, adult and lifelong education, early childhood development, curriculum studies and instruction, educational foundations and school leadership and management. Pre-service teacher training in UNISA covers Bachelor of Education degree (in FET, intermediate and senior phase) degree which normally runs for four years, as well as the Post Graduate Certificate in Education (PGCE) targeted at those who are already in possession of Bachelor degree in Arts, Sciences and other fields outside the Faculty of Education. The initial teacher education programme by distance in UNISA is equipping the trainees with the pedagogical content knowledge as well as practical training, all aimed at producing competent teaching personnel who will be willing to join teaching profession in the country.

2.3 Teacher Training by Distance in Traditional Public Universities and Private Colleges in South Africa

Apart from the University of South Africa which operates mainly by distance, a few of the conventional universities and private colleges in the country also offers teacher training programmes by distance. Prominent among them is the professional development training programme targeted at the in-service teachers run by the Distance Learning Unit of the University of Pretoria. The centre’s distance education courses reach more than 25,000 students who are mostly teachers that are improving their qualifications (Times Higher Education, 2015). The university’s television and web-based training school are parts of the innovations adopted to take education closer to the door-step of people without them leaving their homes or workplaces. Similarly, also worthy of note are the Units for open and distance learning of the University of Free State and North West University which have been drawing learners from all walks of life that would previously not have been able to attain higher education. The teacher training programmes by distance of the two institutions are enabling prospective and in-service teachers to enroll for teacher training programme with the aim of entering teaching profession. Similarly, there are more than 20 private colleges as well as Further Education and Training Colleges providing teacher training programs by distance to those who are in one way or the other restricted by the constraints of location and time.

2.4 E-resources available to Distant Teacher Trainees in South Africa

The term ‘e-resources’ is a general term that encompasses varieties of digital materials and collections for learning. The words like cloud library, virtual library and electronic library are also used as umbrella terms to describe digitized libraries that houses collection of e-resources. Moreover, e-learning resources are also seen as hard learning materials converted into electronic forms which can be accessed by classroom based learners as well as distance learners without any difference in the location and time of access (Reitz 2004). These e-resources are usually accessed with the aid of devices such as computer, radio and television sets, mobile.
phone, among others. In most cases, these devices are also counted as parts of electronic resources for learning.

Figure 2: Commonly used E-resources in ODL Institutions

The introduction of e-resources for teaching and learning activities became prominent in the second half of the 20th century as more conventional universities and colleges became ‘dual-mode’ institutions, offering both face-to-face distance learning programmes (Butcher 2015). While there are opportunities for the students attending traditional institutions to physically visit library and consult their tutors on one-on-one basis within the institution on any matter relating to their studies, distance learning students rely majorly on the internet and whatever type of support system provided by their institutions to access learning materials and get feedback where necessary. This, therefore, made it mandatory for the institutions providing open and distance learning to think hard about quality and ease of accessibility while making educational resources available to clientele, particularly those studying to become professional classroom teachers. The reason is not far-fetched; the quality of educational resources that are available and accessible to teacher trainees, especially those in the initial teacher education phase, will go a long way in shaping their perception and competence in utilizing such resources when they eventually become professional classroom teachers. Moreover, since distant teacher trainees rely majorly on electronic resources in realizing the goal of their training programmes, efforts must be made by the training institutions to equip them with the necessary skills and knowledge both to effectively access and utilize the resources, both to study and practice.

A range of electronic resources are available and accessed by those studying to gain teaching qualification by distance in South African institutions ranging from audio-visual lectures, electronic books and journals which they usually accessed through their institutions’ repositories and e-library services. Other e-resources available to pre-service teachers, as highlighted in Fig 2, include CD-Rom, television broadcast, and electronic mail, as well as the learning management systems such as Blackboard and Moodle, among others.

3. Rationale for this study

A range of studies (Kinshuk et al 2003, Johnson et al 2004, Salmon 2005, Rezaei 2006, and Butcher 2015) have been carried out on the importance of electronic resources to the success of teaching and learning engagements in open and distance learning institutions. Though these studies made profound contributions to the debate on the availability and relevance of electronic resources to teacher training institutions, they seems not to have address the issue of e-learning resources utilization by teachers in the classroom settings. This study, therefore, sought to fill this gap by exploring the experiences of distant pre-service teacher trainees while accessing and utilizing electronic resources and provide recommendations that can further help the institutions offering teacher training by distance in producing competent teaching personnel that meets the demand for quality teaching and learning in today’s elementary and high schools.

4. Theoretical Framework – Technology Acceptance Model

The theoretical framework for this study was based on the Technology Acceptance Model (TAM) of Davis (1986), which emphasized the use of Theory of Reasoned Action (TRA). Theory of Reasoned Action, according to Davis, assumed that attitude of a person towards a system is controlled by his/her belief on that system.
Similarly, Technology Acceptance Model also deals with the acceptability of an information system (Adeyemo, Adedoja and Adelore 2013) and how it can be applied to determine level of acceptability of the system. Furthermore, TAM model assumes that level of acceptability or actual use (AU) is mainly determined by two factors, namely; Perceived Usefulness (PU); and Perceived Ease of Use (PEU).

![TAM Model Showing the Association between PU, PEU and Actual Use](image)

Figure 3: TAM Model Showing the Association between PU, PEU and Actual Use (Davis in Adeyemo, Adedoja and Adelore 2013)

The Perceived Usefulness (PU) of a system can be described as the level to which an individual believe that using the new technology or system will boost his/her performance (Bhatti 2015), while Perceived Ease of Use (PEU) refers to the extent to which a person believes that making use of a particular system or technology to perform a task will be easier or require little effort (Lu et al 2014). Moreover, Davis (1986), through his TAM model, clarified that an individual’s attitude towards a system is not the only factor that influences him/her to use the system, the effect that the system will have on the person’s performance is another significant factor that determines level of acceptance.

Several studies (Shen et al 2006, Padilla-MeléNdez et al 2013, Calisir et al 2014, Teo and Noyes 2014, Ayeh 2015) have used Technology Acceptance Theory to explain users’ acceptance and use of instructional and web based systems, including e-learning. For instance, Shen et al (2006) examined the degree to which subjective norms influence the perception of students towards accepting and using course delivery modes. Findings of the study revealed that facilitators’ influence had significant impact on the students’ perceived usefulness (PU). This finding revealed the impact of facilitators’ role in shaping the perception of students learning delivery system. Similarly, study conducted by Bhatti (2015) on factors influencing the adoption of mobile commerce revealed that user’s willingness to use mobile commerce platforms is influenced significantly by perceived ease of use (PEU) and perceived behavioural control. Drawing lessons from the previous studies, therefore, the current study found relevance of TAM as an important predictor of perception and attitude of pre-service teacher trainees towards e-learning resources.

5. Methodology

Methodology in a research study is simply ‘the act and science of doing research’ usually provides answers to the 5W questions in research, i.e. what, why, who, which, and where. Therefore, this section discusses the manner in which this study was conducted using various subtitles as itemized below.

**Research Design:** This study adopted quantitative method to collect data that provided answers to the research questions for the study. Leedy and Ormond (2008) note two popular approaches which a research study can employ, i.e. quantitative and qualitative methods. Quantitative research study provides answers to questions on the association between variables with the aim of clarifying and predicting phenomena (Williams 2011), while qualitative study attempts to answer questions on the compound nature of phenomena by explaining these phenomena from the perspectives of the study participants (Leedy and Ormond 2008). This quantitative study was conducted through survey that employed semi-structured questionnaire completed by pre-service teacher trainees in the selected ODL based universities.

**Research Instrument:** Since the participants were distance learners, web-based survey, which was designed on Google doc, was used as data collection instrument. The link to the survey was posted directly to the participants by the ICT units of the selected institutions. This was to ensure total anonymity of the student teachers that participated in the study.

**Participants:** Distance learning based pre-service teacher trainees in selected South African universities served as the participants for this study. The teacher trainees selected were in the third year of their Bachelor of
Education (B.Ed.) degree programme. 70 participants were purposively selected in each of the three universities, making the total of 210 respondents. However, only 144 pre-service teachers responded to the survey instrument which represents 68% of the participants.

**Data Analysis:** The data collected were analyzed using descriptive statistics of percentage and frequency counts. The data obtained from the survey were presented in pie chart below.

**6. Findings of the Study**

**Frequency of use of e-resources**

How often do pre-service teachers use e-resources?

![Use of e-resources](image)

As can be noticed on the figure 4, the vast majority of participants use electronic resources on a daily basis.

In the survey distributed among the respondents, they were asked to state the specific types of electronic resources being accessed and used regularly. Some of the popular e-resources mentioned were internet, email, Facebook, Youtube, Blackboard and Moodle, e-journals, e-books, laptop, mobile phone, television, electronic database of thesis and dissertation, among others.

**Commonly accessed electronic resources**

What e-resources do you access most?

![Most accessed e-resources](image)

In the survey, the participants were specifically asked which electronic resources are widely accessed and used by the pre-service teachers. As seen on the figure 5, electronic journals and books, CD-ROM, blackboard, moodle, web 2.0 and social media were the major e-resources identified by the respondents. It is very interesting to note that majority of the participants identified web 2.0 and social media platforms, as their most accessed and used electronic resources. The findings suggest that today's distance learners have constant presence on social media, especially Facebook, which they use majorly to socialize and share knowledge among one another.
Frequency of utilization of e-resources

How often do you utilize e-resources to teach?

Figure 6: Level of utilizing e-resources

Figure 6 shows the responses of the participants on the level of utilization of electronic resources in the classroom. As revealed in the figure, only 20% of the respondents often utilize e-resources to teach in the classroom, 30% rarely utilize e-resources while the majority (i.e. 50%) has never utilized electronic resources to teach in the classroom during their teaching practice.

Do you think you need more training on how to utilize e-resources to teach in classroom?

Figure 7: Further training on e-resources

Through the review of literature and other operational documents about teacher training programmes by distance in South Africa, we found that most of the distance learning institutions usually provide some sorts of virtual training for their students on e-resources and other learning expectations while entering the programme. To ascertain if the training was enough, the participants were asked if they still need further training, specifically on accessing and utilizing electronic resources. On Fig. 7, it is clear that while the largest group of respondents (47%) do not believe they need further training, though a significant portion of the respondents (38%) feel they do.

What is the main device through which you access e-resources?

Figure 8: Devices used in accessing e-resources
Figure 8 shows the participants responses on the devices used in accessing the available electronic resources. A range of devices such as tablet, personal computer, computer in the public library, computer in the institutions’ resource centre, computer in cybercafé, and mobile phone were identified as major devices used in accessing e-resources for learning. It is noteworthy that majority of the respondents (53%) selected mobile phone and tablet as the major devices used to access electronic learning resources.

What is the main source of your internet connection?

![Source of internet connectivity](image)

Figure 9: Sources of internet connectivity

Participants were also asked to indicate their main sources of internet connectivity. As shown in Fig. 9, 15% of the respondents accessed internet by connecting to their private wifi at home, 18% ticked commercial cybercafé as their main source of internet connectivity, while the majority group (49%) indicated data subscription from the telecommunication companies as their major source of internet connectivity. This is so because majority of the respondents uses mobile devices, e.g. mobile phone and tablet, as their major devices of communication as well as accessing electronic learning resources.

What are the main challenges you usually encounter in accessing and utilizing e-resources?

![Challenges in accessing e-resources](image)

Figure 10: Challenges in accessing e-resources

In the anonymous web survey sent out to the participants, they were giving the opportunity to state the specific challenges they face in their quest to access and utilize e-resources. After retrieving the data on the survey, their responses were classified into three categories, i.e. technical related challenges, readability and applicability challenges, as well as internet access related challenges. For clarity sake, technical related challenges apply to the failure encountered by the learner as a result of inadequate skill or knowledge to access or utilize electronic resources. Readability has to do with the ability or inability of the learner to read, listen or watch clearly the content of e-resources being accessed, which may happen as a result of the disability in learner or the inappropriate nature of the e-resources being accessed or utilized at a given time. Internet access related challenges simply refer to the poor/unstable nature of internet connection or the inability of the learner to afford internet connection which limits his/her level of access to e-resources. As shown clearly in the figure 10, the majority of the respondents (53%) identified internet access related challenges as their main constraint to accessing and utilizing electronic resources.
7. Limitations of the Study

The study explored the experiences of pre-service teacher trainees by distance in accessing and utilizing electronic resources. Though the study is used to draw some certain conclusions, it is imperative to note the limitations of this study so that it can be viewed in the correct context in which it was conducted.

a. The number of the respondents sampled may not be the true representation of the entire learners studying to obtain teaching qualification by distance in South Africa. It is important to note again that the number of the participants who responded to the survey was reported as sample for the study. However, the inability of some of the pre-service teachers to respond to the survey could also be to the fact that they were constrained by the problem of Internet access.

b. Also, the study covers only institutions that are using open and distance learning to train pre-service teachers. It is very important for the future researchers to look into the level of access and utilization of e-resources of pre-service teacher trainees in the traditional campus based institutions.

8. Discussions of Findings, Conclusion and Recommendations

The important role of electronic learning resources in the actualization of goals and objectives of distance education cannot be overemphasized. From the analysis of the data collected through survey, some significant insights have been gained into the level of access and utilization of e-resources by pre-service teachers, in line with the perceived usefulness (PU) and perceived ease of use (PEU) put forward by the proponent of the Technology Acceptance Model (TAM). Through the findings, one can establish a significant gap between the level of access to e-resources and the utilization of the resources accessed by the respondents as it shows clearly that while the electronic resources are available and accessed, the majority of the distant pre-service teacher trainees have not been utilizing the e-learning resources in the classroom. This may imply that the respondent did not have the requisite knowledge and skills to effectively utilize e-resources for classroom teaching. This corroborates the findings of Adeyemo, Adedoja and Adelore (2013) which established inadequate computer skills as one of the major factors responsible for learners’ inability to utilize learning technology. Here we use the word ‘utilization’ to mean ‘actively engaging materials to produce stimulating learning experience not only for oneself but also for others’. Hassan and Olaniran (2011) also emphasized the need for institutions of higher learning to expose students to the necessary skills that will prepare them for today’s knowledge economy. It is also interesting to note that the use of radio broadcast is not pronounced by the respondents as one of the most accessed and used learning resources. This may be as a result of the absence or dysfunctional state of the radio stations in the distance learning institutions where the participants were drawn from. Another interesting to note in the study is the use of mobile phone as a major platform for accessing e-learning resources by the participants. This confirmed the finding of (Dalvit et al, 2014) that mobile phone has great potential in enabling learners to gain large exposure to the learning content as mobile devices give one opportunity to do self-learning anytime, anywhere with the assistance provided by mobile technology. Similarly, the result of the survey shows that majority of the distant teacher trainees were constrained by the internet connection problem. This may result from the inability of the respondents to afford the internet data bundle rates which may give them constant internet access on their mobile phones and tablets. Also, as noted on the fig. 6, few of the participants wanted to be trained in how to use e-learning resources for educational purposes. This demonstrates that there is little transfer between using e-resources for their own learning and incorporating e-resources meaningfully into their teaching learning activities.

Based on the findings of the study, therefore, the following recommendations were made:

1. Adequate training of pre-service teacher trainees on information technology, especially the tool that are specifically useful for classroom teaching, as well as the techniques of utilizing the tools. This will enable the teacher trainees to master the use of the available e-resources in carrying out their academic studies, as well as utilizing them for practice. Adeyemo, Adedoja and Adelore (2013) also advocated for capacity building training for students in institutions of higher learning in the area of learning technology to boost their level of access and use.

2. Establishment of radio stations by the institutions providing open and distance learning programmes which will be used purposely for teaching, learning and information dissemination. This is because radio has been found to be the commonest, cheapest and most powerful means of communicating ideas and disseminating information to a large group of people at the same time (Olaniran, 2013).
3. Efforts should be made by open and distance learning institutions to collaborate with telecommunication companies that provide internet data services for the purpose of negotiating subsidized and affordable Internet services for distance learners. This will be of significant help, especially to those studying to gain teaching qualifications since most of them access e-resources mostly from their mobile phones. Constant internet services to teachers gives unhindered accessibility to pictures, videos and other instructional materials which has been proved to be one of the major catalysts for enhancing classroom based teaching and learning activities (Olaniran, 2015).

4. There also a need for the institutions providing open and distance education to take social media as one of the major channels of sharing learning resources among learners. Since majority of distance learners make use of social media platforms like Facebook, Twitter, and Linkedin, for socializing and networking among peers, making learning resources available through such platforms will further enable distance learners to access and share resources among each others. Bosch (2009) also found the use of social media platforms like Facebook, Youtube and Wikis for teaching and learning more stimulating and engaging for today’s learners.

References


Butcher, N. A., 2015. Basic guide to open educational resources (OER). Commonwealth of Learning, Vancouver and UNESCO.


Pityana, M.B., 2007. The History of Distance Education. An Inaugural Lecture delivered on the occasion of the launch of the distance course in Bachelor of Business Management, at the Universidade Eduardo Mondlane, Maputo.


Samkange, Wellington., 2013. "Training Teachers At A Distance: Perceptions Ad Challenges Of Open And Distance Learning (OdI) In Teacher Education The Zimbabwean Experience." Turkish Online Journal of Distance Education 14, no. 4.


Times Higher Education., 2015. If you are this low, the only way is up. Online article available through https://www.timeshighereducation.com/features/if-youre-this-low-the-only-way-is-up/164182.article (Accessed 17 July 2016)


A Continuum of Teachers’ e-Learning Practices

Osman Sadeck and Johannes Cronjé
Cape Peninsula University of Technology, Cape Town, South Africa
osadeck@gmail.com
cronjej@cput.ac.za

Abstract: The introduction of technologies into the teaching and learning environment has implied changes to the way education plays out in an e-Environment. Previous research has highlighted the many barriers and challenges in integration technology into teaching and learning. Technology is said to be underutilised. However there are studies that have identified that teachers are using technology in their work. Little is known about the extent of this use of technology. Accordingly less is known about teachers’ e-Learning practices. This paper seeks to highlight the patterns in teachers’ e-Learning practices.

Using a blend of inductive and deductive techniques data was collected from a sample of teachers known to be using technology in their work. The study was framed by the: (i) Development in use and stages of teaching and learning with technologies (UNESCO) and (ii) Technological skills developmental levels (DoE). The data from the study has highlighted patterns in the use and practice of technology integration in school education. These patterns could be mapped to continuums of use and practice. It has been found that teachers used technology for a variety of purposes: personal, administration, teaching and learning at different frequencies and at varying levels of intensity. Teachers were found to use technology for e-Teaching and e-Learning progressively and in ways that was aligned to their comfort zones. The way teachers’ used technology was found to be progressive from simple to innovative.

Keywords: e-Learning practice, continuum, use, e-Teaching, e-Learning, traditional, innovation

1. Introduction

Educational practitioners go through developmental changes in their approach and execution of their vocation naturally. The introduction of digital technologies in the teaching and learning environment has disrupted this developmental process. These new technologies suggests change, and this concept of change is supported by Laurillard and McAndrew (2003). They (2003, pp.82-83) state that the permeation of technologies in schools is turning teaching into a “conceptual challenge”, which implies that teachers have to re-think their approach to teaching and learning “well beyond the traditional transmission model”. Teachers practices are thus affected through these change processes.

The aim of this article is to provide insights from one aspect of a larger doctoral study that informs us of selected teachers’ e-learning practice. The findings revealed that teachers’ development and progress in using technology for educational purposes can be located on continuums of adoption, use and practice. In this article only the continuums for use and practice are presented.

2. Background

Researchers have echoed in different ways that e-Learning possesses the potential to change education globally. The South African National Department of Education (DoE) states that “ICTs have the potential to improve the quality of education and training” (DoE, 2004, pp.8). This notion was expanded on by Amin (2013, pp.6) who maintains that “ICTs, especially computers and internet technologies, enable new ways of teaching and learning”. Kong et al. (2014, pp.71) further confirm the potential of ICTs in their statement, “The introduction of digital resources, digital ways of communication and digital platforms for learning and teaching brings about many opportunities to enhance the learning process in school education in the 21st century.”

However all does not seem to be going well with the implementation of e-Learning at school level. The literature has shown that even if technology is available, training provided, and resources available, few educators are effectively integrating technology into curriculum (Mumtaz, 2000; Kahiigi et al. 2008; Wilson-Strydom et al. (2005).The DoE notes that one of the challenges in the implementation of its policy (White Paper 7) for e-Education in South Africa is the “integration of ICT into the learning and teaching process” (DoE, 2004, pp.8). Ford and Botha (2010, pp.1) further contend that the “practical implementation of e-Education has been a failure”. A study by Bytheway et al. (2010) concluded that the effective use of technologies at schools is yet to be realised.

Much of the existing research into the use of technology focuses on singularities that evolve around pilots projects, training initiatives, technology testing, models or method testing, and barriers to e-Learning. E-Learning publications appear to highlight, in different permutations, drawbacks and barriers as opposed to advances: Bingimlas, 2009; Bytheway, 2010; Ford and Botha 2010; Cantrell and Visser, 2011; Ndlovu, 2012; Lim et al. 2013. There appears to be fewer studies that focus on patterns of use and concomitantly less on e-Learning practices. This was noted by Hadley and Sheingold (1993) who stated that research has not provided “insight into the individual teacher’s learning process, including both the cognitive understanding of technology and teaching”. Bhalla (2013) furthermore concluded that research “ignored systematic studies into ways of using technology... in teaching-learning process”.

Accordingly the under-utilisation and non-adoption of available technology and varying levels of uptake of e-Learning emerged as concerns. There is not sufficient knowledge of the patterns of teachers’ e-Learning practices.

3. E-Learning practice

e-Learning practice, in the context of this article, is taken as the integrative use of methods, digital resources, systems, technology (physical devices and ICT infrastructure) and services. Previous findings on the use of technologies have reported that teachers’ practices appear to be traditional with glimpses of advancing practices.

Sara Hennessy, Bjoern Haßler & Riikka Hofmann (2015, pp.545) amongst others have found that the use of technology was mainly for preparation of lessons, administration purposes and delivery of planned lessons. They state that teachers were “gradually coming to grips with novel technologies and developing an interactive teaching approach”. Hennessy et al. (2005, pp.185) note that “teachers were sensibly building on and extending existing practice, exploiting the new opportunities arising, yet not blindly jumping in”. However, what is found is temporal, as noted by Pedretti et al. (1999, pp.136): teachers “gradually replaced [old traditional practices] with practices that promoted students’ use of a range of multimedia technologies”.

4. Research Approach

The approach in the study was underpinned by the tradition of grounded theory using a selective blend of qualitative and quantitative approaches, explanatory and exploratory enquiry and, inductive and deductive techniques. According to Neuman (2002, pp.30), some techniques are more effective. Van der Merwe (1996, pp.279) maintains that “induction and deduction should not be regarded as mutually exclusive”. Johnson and Onwuegbuzie (2004) state that using a mixed method approach allows for complimentary qualitative and quantitative research.

The study comprised a purposeful sampling of teachers so as to include the peculiarities of individual cases (Huysamen, 1994, pp.168). This was to done to include participants that were most likely to provide reliable and rich data (Merriam, 2009, pp.77; Bless and Higson-Smith, 2006, pp.95). Teachers were selected from a cross section of public and private schools, in urban and rural locations and comprising primary and high schools (see table 1). The common criteria for selection included: teachers who had received ICT training, and that were known to be using technology in their classrooms. The limitation of the study was practicing teachers who were known to have received some ICT training.

The sample comprised seventy six survey questionnaire respondents and fifteen interviews participants. Motivation for the sample size was based on the understanding of data saturation. This is likely to occur with large samples in qualitative research where more data does not necessarily mean more information (Guest et al, 2006; Glaser and Strauss, 1967).
Table 1: Survey and Interview: Respondents distribution

<table>
<thead>
<tr>
<th></th>
<th>Survey respondents - 76</th>
<th>Interview respondents – 15</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td><strong>Province</strong></td>
<td><strong>School level</strong></td>
</tr>
<tr>
<td>Female</td>
<td>37</td>
<td>3</td>
</tr>
<tr>
<td>Male</td>
<td>39</td>
<td>4</td>
</tr>
<tr>
<td>Western Cape</td>
<td>15</td>
<td>Combined*</td>
</tr>
<tr>
<td>Limpopo</td>
<td>1</td>
<td>Special**</td>
</tr>
<tr>
<td>Gauteng</td>
<td>3</td>
<td>Multi Grade***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>Gauteng 1</td>
</tr>
<tr>
<td>Kwa Zulu Natal</td>
<td>1</td>
<td>Special** (primary)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Combined* (special**)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Independent****</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Combination – schools with both a primary and high components in a single school. 
**: Special - schools where learners have special learning challenges and needs. 
**: Multi grade – schools with more than one grade level in the same class (predominantly in rural context). 
**: Independent - private non-government controlled or owned schools.

The study was framed by: (i) development in use and stages (UNESCO, 2002, pp.17) of teaching and learning with technologies (UNESCO, 2002, pp.15) and (ii) technological skills developmental levels (DoE, 2004; 2007). Data was collected through a survey questionnaire (see appendix A) and face-to-face interviews. Data was subjected to content analysis. According to Cohen et al, (2005, pp.82) fitness for purpose and legitimacy will govern the criteria used in deciding which forms of data analysis to undertake.

5. Development in use and stages of teaching and learning with technology:

The way technologies can be adopted and developed for use has been described as emerging, applying, infusing, and transformational on a four-stage continuum (UNESCO, 2002, pp.15-17). The stages of teaching and learning with and through ICT have been described as discovering, learning how, understanding how and when, and specialising in the use of ICT tools (UNESCO, 2002, pp.15-17). (See Figures 1.1 and 1.2 below.)

5.1 ICT development in schools

![ICT Development Continuum](image)

**Figure 1.1:** UNESCO ICT development in schools (UNESCO, 2002)

5.1.1 Emerging

In this first stage, teachers begin by exploring the possibilities of technology and its use is initially for administration. Some teachers begin to experiment with technology for teaching at a very elementary level.

5.1.2 Applying

As teachers discover the potential of technology, they start to use it for basic e-Teaching. The way it is used sustains traditional teacher-centred teaching methodologies.
5.1.3 **Infusing**
Teachers begin to explore how the use of technology can increase their productivity and way of work.

5.1.4 **Transforming**
At this stage the use of technology starts to become pervasive in teachers’, administration and teaching. A change in practice begins to emerge.

The stages above set out what is seen as the adoption and sequential use of technology by individuals in schools and schools as whole units. Its significance to this study is that it informs the progressive use of technology that could be expected.

### 5.2 Stages of teaching and learning with technology

#### Figure 1.2: UNESCO stages of teaching and learning with technology (UNESCO, 2002)

5.2.1 **Discovering ICT tools**
Discovery is the key in this basic stage. Teachers are learning about technology, both its physical operation and its use for administration and teaching. Discovery of technology is characteristic of the emerging stage.

5.2.2 **Learning how to use ICT tools**
The applying stage above is linked to the learning of how to use technology for their administration or teaching. It is at this stage that teachers expand in their attempts to use technology.

5.2.3 **Understanding how and when to use ICT tools**
At this stage teachers become discerning users. They are able to identify opportunities where technology can be helpful for particular purposes. This suggests a competence to select appropriate technology for particular tasks. In doing this, teachers are found to be in the infusing and transforming stages of technology use and integration.

5.2.4 **Specialising in the use of ICT tools**
In the specialising stage, teachers find innovative uses for technology. This is often characterised when teachers use technology for uses outside of what it was intended for initially. This stage links with the transformational stage. The UNESCO (2002) information provides useful indicators for evaluating practice as well as planning for personal development.

### 5.3 Technological skills developmental levels:
The DoE has highlighted in two of its documents the crucial need for technological competencies among its teachers. They specify the following professional competency in ICT utilisation at levels of entry, adoption, adaptation, appropriation, and innovation (DoE, 2004, pp.25; DoE, 2007, pp.6). (See Figure 1.3)
5.3.1 **Entry**

At the entry stage teachers should at least be able to develop technological literacies to be able to use technology such as, computers, laptops, data projectors. Additionally, the school should be able to assist learners with the operational use of technology.

5.3.2 **Adoption**

At this level teachers should be adopting technology into their professional lives. This should be for administration, teaching and learning.

5.3.3 **Adaptation**

As this level teachers should now be able to adapt the technology to suit more of the curriculum and learner needs. The curriculum and teaching and learning should thus become enriched with use at this level.

5.3.4 ** Appropriation**

At this level there should be shifts from mere use of technology to authentic integration of technology. Teachers should be able to use technology, systems and services in holistic e-Teaching and e-Learning.

5.3.5 **Innovation**

Teachers at the innovative level should be able to develop and create dynamic learning opportunities and environments for e-Learning. Learning should be almost exclusively learner centred and technology should be used as the prime interactivity and collaboration tool.

Synthesis of the levels in the: development in use, stages of teaching and learning with technology, and technological skills developmental levels are depicted in Figure 1.4 below. The mapped corresponding relational levels and stages suggest three stage levels of complexity, that is, basic, integration and, specialisation and innovation. The figure shows an approximation that teachers will progress in how they learn about technologies and begin to use and integrate them. Concomitantly the UNESCO and DoE development levels highlight the levels of complexity at which the teacher may be operating.

---

**Figure 1.3:** DoE ICT competency levels (DoE, 2007)

**Figure 1.4:** Mapped personal levels of technological skills development, use and integration (UNESCO, 2002; DoE 2004, 2007)
The basic stage relates to entry, emerging and discovering ICT tools levels. When teachers are starting out with ICTs they begin by finding out about these tools. This equates to an emergence of a way of work that is characterised by small steps and very basic use and application of technology for basic tasks.

At the integration stage the key levels of note are adoption and application. If adoption is not present, then it is unlikely that one would see any application or integration. As such adoption relates directly to application. Application has two aspects that work in tandem, that is: learning how to use the tools and, as shown in this study, how to adapt the use of the tools to suit the teachers desired way of work.

The specialisation and Innovation stage is indicative of deeper knowledge and skills regarding the use and integration of ICTs. Innovation relates directly to transformation as teachers would be using ICTs in diverse ways and for uncommon applications. These are indications of discerning teachers who by their informed choices are beginning to specialise in the use of ICTs.

Given the relational patterns evident in the mapping in figure 1.4, levels of use, integration and development should be viewed as non-sequential applied levels. For example a teacher may be operating at an advanced application level, but may be struggling at a mechanical level. Alternatively, a teacher who extends an innovation may still be seeking information about the innovation in the orientation level and may not yet have implemented the innovation.

6. Findings

6.1 What teachers use technology for

The data showed that teachers’ use of technology permeated their personal and professional lives. The boundaries between personal and professional use of technology was found to be blurred. Technology was found to be used progressively for social, own studies, work related administration, for teaching (e-Teaching) and for learners learning (e-learning).

Teachers’ responses to what they used technology for showed: teachers’ personal study with technology influencing them to use technology for teaching; social networking services (SNS) in the personal space prompted use of SNS for learners. This appeared to show a progression among personal, administration, teaching and learning.

“Started with our cell phone...for admin of marks.”

“Started typing out our own question papers, I started (to) practice teaching and computers.”

The pattern of use is simply an indication of the emergent uptake pattern when teachers use technology.

Usage patterns were confirmed in both instruments. The survey instrument returned significantly variances in the use of social networking services (SNS) by teachers for own learning and with learners learning. It was noted that for own learning, teachers used more cloud based collaborative spaces. Table (2) below shows the diminishing intensity in SNS where use for personal purposes was used progressively less for own learning and learners learning.

<table>
<thead>
<tr>
<th>SNS - personal use</th>
<th>SNS - own learning / studies</th>
<th>SNS – teaching / learning school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facebook: 64 (84.21 %)</td>
<td>Facebook: 25 (32.89 %)</td>
<td>Facebook: 17 (23.29 %)</td>
</tr>
<tr>
<td>WhatsApp: 65 (85.53 %)</td>
<td>WhatsApp: 26 (34.21 %)</td>
<td>WhatsApp: 14 (19.18 %)</td>
</tr>
<tr>
<td>Twitter: 35 (46.05 %)</td>
<td>Twitter: 18 (23.68 %)</td>
<td>Twitter: 8 (10.96 %)</td>
</tr>
<tr>
<td>Google Docs: 43 (56.58 %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DropBox: 39 (51.32 %)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The findings of the use of technology confirm Kellenberger and Hendricks (2000) findings that teachers used ‘computers’ for more than teaching. They note:

Computer use by teachers was divided into three main components, namely, for teaching purposes (to impart knowledge, create variety, and to give confidence to teachers), administration purposes (in preparation of job-related materials and to ensure safe-keeping of data and information about students), and personal purposes (to engage teachers’ free time in a beneficial and fruitful manner) (cited by Bhalla, 2013, pp.176).

6.2 Methodology of use of technology

The activities for learners were similar to traditional tasks. Learners had to present classwork using a computer or research something and present it. Furthermore many of the activities that learners engaged in were primarily representational as opposed to generative (Hokanson and Hooper, 2000, pp.543).

“to find an artist…need image research…and find different images…and do research on the artist and get a reference pictures and write up (on a computer)…”

“I use the projector and SMART Board to play educational videos, discuss power point presentations, display textbooks, and project our i-Pad screen.”

These activities resonated at different intensities with Gagné (1985b) nine steps of instruction, the five teaching and learning events as proposed by Laurillard (2002) and Salmon’s (2000) five stage model of e-Learning. The overall practice using technology appeared to follow a predominantly traditional path aligned with institutionalised methodologies.

“I use a variety of different technologies and methods to see how it works…I tend to try and follow that pattern”.

The activities that were noted in the data include among others:

- teachers presenting and demonstrating lessons, creating assessments and providing digital resources
- teachers getting learners to find information using the World Wide Web,
- learners completing work using computers, doing assessments online,
- learners using social networking services (SNS) and using a learning management system (LMS).

This was evident in the purposeful selection of digital resources, interwoven with interactional tasks and learning opportunities. The data additional highlighted indications of project and problem based, and collaborative methodologies. These indicators allowed us to locate the use of technology at the basic, integration and, specialisation and innovation stages.

6.3 Pattern of teachers’ use of technology

The general findings were that the actions of some teachers bore similarity to traditional teaching or e-Teaching. As a first level of use, technology was the tool to perpetuate traditional methodologies. Teachers would demonstrate, describe, explain and set tasks for learners. These activities can be mapped to entry, adoption and learning how to use ICTs (UNESCO, 2002) and entry and adoption of DoE (2004; 2007). This is indicated by the basic and integration stages referred to in figure 1.4.

The survey responses tended more towards teaching (demonstration) than learners engaging with technology for learning (see table 2). The data suggests that technology use was at emerging stages with some use at innovative levels. This pattern of use correlates with implementation as an incremental process (Pedretti et al. 1999, pp.136).
“I use a data projector and an interactive white board AND I give projects in which students must use ICT”.

“We use blogs and wikis and occasionally Skype”.

**Table 3: Technology usage**

<table>
<thead>
<tr>
<th>I use the data projector to present our lessons:</th>
<th>I use the interactive white board (IWB) to present and demonstrate our lessons:</th>
<th>I get the learners to use the technology to complete their work (e.g. do a presentation, type a document, complete a worksheet):</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 (30.26 %)</td>
<td>9 (11.84 %)</td>
<td>17 (22.37 %)</td>
</tr>
</tbody>
</table>

All teachers typically blended traditional methodologies with technology integration aligned with the basic and integration stages referred to in figure 1.4. The progression evidenced in these stages was the progressive incorporation and experimenting with technology to extended traditional methodologies.

“We’re now moving towards a combination of Power points, simulation and yes, I still use the chalkboard as well.”

Teachers used simulations and applications (apps) for learners to interact directly with the digital resource. The teacher tells the learners what must be done; provides the limits of the learning opportunity; then guides the process and facilitates a debriefing of the activity by providing feedback and confirmation of learning.

“I use simulation software...we don’t have microscopes...we don’t have equipment for electricity experiments... we can do a circuit...through Phet simulation software.”

Teachers evidenced understanding how and when to use technology. They recognised the relevance of using collaboration and communication to augment learning activities. This was evident in the way in which the experienced teachers adapted technology and integrated SNS. This finding suggested a progression towards specialisation and innovation.

“I’ve introduced our learners to blog site where learners are able to interact and exchange ideas...voice their opinions.”

“I then introduced peer working for them to share more closely.”[reference to using technology for collaboration]

The stage of specialisation and innovation referred to in figure 1.4 in the use of technology was evident in fewer of the teachers. Teachers who operate at these levels typically traversed the entire gamut from entry to innovative. This stage of use employing a LMS was an example of technical specialisation. It is uncommon to find teachers use a LMS with learners at school level. The approaches employed using the LMS were the flipped classroom and blended face-to-face/online engagements. Both instructivist and constructivist approaches were evidenced in the activities. These approaches are not mutually exclusive and no activity appeared to be devoid of instruction as seen in the examples below:

“Learners log onto a site to engage with content and to do assessments...I’ve sequenced the digital object in such a way.”

“Make our own simulations like a podcast and upload to Moodle...learners watch on their own time.”

“PPTs are uploaded to Moodle...students download it...Learners review text, animations, videos, PPTs, podcasts or screen casts before class. In class they...complete text and...digital mind maps on computers”

Teachers were inclined to lean towards the familiar as they navigated new ground with technology. Their use was aligned to their skills and comfort zones. This finding is supported by, Shuldman (2004, pp.323) who stated...
that the “integration of computers...is characterised by...use of technology in such a way that it is compatible with the teacher’s established style of teaching”.

7. Discussion

Incremental use appears to emerge as a pattern across a range of contexts. The findings are congruent with other research that noted incremental and progressive use. Stoddart and Niederhauser (1993) pointed out that technology use could “fit into a spectrum of instructional approaches, varying from traditional to innovative” (quoted in Amin 2013, pp.6).

Dawes (2001) added an additional dimension that “change occurs” as teachers develop “professional expertise” “through stages” from “involved” to “integral users” ultimately (cited in Hennesy et al., 2010, pp.10). These are similar to the findings of Sheingold & Hadley, 1990; Hennessy et al. 2005 and Wilson-Strydom et al. 2005.

The progressive and incremental nature of implementation is also noted by Thomas and Cronjé (2007) as characterised by a beginning and a culminating process. Furthermore, traditional use appears to be the starting point for launching into newer ways, possibly indicating a progression in use.

Teachers used technology in ways familiar to them. These were in alignment with their comfort zones, own expertise, access to technology and levels of compatibility with current practices. Their pedagogical approaches mirrored their beliefs about what they thought was relevant and appropriate for learning. Teachers’ e-Learning practice was highlighted as a progressive pattern of action and was found to be aligned with the UNESCO (2002) and DoE (2004; 2007) frameworks. The teachers were found to operate at different levels of use simultaneously.

Levels of use, integration and development should be viewed as non-sequential applied levels. The way teachers use technology showed two patterns. The first: suggestions of progression in complexity in use from basic to advance. The second: progression in depth of developmental levels. These are not points of attainment, rather indications of growth.

A teacher could be working at different points, but his/her practice may be at varying levels of complexity. For example, an approximation is a teacher working in specialisation and innovation, such as using tools like a LMS, but, could only be operating in the LMS at a very basic level, such as only uploading resources for learners to access. Alternatively, a teacher who extends an innovation may still be seeking information about the innovation in the orientation level and may not yet have implemented the innovation. This is depicted in the consolidation of teachers’ engagements in figure 1.5 below.

Figure 1.5: Consolidation of teacher engagement
8. Conclusions

The data revealed that teachers’ e-learning practices comprise e-Teaching and e-Learning. There was a pattern of progressive application of methodologies from teaching to e-Teaching and from learning to e-Learning. It was found that what teachers used technologies for could be mapped onto a continuum of use (figure 1.6). It was further found that the way teachers used technologies through different approaches and methodologies could be positioned at different points of a continuum of practice (figure 1.7).

8.1 Continuum of Use

![Figure 1.6: Continuum of Use](image)

Continuums provide indicators of ranges or scales. Whilst a range of taxonomies, levels and stages exist, they deal in most instances with singularities. The points are not fixed description of final destinations, but rather levels of operation or engagement at these points. The findings suggest that teachers are able to be active at different points on these continuums and may operate at different points simultaneously whilst moving freely within the range. It is further noted that teachers engage in the use and integration of technology as a continuum of their practice at varying intensities and frequencies.

Emanating from this study is that technology is pervasive in the lives of teachers with initial indicators of domestication. There is a comparable synergy with previous research which found that teachers used technology for more than just teaching and learning. The analysis of our data has revealed additional aspects related to use and we were thus able to extend personal use of computers only, to include the use of social networking services (SNS) and cloud services and systems.

The findings show that teachers use technology for personal use, administration, personal and work related communication and collaboration, for teaching, for own learning and for learners’ learning, all along a continuum of: personal - administration - teaching - learning. There was no discernible evidence to suggest that teaching with technology exerted any backward influence on personal or administrative work. It is thus unlikely that the direction of the progressive stages in the continuum could be reversed. However teachers can be found to operate at different points of this continuum simultaneously. The use of social networking service (SNS) in this sample and at this point does not appear to validate notions of pervasive use. The findings in this study were that teachers used SNS progressively less along the continuum from personal to teaching to learning.

A natural link was found that bridged what teachers used technology for and the manner in which this was approached. It was thus possible to locate these actions on continuums for use and practice. The findings in this study further showed that teachers maintained some traditional ways of doing their work and were
progressively advancing their practice when it made sense to them. The progressive, incremental and transformative natures of teachers’ actions were found to correlate positively with the UNESCO (2002) and DoE (2004; 2007) levels of use and development.

9. Recommendations

This study yielded continuums of use and practice. It did not test the continuums in other contexts and fields of education. Further research is needed to test the utility value of the continuums of use and practice in evaluative studies. Such research should furthermore explore teachers’ specific activities.

References


Viewed November 2015.


Viewed June 2015.


Appendix A

1. Please select Gender
2. Which province do you teach in?
3. What type of school do you teach in?
4. Which area do you teach in?
5. Please choose all the grades that you teach?
6. Which social network services (SNS) do you use for personal purposes?
   - BBM - WhatsApp - MIXIT - Facebook - Twitter - LinkedIn - None - Other
7. Which of these social networking services do you use for your own learning / studies?
   - Google Docs - Drop Box - Sky Drive - LinkedIn - Facebook - Twitter - BBM - WhatsApp - Mixit - None - Other
8. Do you use any social network site for professional development / networking with your peers?
9. Select all the responses that indicate why you choose to use social service for your personal learning?
   - I can get easy access to information - I can collaborate on my work with friends - I can get help whenever I need it - I can be in contact with peers and lecturers at all times - I do not use SNS for my personal learning - Other reasons
10. Select from the list all that you use in your own learning?
    - Technology (e.g. computer / laptop / tablet / smart-phone) - Digital resources - LMS (e.g. Moodle / Sakai / Web CT) - SNS (e.g. Face-book / LinkedIn) - Cloud Services - None
11. Select all the options that you believe are the benefits that you gain from using technology / digital resources / LMS for your own learning?
    - It makes learning easier - I have more easy access to resources - It keeps me on the cutting edge of the use of ICT in education - It puts me in power in the classroom - It puts me at a higher level than the learners - It helps me cope with modern technology savvy learners
12. Which of the following are aspects that motivate your use of ICTs for yourself and/or your learners?
    - It is aligned with the way the learners learn - It helps me teach better - I can make learning more exciting for the learners - It is the way that learning takes place currently
13. Who do you think benefits MOST from your use of ICTs for teaching / learning?
    - Your Learners - You
14. What technologies (ICTs) do you use to teach with?
   *Data Projector-Document Viewer-Laptop / computer-Tablet-Smart-phone-Interactive White Board-None-Other*

15. Select the most important aspect that reflects why you choose to use technologies for teaching.
   *The learning experience is enhanced-It allows anywhere/ anytime learning-It allows self-paced learning-Teaching is more exciting*

16. What type/s of digital resources do you use for e-Learning (in the lessons with your learners)?
   *Video-Podcast-Simulations-Virtual worlds-Power Point / Presentations-Gaming-Animations-None-Other*

17. Select the most important aspect that reflects why you choose to use digital resources for e-Learning.
   *The learning experience is enhanced-You get to see and do things that you cannot do in the traditional way-Teaching is more exciting*

18. Which of the following social network services do you use for teaching/learning at school?
   *LinkedIn-Facebook-Twitter-BBM-WhatsApp-Mixit-None-Other*

19. What Virtual Learning Environment (VLE) / Learning Management System (LMS) do you use for teaching/learning at school?
   *Moodle-Web CT-Sakai-Edmodo-None-Other*

20. Indicate the most important factors only that motivate you to use ICT for teaching?
   *It is convenient-Can bring the world into the classroom-It is a fast means to access information-It makes my work easier-It allows simulation of real world experiences-It is aligned with the learners way of working-It is mandatory at my school that we use ICT for teaching-There are many resources available to enhance my teaching-I found that it works for me in my teaching-I found it works and the learners learn better*

21. Which of the following reflects how you use technology (ICT) and digital resources for teaching and learning in your classroom?
   *I teach learners how to use the technology-I use the data projector to present my lessons-I use the interactive white board (IWB) to present and demonstrate my lessons-I get the learners to follow the instructions of the computer program-I get the learners to use the technology to complete their work (e.g. do a presentation, type a document, complete a worksheet)-I get the learners to use the camera or microphone to create their assignments*

22. Which of these are typical of how you use social network services (SNS); a LMS-VLE systems or cloud services for teaching and learning in your classroom?
   *I respond to questions and request for help online-I send reminders of homework and tasks to be done-I set out questions and exercises-I use the drop-box or upload facility to get work sent to me-I engage in discussions in a forum with the learners-I get the learners to use the forum or blog to discuss their work-I set out lessons with information, assignments and assessment for the learners-I put out information for learners to access on their own*

23. Which of these are typical of why you choose to use these social networking services (SNS); virtual environments and cloud services?
   *Helps manage teaching-Helps manage learning-It is useful if a learner is absent-The Learner can work on his/her own pace-A virtual system like a LMS is a useful all in one management system-It is more convenient to access documents and information from the cloud-Using the cloud means I don’t have to use a LMS or any internal system-It is easy for me to get a message to the learners using a SNS-The SNS is useful for short quick messages-The SNS is useful for rapid responses-With the SNS I am connected to my class all the time-My school has made it compulsory to use one or all of these options for teaching and learning-There is pressure from the learners for me to use it at our school*

24. What methodology (approach) do you use in your lessons when you integrate technology and digital resources?
   *Constructivist-Instructivist-Connectivist*

25. Which one of the following best represents what motivates you to use e-Learning for your learners?
   *It is the way of the future-It is how learners learn-It is easy to use-It is a better way of learning-It makes my work easier*

26. Do you think the learners learn better with or without ICTs?
   *I don’t use it because I do not have access-No affect…I make a plan to get access-I use it only if I can get access.*
28. How does technical support for technologies and systems affect your decisions to use technology for teaching/learning?
   I don’t use it because I do not get support if something goes wrong or does not work-No affect... I find a way to make it work-I use it if I know that there will be technical support.

29. How does the availability of digital resources affect your decisions to use it for teaching/learning?
   I don’t use it because I do not have any and cannot get access to these resources-No affect...I make a plan to get resources-I will only use it if I and get it from somewhere or someone.

30. How does support of management / peers / department affect your decisions to use ICTs for teaching/learning?
   I will not do it because there is no support at school or from the department-No affect... I will make a plan to do it without any support-I will be willing to use it if I get the support that I need.

31. Please state what are the things that prevent you from using ICTs for e-Learning / teaching?
   Having the latest technology-Having good digital resources

32. What do you think is more useful to help learning: having the latest technology, or, having good digital resources?
   Tablets...Yes-Tablets...NO-Cell phones...Yes-Cell phones... No

33. Do you think we should be using tablets or cell phones in classrooms?
   Interactive digital resources are more useful-interactive white board is more useful.

34. Do you think interactive digital resources (e.g. simulations, virtual gaming) are more useful that having an interactive white board?
   Interactive digital resources are more useful-interactive white board is more useful.

35. Please type any comments that you may have in the space provided.
Project Robot: A Software Simulation for Systems Engineering Education

Ross D. Arnold and Jon P. Wade
School of Systems and Enterprises, Stevens Institute of Technology, NJ
ross.arnold1@gmail.com
jon.wade@stevens.edu

Abstract: The U.S. defense industry spends billions of dollars each year developing defense systems to keep the nation and allies secure. However, the failure rate of system development is notoriously high. Even when development efforts do succeed, they often do so with cost overruns and compromises in system performance. As a result, large amounts of money are wasted in defense acquisition, leaving the nation both poorer and less secure than it could be.

Though this problem is certainly multi-faceted, one way to approach the problem is to provide better systems engineering education to engineers. Systems engineering skills, generally considered to be key to the successful development of large scale systems, often require many years to acquire. However, recent research investigates the theory that these years can be reduced through the use of simulation software.

This paper describes Project Robot, a defense systems engineering simulator designed to facilitate the acquisition of systems engineering skills at an increased rate. Project Robot was the co-winner of the 2010 Experience Accelerator international systems engineering simulator competition held at Stevens Institute of Technology, NJ. The development of this simulator is a first step towards the design and development of experience accelerating simulations and software games that push the boundaries of engineering education to the next level using modern computer software techniques. The paper introduces the concepts of systems engineering and systems thinking, then discusses the Project Robot game concept, design, theory, and implementation, including detailed screen captures. The paper concludes with a discussion of the future of Project Robot and related research efforts to improve systems engineering education through simulation.

Keywords: systems engineering, systems thinking, systems approach, system dynamics, systems engineering education, systems thinking assessment, educational games, experience accelerator, experiential learning, game-based learning, system analysis and design, systems engineering and theory, simulation

1. Introduction

Despite their importance to both national and global security, many challenges lie in the path of large-scale defense system acquisition and development. One of these challenges is to effectively build the skill sets of the engineers responsible for overseeing these highly complex, large-scale systems. These engineers often shoulder a great mantle of responsibility and can significantly affect the course and outcome of engineering projects. However, many of the most experienced among these systems engineers are leaving the workforce in the near future, leaving an experience gap behind (International Council on Systems Engineering, 2014). This predicament is not shouldered by the defense industry alone; the problem affects areas ranging from healthcare to the space program to industry and more. As highly skilled engineers retire and exit the workforce, key sources predict that a 15 year skill gap will emerge (International Council on Systems Engineering, 2014).

This skill gap opens a Pandora’s Box of questions. What happens when we no longer have highly skilled engineers to oversee these massive defense projects? Will we, as a nation, still be able to maintain our military edge over our adversaries? Will we expend so much money in our defense engineering projects that other areas of the nation will suffer as a result? The political implications and affected systems are convoluted, complex and impossible to predict at present. Meanwhile, what can we do to mitigate this huge risk?

One way to approach this challenge is to educate engineering students in these areas of complex systems thinking and systems engineering. However, unfortunately the skills required by the systems engineers overseeing these systems are developed over long periods of time, and through vast experience. These are not skills traditionally taught at the university level, though some universities have begun to offer classes in these areas.
As one way to improve education in various systems engineering skills, research into the use of systems engineering simulation is underway (Squires, Dominick, Wade, & Gelosh, 2011; Valerdi, 2012; Wade et al., 2015; Zhang, Bodner, Turner, Arnold, & Wade, 2016). Using simulation, realistic scenarios can be offered with accelerated timescales. These scenarios provide a way for students and learners to experience the full life cycle of an engineering project, at least in some small way. This approach is similar to the use of flight simulators, tank simulators, or other types of training simulators in various other fields. Of course, simulations are not (yet) a replacement for real life experience; it will probably be quite some time before they are. However, simulations offer many advantages over other learning methods; they provide a way for learners to actually experience a scenario with many of its embedded intricacies and complexities, rather than read or hear about it through other educational materials.

As a spearhead effort to research systems engineering simulation, Stevens Institute of Technology held the Experience Accelerator competition in July of 2010. The competition challenged students from across the world to build an innovative serious game or simulation that enabled future technical leaders to gain key experience to prepare them for the demands of developing and deploying complex systems. The overall objective of each simulation was to build insights and wisdom, and hone decision-making skills by (Stevens Institute of Technology, 2010):

- Creating a “safe” but realistic environment for system level decision-making where the participants have to make the trade-offs between the need for more analysis and information and the need to “get done” with the limited time and resources available
- Providing rapid feedback by accelerating time and letting the participants experience the downstream impact and consequence of their actions and decisions

The Project Robot simulation, which is the focus of this paper, is a defense systems engineering simulator designed and developed for the competition. Project Robot tied for the $10,000 grand prize, with another simulation titled Healthcare Reborn (Dimitrov, Hess, Perkins, & Valerdi, 2010). The following sections in this paper describe some key principles of both systems engineering and systems thinking. These two skills are core to Project Robot’s design. Following the descriptions of these skills, the details of the Project Robot simulator are described.

2. Systems Engineering

Systems engineering is the design and creation of complex technical systems of any sort. When speaking of systems engineering, it is often implied that the technical systems under discussion are highly complicated, such as airplanes, cars, computers, guns, jet engines, or smart phones. Thusly described, systems engineering may sound overly broad, but this is necessarily so; systems engineering often draws upon many engineering disciplines as well as interpersonal skills. On a single large-scale project, many engineers often perform systems engineering in addition to their other technical duties. However, often the title of Systems Engineer is held by only one, or just a few, engineers. A single term to describe what this Systems Engineer “does for a living” is needed. This broad, general concept of systems engineering is widely accepted in the field (BKCASE Editorial Board, 2016; International Council on Systems Engineering, 2014; Zhang et al., 2016). It is important to be able to collectively describe the skill sets of engineers doing this kind of work so that education and training efforts can be targeted towards their needs.

According to the literature, systems engineering is an interdisciplinary approach and means to enable the realization of successful systems (International Council on Systems Engineering, 2014).

Successful systems must satisfy the needs of their customers, users and other stakeholders (BKCASE Editorial Board, 2016). In the defense industry, this usually means producing cost-effective, performant, user-friendly systems that enhance national security and/or Warfighting functions.

It is often said that systems engineering and technical leadership is as much an art as a science (Zhang et al., 2016). While a traditional model of education can teach the fundamental body of knowledge, it is not until this knowledge is put into practice in an integrated, real world environment that a systems engineer can develop the necessary insights and wisdom to become proficient.
Systems engineering educators are struggling to meet the growing educational demands for a workforce able to solve problems driven by accelerating technology, rapidly evolving needs, and increasing systems complexity (Bagg, Brumfield, Casey, Granata, & Jamison, 2003; Davidz & Nightingale, 2008; Squires, Wade, Dominick, & Gelosh, 2011). At the same time, there is a widening gap in industry between the need and the availability of systems engineering practitioners with the necessary experience to address these challenges (Charette, 2008).

3. Systems Thinking

A key part of successful systems engineering involves using a skill set called systems thinking. Systems thinking is a set of synergistic analytic skills used to improve the capability of identifying and understanding systems, predicting their behaviors and devising modifications to them in order to produce desired effects. These skills work together as a system (Arnold & Wade, 2015).

Systems thinking can be used to better understand the deep roots of complex behaviors in order to better predict them and, ultimately, adjust their outcomes. With the exponential growth of systems in our world comes a growing need for systems thinkers to tackle these complex problems. The problems we now face are stubbornly resistant to our interventions (Richmond, 1993). Now more than ever, it has become necessary to recognize the need for a paradigm shift that can carry our analytical efforts beyond the reductionist approach, and towards a more comprehensive systemic perspective (Dominici, 2012).

Systems thinking provides a holistic approach that results in greater success when describing and analyzing these kinds of complex problems (C. Liew, Foo, Lee, & Goh, 2006). Studies have clearly shown the advantages of using systems thinking when solving ill-defined, non-routine problems and making decisions in a world that exhibits a high degree of interconnectedness along with many uncertainties and complexities (Haines, 2000; Houghton, 1989; Kaufman, 1980; Resnick & Wilensky, 1998; Senge, 1990). Systems thinking has been used to tackle a wide variety of problems in different sectors (Burandt, 2011; C. Y. Liew, Foo, Goh, & Lee, 2014; Luong & Arnold, 2016; Pan, Valerdi, & Kang, 2013).

Systems engineering entails systems thinking and several other skills. These skills are exercised by design during the use of the Project Robot simulation.

4. Project Robot: Game Concept

The Project Robot simulator presents a situation in which the player is responsible, as the lead systems engineer, for the development of a large military robot. This includes a three-year design and development period followed by a ten-year maintenance period. Although such robots do not actually exist in the military today, Project Robot was built by a defense systems and software engineer and is based upon real experience in the defense engineering field. The underlying principles and systems engineering skills required to navigate the scenario are identical to those required in typical defense engineering projects.

Project Robot focuses on several systems engineering challenges. These challenges include balancing stakeholder needs both against each other and against the true needs of a system, the necessity of making tough choices without complete information, and the consequences of early system design decisions. All of these challenges are very real and are present in actual defense engineering, often arising as key barriers to success.

Project Robot presents decision-based game play and was designed with realistic but achievable goals as well as a balance between fun and learning. Rewards are score-based, and the game provides evaluation data in the form of final scores and ratings. Multiple play-throughs are encouraged to produce additional learning. No training or preparation is required to play the game, provided that the user has a basic knowledge of computers and some basic computer skills. All necessary information and instructions are presented in the game format during gameplay as needed.

5. Project Robot: Gameplay

The Project Robot game is set in the not-too-distant future, with the player taking on the role of a chief systems engineer of a military defense system intended to be used to fight off an alien invasion. During gameplay the player can interact with a set of seven stakeholders that both control project funding and
provide information and feedback to the player. These stakeholders have different viewpoints which are often contrasting. The stakeholders may also change at random; for example, a particular senator with one set of preferences may be randomly replaced by another with a completely different set. The player must take steps to accommodate for these possible changes. The stakeholders include:

- A senator
- The player’s direct supervisor
- A military equipment trainer
- A government integrator responsible for putting all the pieces together
- A contracting company responsible for the manufacturing of the robot
- A politician
- A user / Warfighter representative

This set of stakeholders is simplified, but consistent with typical defense projects. The player has the opportunity to ask a limited number of questions (Figure 1) to these stakeholders to determine their needs and preference, and then spend a limited amount of resources to choose and refine different components, sub-systems, and attributes of the giant robot (Figure 2) in order to satisfy these preferences and ultimately field a product that fulfills its purpose.

**Figure 1: Stakeholder Question Screen**

The names of the various stakeholders are deliberately humorous in order to provide an additional layer of enjoyment to the game. Approval ratings for each of the stakeholders are shown on the right side of the screen (Figure 1). These ratings can be accessed at any time from the overview screen (Figure 3).
The player is able to manipulate the robot’s design through interaction with the overview screen (Figure 3) and other related screens. The overview screen shows the overall system specifications and attributes according to its current design, and allows the player to select different parts of the robot to enhance, change, or build.

**Figure 2:** Robot Attributes Screen

**Figure 3:** Project Robot Overview Screen
To measure the player’s success or failure, the game keeps track of a score based on how well the player’s decisions meet the needs of the stakeholders and how well those decisions meet the real needs of the system. The system’s real needs are randomly generated at the beginning of a game, and are reflected to some extent in certain stakeholder needs. However, the real needs and the stakeholder needs are not identical. As in real life, engineers and managers can only take best guesses at how a system should be designed. Different stakeholders also have different priorities and perceptions of system needs. Some of these might be accurate, but some are likely very different from true user needs. A software user interface that a designer considers extremely clever might, in fact, not be appropriate for its user-base. Sometimes (uncomfortably often, in fact) systems designed by intelligent people still fail to meet their true needs when used in a real environment.

Score calculation in Project Robot places a much greater emphasis on how well the player’s design choices meet the real needs of the system, with less emphasis on how well they meet the needs of the stakeholders; however, if stakeholder needs are not met, stakeholders may cut funding to the program, compromising the player’s ability to build the “correct” system. In the real world, money is provided by a person or company. If this person or company is not happy, money will not come, whether or not the system is actually designed correctly. Designing and developing a technical system is a balance of keeping the money-providers happy while developing the system that the end users actually need (and the two often do not align completely). Figure 4 shows the game’s stakeholder approval screen.

Figure 4: Approval Screen

The game is separated into two phases. Phase One is the design and development phase, and Phase Two is the fielding and maintenance phase. Phase One occurs over a three year period in-game, allowing the user twelve turns (a quarter-year per turn) to develop the robot. The user is awarded more questions to ask the stakeholders after each turn, and, of course, items with associated development times are brought closer to completion. After each year in the development phase (i.e. every four turns) an “operational demonstration” will occur, which essentially is just an in-game way of saying that the stakeholders will alter their approval ratings and settle on funding for the project for the next year. Score and additional funding is given to the player for high approval ratings. The idea behind this gameplay element is to simulate the real world fiscal year cycle that governs most military system development.

After three years of in-game time (twelve turns, as stated previously), the giant robot system is fielded and the game enters into Phase Two. Phase Two covers a period of ten years post-deployment, with one year per turn instead of one quarter (for a total of ten turns). At this point, the score is now determined only by the closeness of the system to the true needs of the field. However, stakeholder approval still governs yearly funding, so it still holds an importance to the player even though it no longer directly affects game score. Also
in Phase Two the player is no longer allowed to make major system changes, such as re-selection of sub-systems. The player may still tweak parameters and alter equipment and accessories, though the resource cost for such tweaks is vastly increased.

The game ends after the full 22 turns (Phase One, development phase, plus Phase Two, maintenance phase), and at that point the player is given a final score. The game ends in failure if the player has not selected all sub-systems by the maintenance phase (Figure 5); without all sub-systems (head, legs, engine, etc.), the robot cannot operate and thus has failed. If the player has selected all sub-systems, then poor systems engineering decisions, such as failing to spend resources to boost confidence in sub-system interfaces, simply result in a lower final score.

Figure 5: Failure Screen

The game is designed so that the player can replay the game after success or failure, with a different solution and different stakeholders generated at random, using lessons learned from the previous game to try to attain a higher score. This paradigm provides students with a way to directly apply what they have learned from the experience and see how much better they can do; because the solution and stakeholders are randomly generated, the game experience will be different and replay value is high.

6. Project Robot: Lessons and Learning

Project Robot is designed to support a number of learning objectives. Some of its lessons are emphasized as the primary lessons of the game, while others are learned simply through the general experience of playing through the simulation.

The first lesson is based on the fact that many systems have unclear requirements and are the result of the input of multiple people with different opinions and viewpoints; building a successful system depends on how well these viewpoints are balanced and managed. This is reinforced by the way that the game handles multiple different stakeholders with different needs, many of which are not in line with the true needs of the system.

Secondly, the player will develop an appreciation for the importance of early design and architecture decisions, learning the frustration of managing the results from a poor decision made years ago based on incomplete information. This lesson is reinforced by the way that the game handles sub-system selection and
improvement, and how changes to these systems are very resource- and time-consuming, as well as the fact that many components are restricted either cost-wise or technically by architectural decisions.

Thirdly, the player will develop an understanding that, at times, it may be necessary to make decisions and continue to move forward with system development even when full information is not available. Very often these types of decisions must be flexible to accommodate unseen circumstances. This concept is reinforced in game by the way that information is garnered from stakeholders at a staggered pace over successive turns. The concept also manifests itself in the way that the true system needs are not revealed until the system is actually fielded. When the true system needs become apparent, changes to the system may be needed even after the three year development cycle is complete. In these cases, a design that emphasizes flexibility is highly desirable. If the system was designed to be inflexible, changes may not be possible after deployment and the system may perform poorly with no reasonable avenue for improvement.

Another of Project Robot’s lessons is the idea that interfaces between sub-systems must be touched and explored. Interfaces and interactions between components should not be left to chance. Spending resources on interface improvement may not actually show visible attribute improvement, so it may not seem intuitively beneficial. However, the quality of interfaces between components tend to have a large effect on overall system robustness. The game reinforces this take-away by the nature of the score assigned in the post-development phase based on interface confidence levels.

Scores in Project Robot are calculated based on external needs, including numbers (attacks, defense, sensors) and preferences, internal needs (limits such as weight, cooling power), and true needs vs. stakeholder desires. Of particular note, the needs of the Program Manager are generally the most critical during system development in order to procure sufficient funding, but these needs do not always align with the true needs of the Warfighter. The needs of the Program Manager and Warfighter generally align more closely than the needs of other stakeholders, but are still not identical and thus balancing is needed between procuring funding, and developing the correct product for the Warfighter. If the Program Manager is not happy, funding will be withheld and the program will fail. However, if the Program Manager is completely appeased, the product will actually not be the correct product for the Warfighter. The player (the Chief Systems Engineer) must mindfully balance the appeasement of the Program Manager with the needs of the Warfighter, discovering both through strategic information-gathering (using the provided questions). Additionally, the warfighter himself does not know the precise true needs of the project, and thus some randomness is introduced.

Future unimplemented plans were to include a research screen which would allow a player to allocate resources to research the true operational needs of the system. This would add an additional facet – forcing the players to choose between operational solution and stakeholder needs, instead of simply between the needs of different stakeholders (as in the submitted implementation). In the implementation submitted to the Experience Accelerator competition, this capability was not included. In future iterations of the simulation, such a capability would be desired.

Overall, the player will take away a general understanding and appreciation for many critical aspects of the system engineering process that are typically only gained through experience, as the game provides a limited but important subset of systems engineering experiences that are difficult to teach in a classroom setting.

An area for additional consideration is the use of post-game reflection as a learning tool. Although Project Robot did not implement this method, research indicates that it can be effective (Wood, 2011). A simple way to introduce this concept would be to provide players with an additional “reflection” screen upon completion (or failure) of the Project Robot scenario. This screen could be used simultaneously as a reflection for the player, and as a way to collect data about the player’s usage patterns. On this screen, players could be asked a variety of appropriate questions, such as:

- What was the main reason for your success (or failure?)
- What could you have done better to improve your success next time?
- What area did you feel you spent too much time on? Not enough time on?
- Which system attribute did you feel was most important? Least important?
• Which stakeholder’s opinion did you feel was the most critical? Least critical?
• What is the most significant lesson you have taken away from this play through?

These questions are just a sampling of the types of questions that could be asked. Using this method, players would have the opportunity to think and reflect upon their actions, as well as provide additional information that could be used to assess the player’s learning. This information could also be leveraged to evaluate the effectiveness of Project Robot as a learning tool. For example, the significant lessons learned, and the stakeholder’s opinions judged as most critical, should match up with the simulation’s learning objectives. In this way, a post-game reflection would address three significant areas: learning, learning evaluation, and simulation improvement.

7. Project Robot: Learning Evaluation and Assessment

The evaluation and assessment of systems thinking and systems engineering is an area of significant ongoing research (Arnold & Wade, 2015). Project Robot provides a final score to its users, and this score can actually be used to evaluate learning over successive plays. The final score indicates the closeness of the robot’s final specifications to the true needs of the system, and thus describes with some accuracy, the player’s success in the simulation. If this score is recorded periodically over the course of several plays, variations in the score could be used to demonstrate that learning has occurred.

Problems arise in that it might be difficult to separate out systems engineering skill from simply skill in the game interface itself; surely over multiple plays, the player will acquire a better understanding of the Project Robot game and its interface, and therefore play more successfully. However, the variations in scores of experienced systems engineer vs. an inexperienced or non-systems engineer could be used to determine the validity of the simulation score as a learning assessment measure.

Pattern matching techniques could also be used to record the playing patterns and strategies of expert systems engineers. These patterns could then be used to analyze and evaluate the playing style of less experienced engineers. For example, more experienced engineers might focus more questions on particular stakeholders, while inexperienced engineers might distribute questions equally across all stakeholders. Research into the use of this technique for systems thinking assessment using simulation is ongoing (Arnold & Wade, 2015) and could be applied to Project Robot as well.

Usage pattern matching is likely to be effective for simulation performance assessment, but requires different validation than the use of a game score. Usage pattern matching assumes that the simulation itself accurately represents a system that experts would excel in, while non-experts would not. Although the score in the actual simulation becomes less important than the player’s usage patterns, the fidelity of the simulation remains crucial. One way to validate the fidelity of the simulation could be through post-game evaluations provided to expert systems engineers; let the experts verify the system. Usage pattern matching techniques for simulation performance assessment do offer several benefits, such as a de-emphasis on the game’s scoring mechanism (which could be flawed or incomplete), and a way to explore the complete picture of the way a player interacts with the system (potentially revealing more insight).

8. Project Robot: Architecture and Implementation

Project Robot was built by a single programmer in the C++ programming language. It was designed for the Microsoft Windows family of operating systems. All of the artwork is original, with the exception of the picture of the Robot itself and the background of the first screen, which is a NASA photo from the Hubble Space telescope.

By design, the game does not require a Windows install. This capability affords it the flexibility to be played by a user lacking Administrator rights. However, the game does utilize the Windows Application Programming Interface (API) and thus can only be used on Windows operating systems. Although this design allowed for a complete, robust program development at the time, modern web languages allow for the implementation of a high level of capability while facilitating cross-platform deployment. Also, the C# and Java programming languages both provide methods for cross-platform deployment. One of these technologies would be ideal for a port of the Project Robot code, or for future projects within this subject area.
9. Project Robot: The Competition

During the Experience Accelerator competition in 2010, Project Robot was exercised by several evaluators as well as demonstrated to an audience by its creator. Universally, the game was rated as a high-quality software program with a compelling gameplay style and high potential to achieve important systems engineering learning outcomes. Subjective opinions provided by graduate student evaluators revealed that the simulation actually did improve systems engineering knowledge and skills to what was considered a moderate degree. However, as noted in the above sections, a more quantifiable method of learning evaluation would be highly desirable. The evaluations resulted in the emergence of several key feedback areas.

Firstly, evaluations revealed that the game accurately depicted an appropriate defense engineering system, including multiple common pitfalls associated with building such a system. A number of strengths were identified, many of which were incorporated into future research projects (Zhang et al., 2016). Notable strengths included:

- Conflicting stakeholder needs with limited ability to discover all stakeholder desires
- Limited resources to be distributed over many different system attributes
- Changing stakeholders over time
- An accurate engineering life cycle for large defense projects
- Long-term consequences for short-term shortcuts and decisions
- A need to balance building the correct system vs. facilitating continued inflow of funds
- The need to design for uncertainty
- A visually engaging, easily-approachable user interface
- Depth of the number of available choices and options

Along with these strengths, evaluators also noted areas in which the simulation suffered or could be improved upon. Some evaluators felt that the simulation was too difficult to learn, and took too long to complete. The first play-through of the simulation typically took between 2 and 3 hours to complete. Some evaluators expressed that a shorter simulation might be more appropriate, while others indicated that the time was actually appropriate. Notably, those who felt that the simulation took too long tended to be experienced professors, while those who felt the simulation was appropriate were younger graduate students who may have been more accustomed to learning and playing new computer game (as well as the time it takes to do so).

Several evaluators expressed their opinions that the game did not feel “sufficiently game-like.” Rather, it was more of a simulation, and less of a game. This may or may not be considered a problem, depending on the intended audience and use of the simulation. For example, the simulation was likely more appropriate for a classroom session than as a publicly-available game. However, in either case, a highly engaging simulation is desirable.

Ultimately, due to the game’s accurate depiction of systems engineering activities and their associated pitfalls, along with its close adherence to the objectives of the competition and fluid gameplay style, Project Robot tied for first place in the competition.

10. Conclusion and Future Work

Many of the ideas and concepts both included in the Project Robot simulation and discussed in this paper have been incorporated into the Systems Engineering Experience Accelerator (SEEA) (Zhang et al., 2016). The SEEA is a web-based software platform with a Java-based back-end that facilitates learning through simulation. It is the spiritual successor to the Experience Accelerator competition, and has built upon the lessons learned during the competition as well as the ideas presented in the competition’s game entries. The concepts introduced in Project Robot are being furthered through the SEEA simulation and other systems engineering research efforts.

One important area of future work is to actually apply the Project Robot simulation to learners and evaluate the results. As part of the competition, Project Robot was only played by a 12 players in total. All 12 players subjectively stated that they felt they had gained Systems Engineering insight through the game. However,
applying the simulation on a larger group of subjects as a more formalized research effort would be desirable. An evaluation method that formally assesses learning is also highly desirable.

Despite Project Robot’s various successes, improvement to several areas of the simulation would be desired based on feedback acquired during the competition. Also, new enhancements could significantly improve the game as well.

During the Experience Accelerator competition, the introduction and orientation of the game turned out to be relatively time-consuming, taking 30-45 minutes. A simpler, more streamlined version of the game would be desired. For example, the sub-system selections offered to the player could be much more limited than those included in the current game. Also, the different attributes of the robot could be reduced from over twenty to less than ten. Minor changes such as these would likely improve the initial gameplay experience considerably while not impacting the learning in a significant way.

Project Robot forms the basis for a game that could evolve based upon the feedback of students and instructors using the game in a classroom setting. Its architecture and design is intended to be expandable and flexible; the lessons of Systems Engineering are not lost upon the design of Project Robot itself. One exceptional feature would be a multiplayer mode in which a team of systems engineers could all develop different parts of the system in tandem, with a much more in-depth view into the selections of system sub-components, right down to specification diagrams, informational drawings and data sheets of each selectable sub-component that would appear just like real life.

Another improvement to the game could allow spin-off programs from the main program. For instance, if the giant robot performs well in the field after two years, perhaps one or more spin-off programs would be requested by the Product Manager, and the player would then be required to manage several projects all at once. This could be an advanced version of the game. It would be played by the player after successful completion of the basic version, perhaps in a successive systems engineering class or lesson. For example, in a theoretical class called “SYS 999 – Practical Applications of Systems Engineering” perhaps one class period would be based on the students playing a session of the basic version of Project Robot, with a second game session afterwards, for a total of two sessions of the basic version. Once the students had an idea of how to play and had learned some of those systems engineering lessons, they could move onto the advanced version of Project Robot in the next class period, which could then include those spin-off systems and possibly the multiplayer mode as well as other more complex game play aspects that would be difficult for a new player to understand. Players could even import their data from the basic version and continue working with the system they previously built, perhaps with new technological developments and more options that would give them added appreciation for system flexibility.

Improvements to the Graphical User Interface are also desirable. For example, instead of a screen that lists stakeholders and questions as text, the game could include a graphical depiction of a meeting table along with pictures of the faces of the various stakeholders. The game could also include a meeting room to speak with stakeholders, an office to analyze system requirements, and a lab or set of labs where each sub-system component could be selected and refined. These improvements would create a more modern game-like environment that would likely feel more interactive and easier to learn. Additional UI improvements could include dynamic buttons that animate and move around depending on where the mouse is on screen, floating graphical tooltips for help on different game features and things of that nature that could greatly enhance the playing experience.

Another interesting improvement could be to remove the “content” from the “game engine” to allow any content to be used in the game. Such a capability would allow an instructor to take an existing Systems Engineering project, one that had failed, for instance, and plug its contents into the game. Students could then play through and experience the failure themselves, or try to make the project succeed. This type of capability is being explored in other systems thinking research such as the Systems Engineering Experience Accelerator (SEEA) (Arnold & Wade, 2017). Project Robot is currently undergoing a software port to the SEEA platform. The SEEA is the spiritual successor to the Experience Accelerator competition, and has been put to use by the United States Defense Acquisition University as well as the United Kingdom Ministry of Defence. The SEEA allows the introduction of a variety of different systems engineering scenarios, as well as the use of different simulators to produce different kinds of results. The SEEA expands the limits of systems engineering education.
as it continues to grow and improve, allowing both beginner and veteran systems engineers to experience engineering projects in accelerated time according to specific learning objectives. The future plans for the SEEA involve additions of multiplayer capabilities, additions of new simulators and systems, and additions of evaluation capabilities for both systems engineering and systems thinking. This is a future in which systems engineers must no longer spend decades working complex engineering projects to learn critical “life lessons” about systems engineering, which can be costly and detrimental on a massive scale. In this future, we see a significant reduction in time, money, and material waste as engineering education improves, moving us another step closer to global sustainability.

References
Stevens Institute of Technology., 2010. Experience Accelerator: An Interdisciplinary Student Competition. Hoboken, NJ.
Appendix A: Experience Accelerator Objectives and Guidance

The following objectives were offered as part of the Experience Accelerator Competition of 2010 (Stevens Institute of Technology, 2010). This appendix describes how Project Robot fulfilled each objective.

Creating a "safe" but realistic environment for decision-making where the participants have to make the trade-offs between the need for more analysis and information and the need to "get done" with the limited time and resources available:

This objective is one of the primary challenges presented by Project Robot; with a limited number of questions to ask stakeholders each turn and a time limit in terms of when the system must be complete, the player must make trade-offs between learning more information about stakeholder needs and system needs and simply making the best choice possible at any given time despite lack of information.

Providing rapid feedback by accelerating time and letting the participants experience the downstream impact and consequences of their actions and decisions:

Project Robot is designed to directly meet this objective by its format of a 13 year system life cycle that awards players based on actions and decisions made during system development. Most of the game score is awarded during the 10 year post-development phase but is based primarily on decisions made during the 3 year development phase, which shows players how their decisions have impacted the program success many years after the original design.

Developing the insight that even the "best" system is worthless if it does not provide the expected value in the environment in which it is being used. It is therefore important to understand the fundamental needs a system shall address, and the multidimensional context that it is developed and deployed in:

This concept is directly addressed by the score awarded in the post-deployment phase; even the “best” system, either as dictated by one or more of the stakeholders or as determined by the player (for instance a system with the highest possible long range attack and defense values) is worthless if it doesn’t meet the true needs of the system (i.e. provide the expected value), and this is reflected in the score awarded in Phase Two of the game. This shows the importance of understanding the system’s fundamental needs, which can be most closely ascertained by spending questions on the User stakeholder, who has the most intimate knowledge of what the system must do.

Developing the insight that a system’s defining properties are largely a consequence of the interfaces and interactions between its constituent elements and less a result of the properties of the elements themselves. In addition, identifying the impact of early conceptual and architectural decisions on system capabilities and flexibility:

A major factor of score in the post-deployment phase of Project Robot is the confidence level of the interfaces between various sub-systems and system components, which is a part of the system that the player may spend resources on during both the development and maintenance phases of the life cycle. This shows that even a system with excellent parameters, such as high defense values and great maneuverability, is likely to fail without proper time and resources spend refining and exploring the system’s interfaces. As to the second piece of this objective, early architectural decisions have a major impact on the system in Project Robot due to both funding and development time; for instance, changing the Frame of the robot results in every other system requiring re-development, so if the Frame of the robot were changed halfway through development cycle, the player would probably not even be able to deploy and would receive a game-over at the entrance to Phase Two. The same is true for other sub-components – each takes time and funding to develop, and this time and funding is lost if major changes are made later in the development cycle, so it is very important to make flexible decisions about sub-systems that allow for different accessories, armor types, or other equipment that may be necessary to achieve system success, especially when information available is slim, such as at the beginning of the game.

The real needs are often: hidden behind perceived needs or expressions of needs in the form of (inadequate) solutions, or a smokescreen of conflicting and inconsistent "requirements," and might evolve while the solution is being developed:

The real needs in Project Robot are hidden behind the desires and wishes of the stakeholders – no stakeholder’s preferences are perfectly in line with the “true” solution, and many are even inconsistent with each other. Additionally, some stakeholders can and will change completely partway through the game,
bringing entirely new sets of needs and requirements to the table that may not be consistent with the current stakeholder needs.

Many stakeholders have to be satisfied before the solution can even be made available to the stakeholder(s) with the "real" needs:
In order to achieve score and funding, approval ratings for each stakeholder must be taken into consideration, even when their needs may not reflect the "real" needs of the system. If these approval ratings are ignored, the project may not even get enough funding for completion, or at the very least, will not have enough funding to develop a solution that will adequately satisfy the User stakeholder after being fielded, resulting in serious score penalties.

Most system level problems are either due to issues at the interfaces, interactions between system elements, or a poor understanding of the real needs:
This is reflected in the way that Project Robot calculates and adds score. Interface confidence levels are a major factor to score, and if the system’s real needs are not understood and met, score will suffer heavily as score is primarily focused on the proximity of the player’s solution to the real system solution after the fielding phase.

(Early) conceptual and architectural choices for a solution will impact the ability/flexibility to address the real needs as they, as well as the understanding of them, evolve while the solution is being developed, the ability to support the solution over time, to evolve the solution to address emerging future needs, and to effectively and efficiently create system variants to address related needs:
This was covered earlier in this document to some extent, but for some additional info: As many systems in Project Robot have restrictions and requirements, and many items have an associated development time, early architecture and design decisions are very important and have major impacts down the line, as critical components could be restricted or parameters unfulfilled, resulting in compensation in some other less cost-efficient area.

Trade-offs can have many dimensions - such as technical, economic, organizational, cultural, or socio-political:
Trade-offs in Project Robot are primarily limited to technical and economic factors, with some stakeholders desiring specific cost parameters and awarding approval and score based on keeping costs within certain limits. Additional trade-offs could be included in future versions of the game, such as losing funding or score based on public approval (although this is already touched upon with the Senator stakeholder) or international approval, or organizational conflicts of interest (for instance, certain sub-systems may be developed by the system engineer’s own organization and would be preferred components).

All solutions will most likely have unintended consequences on its environment once deployed:
This is not addressed in the current version. One way to include this capability in a future version is to include environmental impacts for sub-system has environmental which are reflected in score and reported in the field reports.

Integrating the different constituent components/elements of a solution will in most cases lead to surprising emergent behavior. This can be reduced by up-front considerations to understand the intended and unintended interactions between the components:
Project Robot gives the player an ability to allocate resources to research, development, and understanding of the interfaces and interactions between sub-systems, which increases their confidence levels. Those levels have a major impact on score during Phase Two of the game, acting as a multiplier in many cases, even though on the surface the player doesn’t seem to be “getting anything out of” putting resources into the interfaces, as no parameters are increased. Just like real life, focusing resources on understanding interfaces and interactions is a matter of learning that it’s something that simply has to be done.

The deployment of the solution and exposure to the actual end-users can often lead to the realization that it "missed the mark", or at least missed significant aspects of the real need and what the critical attributes of an acceptable solution would look like:
This is one of the primary objectives of Project Robot. As the final solution is randomly generated and not exposed to the player, the player has to try to figure out what the solution is based on conflicting stakeholder needs. Once the system is deployed, the player may find that his or her solution is vastly different from the “real” solution. If this were the case, the player’s score would suffer significantly.
The Feasibility of E-Learning Implementation in an Iranian University

M.H. Mirzamohammadi
Associate Professor in Education, Shahed University, Tehran, Iran

Abstract: The present research aimed to investigate the feasibility of e-learning implementation in an Iranian comprehensive university (including medical and non-medical fields) to provide appropriate solutions in this regard. To achieve this objective, seven research questions were formed. Surveying method was applied for data collection in this study. From the results, the readiness of the Iranian university to implement e-learning was moderate to low. This means that the Iranian university is not prepared for this type of learning. Accordingly, five factors were evaluated: human, infrastructural, and cultural factors were in moderate to low level, and two factors: pedagogical and support, were at a low level. Ten basic strategies for successful implementation of e-learning were extracted at the Iranian university based on the studied five factors and they were presented according to the knowledge and research in the field of e-learning in the world and in Iran. Some of these consisted of holding training courses at the university level, considering a special place for e-learning in the university strategic plan, developing a mechanism for monitoring the activities of teaching and research in the e-learning environment for students and faculty, and allocating and spending an appropriate budget.

Keywords: Feasibility, e-learning, Iranian university, strategies

1. Introduction

"Electronic learning" is the modern paradigm of the higher education (Sun, et al. 2007). This new phenomenon is an approach to design, develop, deliver, and evaluate education, which makes use of electronic facilities and learning capabilities in a better way. In general, e-learning is shaped and developed in two major approaches (one in management and the other in psychology). These approaches include the systemic approach and the constructivist approach. A number of experts in system space have paid attention to e-learning. For example, Hao and Barich (2010) provided an interesting model to evaluate e-learning courses using the systemic approach. Some experts argued that network learning i.e. learning using the Internet is the best way to build the application-oriented perspective on learning. Given the constructive approach, the educational design process lacks specific and predetermined steps. However, three stages of analysis, design, and evaluation are overlapped and they are conducted consecutively.

E-learning experience requires the discreetness and cunningness of an intelligent and fast thinker faculty member who can convert the principles and strategies in any position to make up events and their unique requirements. Many types of research have shown that lack of knowledge and attitude of faculty members in the field of information and communication technology (ICT) is one of the major limitations of using e-learning in the classroom. Lin, Huang and Chen (2014) showed in a research that the barriers related to faculty members in IT application consist of two general inner and outer parts, which includes the lack of organizational support, inadequate faculty members’ preparation, the problem of time, lack of personal motivation, and technical support problems. Nedelman (2013) stated that the faculty members’ barriers in the use of technology in higher education include the lack of technical knowledge, management structure, assessment shortages of the effectiveness of the technology, and organizational changes. Jariang Pcasert (2003) examined the understanding and readiness of faculty members and students of faculty of Business Administration at “Chiang Mai” University in using e-learning.

The component of the student, as well as the faculty member, is important in teaching and learning. Kint and Zhu (2016) showed that the students’ characteristics and environmental features are two major factors in the design of blended learning environment. Liaw and Huang (2003) concluded that the learners’ readiness in terms of characteristics such as motivation, attitude, belief, and confidence should be determined to implement and develop e-learning. Sadic (2007) concluded that three factors of attitude, experience, and competence affect the development and implementation of e-learning. Malik (2010) reached the conclusion that there is a direct relationship between the student’s motivation and education continuation in e-learning. Hart (2012) concluded that a set of required behaviors, attitudes, and skills for students helps the complete success of online training courses and encourages them to continue the education in this system of learning.
Gutierrez-Santuste, Gallego-Arrufat & Simone (2016) have shown that communication barriers with the help of computers in universities are institutional in the application of technology, faculty members' exposure problem, and students' progress barriers. Birch and Barnett (2009) declared that the institutional problems in the use of technology in higher education include the lack of strategy, lack of institutional policies, and administrative costs. Sun et al. (2007) identified the six factors including student, faculty member, curriculum, technology, and environment, affecting the learner's e-learning satisfaction.

Since 2001, some universities in Iran such as Science and Technology, Shiraz, Amir Kabir, Khajeh Nasir, Hadith Sciences, Mehr Alborz, Shahid Beheshti, and Isfahan industrial have established e-learning courses. The research findings related to the topic in Iran can be divided into two general categories. Some of them have shown that e-learning implementation is possible in the studied universities. Rahimidoost and Razavi (2013), Keshavarzi et al. (2013) and Afyuni and Foroughi Abari and Yarr Mohammadian (2014) can be mentioned in this regard. Some other studies have shown that e-learning implementation is not possible in the studied universities. Sheykhian et al (2015) and Hosseini, et al (2015) can be noted in this regard.

It seems that there are a number of challenges facing the deployment of e-learning in universities including the facts that educational technology has no specific position in the strategic plan of universities. There is no defined framework and model for the use of educational technology in universities. Faculty members (and students) do not attend the required courses to design and evaluate the training programs with technology, and they are not familiar with the literature of this field. There is no necessary infrastructure for the use of new technologies in higher education. An appropriate budget is not allocated for the acquisition, deployment, and maintenance of equipment.

However, technology in higher education is strongly emphasized in Iran's higher education documents. For example in National Master Plan for Science and Education “National Action No. 25 of Overall Strategy 6” (Supreme Council for Cultural Revolution, 2009) “the development of e-learning system and ICT infrastructures in higher education" has been emphasized. In Article 5 of the Bylaws for associate and bachelor courses “continuous and discontinuous”, universities are autonomous to provide at most ten percent of each course lesson units, with the priority of basic and public courses in electronic form (virtual) except for the Islamic sciences and public Persian, with an emphasis on the electronic content and observing the approved standards by the Ministry (Ministry of Science, Research and Technology, 2014). According to the cases, the major issue of the present research is that how much is the studied university prepared to implement e-learning and what are the necessary solutions in this context?

Based on the summary and analysis of e-learning models and the related types of research in this field, the conceptual model of the present study is formed as follows:

![Figure 1: The research conceptual model: researcher-made](image_url)
2. Methodology

2.1 Method

The present study is a descriptive research, which has been conducted through surveying method. In this research, the possibility of implementing e-learning in the studied universities, as well as the appropriate solutions in this field in terms of human, infrastructural, cultural, support, and pedagogical factors, have been described and surveyed from the view of university faculty members, managers, and educational experts. The studied university was chosen because of its comprehensiveness. In the Iran's higher education system, the universities related to the fields of engineering sciences, basic, agriculture, arts, and humanities are affiliated to the Ministry of Science, Research and Technology, which are independent of the universities related to the fields of medical, dental, nursing, and midwifery. Medical universities are affiliated with the Ministry of Health and Medicine. The studied university is one of the few universities that has the both educational fields. Therefore, it is considered as a comprehensive university. Naturally, choosing the surveying field in such universities can introduce medical and non-medical cases in the country.

2.2 Population and Sample

The statistical population of the present research consisted of the following populations:
All full-time faculty members of the studied university according to the latest statistics of its Educational Planning Office consisted of 313 people as follows:

<table>
<thead>
<tr>
<th>Faculty Name</th>
<th>The number of faculty member</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humanities</td>
<td>72</td>
<td>23%</td>
</tr>
<tr>
<td>Basic Sciences</td>
<td>30</td>
<td>9.6%</td>
</tr>
<tr>
<td>Agricultural Sciences</td>
<td>24</td>
<td>7.7%</td>
</tr>
<tr>
<td>Engineering</td>
<td>44</td>
<td>14.1%</td>
</tr>
<tr>
<td>Art</td>
<td>12</td>
<td>3.8%</td>
</tr>
<tr>
<td>Dental</td>
<td>40</td>
<td>12.8%</td>
</tr>
<tr>
<td>Medical</td>
<td>77</td>
<td>24.6%</td>
</tr>
<tr>
<td>Nursing</td>
<td>14</td>
<td>4.5%</td>
</tr>
<tr>
<td>Total</td>
<td>313</td>
<td>100%</td>
</tr>
</tbody>
</table>

A random stratified sampling method was used to select a representative sample of the population. The sample size was obtained through Morgan Table (167) as follows:

<table>
<thead>
<tr>
<th>Faculty Name</th>
<th>The number of samples</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humanities</td>
<td>32</td>
<td>19.2%</td>
</tr>
<tr>
<td>Basic Sciences</td>
<td>19</td>
<td>11.4%</td>
</tr>
<tr>
<td>Agricultural Sciences</td>
<td>12</td>
<td>7.2%</td>
</tr>
<tr>
<td>Engineering</td>
<td>20</td>
<td>12%</td>
</tr>
<tr>
<td>Art</td>
<td>9</td>
<td>5.4%</td>
</tr>
<tr>
<td>Dental</td>
<td>21</td>
<td>12.6%</td>
</tr>
<tr>
<td>Medical</td>
<td>46</td>
<td>27.5%</td>
</tr>
<tr>
<td>Nursing</td>
<td>8</td>
<td>4.8%</td>
</tr>
<tr>
<td>Total</td>
<td>167</td>
<td>100%</td>
</tr>
</tbody>
</table>

Of these, 155 questionnaires were completed and returned.

- Graduate Studies and educational assistants of an Iranian University.
- Educational experts of an Iranian University.

The sample sizes of graduate studies and educational assistants (n=8) and education authorities (n=8) were all counted due to their limited number.

2.3 Data collection tools

The data collection tools in the present research include a researcher-made questionnaire and interview. These tools were developed based on the study of literature and analysis of previous research tool and initial interviews with some administrators, faculty members, and educational experts regarding the university’s e-
learning. It consists of five types factors for e-learning feasibility. Questionnaires were given to faculty members, and educational assistants and officials were interviewed. The validity of tools was obtained using the opinions of 15 experts in the field of e-learning in higher education, and reliability was obtained using Cronbach’s alpha result as follows:

<table>
<thead>
<tr>
<th>Table 3: Cronbach’s alpha results regarding the e-learning feasibility questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of factor</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Human Factor</td>
</tr>
<tr>
<td>Infrastructural factor</td>
</tr>
<tr>
<td>Cultural factor</td>
</tr>
<tr>
<td>Support factor</td>
</tr>
<tr>
<td>Pedagogical factor</td>
</tr>
<tr>
<td>Total Reliability</td>
</tr>
</tbody>
</table>

Cronbach’s alpha results showed that the obtained reliability for the e-learning feasibility questionnaire is desirable because the achieved reliability was 0.924 more than 0.70.

2.4 Research data analysis method

The present research’s data is of two types: quantitative data (data obtained from the questionnaires) and qualitative data (data from interviews). Therefore, the analysis methods of these data include qualitative and quantitative methods, respectively. Descriptive statistical methods including frequency, percentage, average and standard deviation, and inferential statistics including t-test (with 0.05 error p-value), analysis of the variance and Friedman, were used to analyze the quantitative data in the research.

3. Results

Answer to the main question: how is the readiness of an Iranian University to implement e-learning?

<table>
<thead>
<tr>
<th>Table 4: One-sample t-test results on the readiness of an Iranian University to implement e-learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>155</td>
</tr>
</tbody>
</table>

Reviewing the presented results in Table 4 indicate that there is a significant difference between the sample mean and the assumed mean of the population at the significant level of 0.01 (t=54.37) regarding the readiness of an Iranian University to implement e-learning. The results indicate that the readiness level of an Iranian University to implement e-learning is moderate to low.

The analysis of interview questions has shown that the readiness level of an Iranian University to implement e-learning is medium and low from the graduate studies and educational assistants view, respectively.

<table>
<thead>
<tr>
<th>Table 5: The result of Friedman test regarding the readiness level of an Iranian University to implement e-learning from the educational assistants view</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>Support factor</td>
</tr>
<tr>
<td>Infrastructural factor</td>
</tr>
<tr>
<td>Cultural factor</td>
</tr>
<tr>
<td>Pedagogical factor</td>
</tr>
<tr>
<td>Human factor</td>
</tr>
<tr>
<td>Statistical results</td>
</tr>
</tbody>
</table>

Table 5 shows that the most important priority for educational assistants was the human factor and the least important was support factor, but this relationship was not statistically significant because the obtained significant level was 0.656 more than 0.05.
Table 6: The result of Friedman test regarding the readiness level of an Iranian University to implement e-learning from the educational experts view

<table>
<thead>
<tr>
<th>Factor</th>
<th>No.</th>
<th>Mean</th>
<th>Percentage</th>
<th>Standard deviation</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructural factor</td>
<td>8</td>
<td>1.7500</td>
<td>35.00</td>
<td>1.16496</td>
<td>0.41188</td>
</tr>
<tr>
<td>Pedagogical factor</td>
<td>8</td>
<td>2.1250</td>
<td>42.50</td>
<td>1.24642</td>
<td>0.44068</td>
</tr>
<tr>
<td>Human</td>
<td>8</td>
<td>2.6250</td>
<td>52.50</td>
<td>0.74402</td>
<td>0.26305</td>
</tr>
<tr>
<td>Cultural factor view</td>
<td>8</td>
<td>2.8750</td>
<td>57.50</td>
<td>0.64087</td>
<td>0.22658</td>
</tr>
<tr>
<td>Support factor</td>
<td>8</td>
<td>3.3750</td>
<td>67.50</td>
<td>1.18773</td>
<td>0.41993</td>
</tr>
</tbody>
</table>

Table 6 shows that the most important priority for educational experts was the support factor and the least important was the infrastructural factor, but this relationship was not statistically significant because the obtained significant level was 0.074 more than 0.05.

The answer to secondary research questions:

Answer to the first question: how is the readiness of an Iranian University to implement e-learning from the human factor view?

Table 7: The result of t-test regarding the readiness level of an Iranian University to implement e-learning from the human factor view

<table>
<thead>
<tr>
<th>No.</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Standard error</th>
<th>T value</th>
<th>Degrees of freedom</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>155</td>
<td>2.4351</td>
<td>0.05720</td>
<td>0.70988</td>
<td>42.65</td>
<td>154</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Evaluating the presented results in table 7 indicates that there is a significant difference between the sample mean and the assumed mean of the population at the significant level of 0.01 (t=42.65) regarding the readiness of an Iranian University to implement e-learning from the human factor view. The results indicate that the readiness level of an Iranian University to implement e-learning from the human factor view is moderate to low.

Analysis of interview questions has shown that the readiness of an Iranian University to implement e-learning from the view of educational assistants, graduate studies and educational assistants, educational experts is moderate to low in terms of the human factor. Graduate studies and educational assistants have considered e-learning courses and workshops very necessary for faculty members and university administrators regarding the human factor (n = 6). They have also emphasized using educational technology experts to implement e-learning in an Iranian university (n=1). The educational experts of the faculties have considered e-learning courses and workshops essential for university staff (n=4). They considered faculty members’ preoccupation as one of the obstacles to implement e-learning in universities (n=1).

Answer to the second question: how is the readiness of an Iranian University to implement e-learning from the infrastructural factor view?

Table 8: The result of t-test regarding the readiness level of an Iranian University to implement e-learning from the infrastructural factor view

<table>
<thead>
<tr>
<th>No.</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Standard error</th>
<th>T value</th>
<th>Degrees of freedom</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>155</td>
<td>2.5728</td>
<td>0.51933</td>
<td>0.04171</td>
<td>61.67</td>
<td>154</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Evaluating the presented results in Table 8 indicates that there is a significant difference between the sample mean and the assumed mean of the population at the significant level of 0.01 (t=61.67) regarding the readiness of an Iranian University to implement e-learning from the infrastructural factor view. The results indicate that the readiness level of an Iranian University to implement e-learning from the infrastructural factor view is moderate to low.

Analysis of the interview questions has shown that the readiness of an Iranian University to implement e-learning from the view of educational assistants, graduate studies and educational assistants, educational experts is moderate to low in terms of the infrastructural factor. Graduate studies and educational assistants
have suggested developing a comprehensive program to implement the e-learning in an Iranian University (n = 5). They have also suggested developing the necessary laws and regulations for the implementation of e-learning in an Iranian University (n=4), increasing expert labor in the Human Development Office of the University (n=3), and adopting the required security measures for the proper use of e-learning in an Iranian University (n=3).

Answer to the third question: how is the readiness of an Iranian University to implement e-learning from the cultural factor view?

Table 9: The result of t-test regarding the readiness level of an Iranian University to implement e-learning from the cultural factor view

<table>
<thead>
<tr>
<th>No.</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Standard error</th>
<th>T value</th>
<th>Degrees of freedom</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>155</td>
<td>2.2871</td>
<td>.83296</td>
<td>.06691</td>
<td>34.18</td>
<td>154</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Evaluating the presented results in Table 9 indicates that there is a significant difference between the sample mean and the assumed mean of the population at the significant level of 0.01 (t=34.18) regarding the readiness of an Iranian University to implement e-learning from the cultural factor view. The results indicate that the readiness level of an Iranian University to implement e-learning from the cultural factor view is moderate to low.

Analysis of interview questions has shown that the readiness of an Iranian University to implement e-learning from the view of educational assistants, graduate studies and educational assistants, and educational experts is moderate to low in terms of cultural factor. The educational experts have expressed a very important and delicate point regarding the cultural factor. This point is that considering the lack of direct control and supervision of students in e-learning system, there is a concern that the students do not study their lessons well and this would result to academic failures. Therefore, the provision of the necessary mechanisms in this field is essential (n=2).

Answer to the fourth question: how is the readiness of an Iranian University to implement e-learning from the support factor view?

Table 10: The result of t-test regarding the readiness level of an Iranian University to implement e-learning from the support factor view

<table>
<thead>
<tr>
<th>No.</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Standard error</th>
<th>T value</th>
<th>Degrees of freedom</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>155</td>
<td>2.0325</td>
<td>.80374</td>
<td>.06477</td>
<td>31.38</td>
<td>154</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Evaluating the presented results in Table 10 indicates that there is a significant difference between the sample mean and the assumed mean of the population at the significant level of 0.01 (t=31.38) regarding the readiness of an Iranian University to implement e-learning from the support factor view. The results indicate that the readiness level of an Iranian University to implement e-learning from the support factor view is moderate to low.

Analysis of interview questions has shown that the readiness of an Iranian University to implement e-learning from the view of educational assistants, graduate studies and educational assistants, and educational experts is moderate to low in terms of support factor. The graduate studies and educational assistants suggested allocating the necessary funds as one of the most important components of the implementation of e-learning in an Iranian University regarding the support factor (n=6). They have also considered the production of electronic content as one of the successful strategies of e-learning in an Iranian University (n=3). The educational assistants have considered allocating the necessary funds as one of the most important components of the implementation of e-learning in an Iranian University (n=4).

Answer to the fifth question: how is the readiness of an Iranian University to implement e-learning from the pedagogical factor view?
Table 11: The result of t-test regarding the readiness level of an Iranian University to implement e-learning from the pedagogical factor view

<table>
<thead>
<tr>
<th>No.</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Standard error</th>
<th>T value</th>
<th>Degrees of freedom</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>155</td>
<td>2.0091</td>
<td>0.82203</td>
<td>0.06624</td>
<td>30.33</td>
<td>154</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Evaluating the presented results in Table 11 indicates that there is a significant difference between the sample mean and the assumed mean of the population at the significant level of 0.01 ($t=30.33$) regarding the readiness of an Iranian University to implement e-learning from the pedagogical factor view. The results indicate that the readiness level of an Iranian University to implement e-learning from the pedagogical factor view is moderate to low.

Analysis of interview questions has shown that the readiness of an Iranian University to implement e-learning from the view of educational assistants, graduate studies and educational assistants, and educational experts is moderate to low in terms of pedagogical factor. The graduate studies and educational assistants suggested that the implementation of e-learning in faculties whose discipline is based on practical work (in particular dental, medicine, and agriculture faculties) is more difficult than other faculties regarding the pedagogical factor. Therefore, it is better to implement this type of training initially in those faculties ($n=2$).

Answer to the sixth question: what are the appropriate solutions for e-learning’s future in an Iranian University?

According to the available knowledge and research in the field of e-learning in the world and Iran and based on the research findings, ten basic solutions were extracted and introduced to implement e-learning in an Iranian University based on the five analyzed factors as follows:

Solutions related to the human factor, including holding training courses and using educational technology experts at the university level.

Solutions related to the infrastructural factor, including considering a special place for e-learning in the university strategic plan, adopting the necessary laws and regulation regarding the implementation of e-learning at the university level, strengthening and developing communication networks, and developing a digital library at the university.

Solutions related to the cultural factor, including developing a mechanism for monitoring the activities of teaching and research in e-learning environment for students and faculty.

Solutions related to the support factor, including allocating and spending an appropriate budget and producing electronic contents.

Solutions related to the pedagogical factor, including holding training courses.

4. Discussion

Studies have been conducted on the feasibility of implementing e-learning in higher education in Iran, or in the universities of the Ministry of Education or the Ministry of Health. However, there is no conducted research in Iran's higher education, which has investigated the possibility of implementing e-learning in the two classes of universities together. The present research is distinguished in this regard and its results are innovative.

Faculties of the studied university in this research include diverse fields of engineering, the humanities, the arts, and medicine. Typically, the advantages and problems of these fields in Iran are assessed separately and unrelated to each other. Therefore, this research has violated this procedure and evaluated the field together as an opportunity to examine the feasibility of a new phenomenon called e-learning in this space.

Another important issue that should be mentioned here is that the two elements of faculty members and students, and issues related to them are still the most important point of attention in e-learning in the present research, as well as the related types of research in Iran. The research results showed that the pedagogical
factor on the faculty members and students has allocated the lowest average to itself. Thus, according to the respondents, the lowest level of preparedness for the implementation of e-learning in the university and higher education in Iran are in these two critical elements. Despite the structural and financial difficulties in the studied university and Iran's university system, it is expected that this factor should have the lowest level of preparedness for the implementation of e-learning, but it is not such a thing and the respondents believe that attention should be focused on faculty members and students.

Comparing the research results related to the issue (mentioned in the introduction), it can be concluded that these studies are aligned with the present research in terms of emphasizing the role of the faculty member and student. Studies have shown that the lack of Faculty members’ knowledge (and performance) and their inappropriate attitude regarding the application of technology in education can be serious obstacles to the implementation of e-learning in higher education. Lack of motivation, interest, and negative attitudes are the most serious obstacles in students. According to the results, the technology training model for faculty members and students can be as follows:

Figure 2: The technology training model for faculty members and students

5. Conclusions

E-learning in Iran’s higher education is a new phenomenon, which was created in less than two decades. The experience of this type of teaching and learning included successes and failures. The results of this research have also shown that in general, the possibility of implementing e-learning in universities is relatively weak. E-learning in Iranian universities has been mainly implemented in the form of "non-physical presence of teachers and students". A sudden change in the educational model of direct and face-to-face instruction, which has a long history in Iran’s higher education and civilization and religious teachings of Iranian, which was based on the impact of master’s presence on the student, would not have any result except for failure. It seems that selection, customization, and implementation of "blended learning" can lead to the gradual success of e-learning in higher education in Iran. This issue can gradually replace the face to face training and inspire students towards independent learning without a sudden removal of faculty members and students' presence from the teaching and learning scene. Mironov, and Cioan, and Borzea (2012) believe that variety of traditional and on-line learning and teaching cannot alone lead to the desired quality, but an appropriate combination of presence and online learning is a flexible approach to learning. Graham (2013) points out that a framework should be sought to conduct blended learning in the field of organization. In this regard, researchers suggest six cases including awareness/exploration, compatibility/initial application, and full application/grow, such that using them can improve the blended learning at the organizational level. Accordingly, the model of e-learning in Iran universities can be illustrated as follows:
The model of e-learning in Iran universities

This model can be applied to the university systems in countries that are culturally and historically close to Iran and which have newly deployed e-learning, such as the developing Islamic countries.

References


Ministry of Science, Research, and Technology. 2014. Educational regulations for associate and bachelor courses [online] Available at : < www.msrt.ir/fa/Pages/SubSitePages/Laws/prog.aspx > [Accessed 22 July 2017].


Sheykhhian, A., et al. 2015. Feasibility of implementing an e-learning project in Lorestan University of Medical Sciences from the perspective of faculty members, students, managers, and administrative staff, Yafte: Lorestan University of Medical Sciences, 16(4), pp. 5-17.

Street, H. D. 2010. Factors influences a learner decision to drop out or persist in higher education distance learning, online journal of distance learning administration [online] Available at <http://www.westga.edu/~distance/ojdla/winter134/street134> [Accessed 22 July 2017]


Drivers and Barriers to Adopting Gamification: Teachers’ Perspectives

Antonio Sánchez-Mena¹ and José Martí-Parreño*²
¹HR Manager- Universidad Europea de Valencia, Valencia, Spain and Universidad Europea de Canarias, Tenerife, Spain
²Associate Professor - Universidad Europea de Valencia, Valencia, Spain
antonio.sanchezmena@universidadeuropea.es
jose.marti@universidadeuropea.es

Abstract: Gamification is the use of game design elements in non-game contexts and it is gaining momentum in a wide range of areas including education. Despite increasing academic research exploring the use of gamification in education little is known about teachers’ main drivers and barriers to using gamification in their courses. Using a phenomenology approach, 16 online structured interviews were conducted in order to explore the main drivers that encourage teachers serving in Higher Education institutions to using gamification in their courses. The main barriers that prevent teachers from using gamification were also analysed. Four main drivers (attention-motivation, entertainment, interactivity, and easiness to learn) and four main barriers (lack of resources, students’ apathy, subject fit, and classroom dynamics) were identified. Results suggest that teachers perceive the use of gamification both as beneficial but also as a potential risk for classroom atmosphere. Managerial recommendations for managers of Higher Education institutions, limitations of the study, and future research lines are also addressed.

Keywords: gamification, games and learning, drivers, barriers, teachers, Higher Education.

1. Introduction

Technological developments and teaching methodologies associated with them represent new opportunities in education but also a challenge for teachers of Higher Education institutions. Teachers must face questions regarding whether to implement new teaching methodologies in their courses based on their beliefs on expected outcomes, performance, costs, and benefits. For example, associated costs when implementing a new teaching technology in a course vary from personal costs (e.g. time devoted to preparing new teaching materials) to institutional costs (e.g. new equipment like digital blackboards or computers). Not less important are the uncertainty of the expected learning outcomes or students’ satisfaction with the new teaching methodology. For example, previous research found that students show different attitudes towards active learning methodologies that demand a more proactive learning role on the student side (Liu and Littlewood, 1997). Moreover, previous research also found that students can show a resistant attitude towards active learning methodologies such as group-based projects (Livingstone and Lynch, 2000). Gamification represents such a challenge for teachers serving in Higher Education institutions as it is becoming a trending topic in education. Although gamification is not limited to the use of technology-driven games for educational purposes (for example, educational video games in the shape of serious games), educational video games account for a high percentage of all gamification efforts in education (for a review see: Boyle et al, 2016). These technology-driven educational games can challenge teachers’ attitude in terms of media literacy but also the uncertain outcomes when using gamification in their courses. On the one hand, it has been stated that the use of video games for educational purposes might motivate the new generations of students that have grown up in the age of video games (Glover, 2013). Educational video games can also motivate digital natives (Prensky, 2001) who make an intense use of technology and digital interactivity and for whom traditional learning methodologies do not appeal or motivate them anymore. Consequently, they have become disengaged with school and this disengagement has affected their learning outcomes (Simões, Díaz Redondo, and Fernández Vilas, 2013). It has also been stated that the fun and excitement provided by video games can highly motivate players (Ferguson and Olson, 2013) providing a huge potential for educational application (Cheng, She, and Annetta, 2015). On the other hand, the literature review offers mixed results regarding the effectiveness of gamification in education (Girard, Ecalle, and Magnan, 2013). It has been criticised that game-based learning often concerns repetition of cyclic content that provokes persistent re-engagement which tends to address lower-level learning goals rather than higher-level goals (Ma et al, 2007). This process can also elicit adverse effects in social interaction in team-based conditions (Brom et al, 2014).
In light of these mixed results, teachers can be challenged on the decision of whether to implement or not gamification in their courses. Academic literature acknowledges that teachers are the primary agents in introducing new teaching methodologies in their courses (Teo, 2008). Nevertheless, it has been pointed out that research on game-based learning has been largely ignoring the important role teachers play (Jong and Shang, 2015). Thus, the main goal of this study is to gain a better knowledge of factors acting as drivers or barriers for teachers to using gamification in their courses. A better understanding of teachers’ experiences and beliefs about the use of gamification can help both teachers interested in successfully implementing gamification in their courses and Higher Education managers interested in introducing gamification in their institutions.

Therefore, this study’s main goal is twofold: a) to explore the main drivers that encourage Higher Education teachers from using gamification in their courses, b) to explore the main barriers that prevent Higher Education teachers from using gamification in their courses. To achieve this goal, 16 online structured interviews were conducted and analysed using a phenomenology approach consisting of a constant comparative analysis via text mining.

This piece of research contributes to current academic literature in gamification providing useful insights on the main drivers that can fuel teachers’ use of gamification. It also provides information about the main barriers that can prevent teachers from using gamification. By identifying these drivers and barriers, the results of this research will contribute to Higher Education institutions policies regarding the adoption of gamification. Higher Education managers will find in this study useful insights to support teachers interested in using gamification in their courses.

This paper is structured as follows: firstly, we review literature on gamification to posit the research questions. Secondly, we present the method used and the results. Lastly, we address discussion, conclusions, managerial implications, limitations of the study, and future research lines.

2. The gamification of education

Although a game-based approach to education can be traced back to the sixties (Piaget, 1962) and the pioneer work of Abt (1970), Malone and Lepper (1987), and Loftus and Loftus (1983), the potential of using video games in education has been highlighted more recently (Prensky, 2001; Gee, 2003). Gamification has been defined as “the use of game design elements in non-game contexts” (Deterding et al., 2011, p. 9). Therefore, gamification focuses on game design and game mechanics. Deterding et al.’s (2011) approach contrasts gamification “against other related concepts such as serious games via the two dimensions of playing/gaming and parts/whole” (p. 5). One important conceptual implication of this approach is that there is no need for a “game” in gamification. Rather than using a game in the classroom, the teacher makes the class itself a game (Hanus and Fox 2015). Consistent with Deterding et al.’s (2011) definition of gamification, the gamification of education has been defined as “the use of game elements in a learning environment” (Simões, Díaz Redondo, and Fernández Vilas, 2013, p. 3).

The rationale behind applying game design elements to non-game contexts like education is that key psychological states elicited by games (e.g. immersion, flow, involvement) can help to increase individuals’ motivation, engagement, and performance in non-gaming activities. In education, it has been stated that through gamification ‘students could be motivated to learn in new ways or enjoy otherwise tedious tasks’ (Hanus and Fox, 2015, p. 152). It is assumed that the elements that make games fun along with the nature of games themselves are intrinsically motivating (Adams et al. 2012) so applying game elements and mechanics to the classroom may increase students’ intrinsic motivation to learn (Hanus and Fox, 2015).

Previous research found that using games or games elements in learning favours a trial-and-error process which makes mistakes recoverable (Hanus and Fox, 2015); gives students the freedom to fail without fear when learning (Lee and Hamer, 2011); provides immediate and frequent feedback (Kapp, 2012); tailors difficulty progression that facilitates scaffolded instruction based on each individual student’s needs (Hanus and Fox, 2015); offers a visual display of progress (e.g. using badges) (Kapp, 2012); and encourages motivation through competition (e.g. through leaderboards) (Camilleri, Busuttil, and Montebello, 2011). Previous research also found that lack of expertise in applying new methodologies or lack of resources are common barriers for teachers when applying technological innovations in the classroom (Mumtaz, 2000). Moreover, teachers can
face new technological developments in education as a threat and technological innovations can be a cause of much anxiety (Goodwyn, Adams, and Clarke, 1997). As gamification can be considered a technological innovation this study is focused on the main drivers and barriers teachers experience when using gamification.

3. Research questions

Literature review clearly suggests that teachers face different barriers when implementing game-based learning in their courses. For example, Demirbilek and Tamerb (2010) identified six main barriers in Lower Secondary and Upper Secondary School teachers to adopt game-based learning including classroom management problems and technical infrastructure (e.g. computers not working or power cuts). Teachers also expressed anxiety of not being able to complete all the curriculum topics if they use game-based learning. Bourgonjon et al. (2013) found that teachers were reluctant to use educational video games because they were not really convinced that educational video games are very useful for enhancing their job performance. This finding suggests that perceived value is an important driver to implementing pedagogical innovations. Hamari and Nousiainen’s (2015) findings suggest that educational video game adoption is affected by teachers’ perceived compatibility of Information and Communication Technologies (ICT) with teaching, teachers’ perceived self-efficacy with ICT, teachers’ perceived supportive ICT organizational culture, teachers’ openness towards ICT, and teachers’ perceived value of educational video games. Therefore, teachers’ adoption of educational video games as a teaching methodology relies heavily not only on individual factors but also on social environment (e.g. supportive ICT organizational culture in the education institution) (Hamari and Nousiainen, 2015). This finding supports previous research that identified the key role teachers play in introducing pedagogical innovations in the classroom, especially technology-related innovations (Ketelhut and Schifter, 2011; Mumtaz, 2000). Ince and Demirbilek (2013) investigated Secondary and High School teachers’ perceptions about adopting educational video games in their courses finding two potential barriers: a) teachers viewed themselves as technically unprepared for computer usage skills needed to manage educational video games, and b) teachers expressed the necessity of increasing the amount of educational video games aligned with the curriculum.

As teachers are key agents in the teaching-learning process (Biesta, Priestley, and Robinson, 2015), and teachers play a key role in introducing pedagogical innovations in the classroom, especially technology-related innovations (Ketelhut and Schifter, 2011; Mumtaz, 2000), teachers’ beliefs of gamification will play a key role in implementing or not gamification in their courses. Therefore, this study focuses on the key drivers that encourage teachers to using gamification in their courses and the main barriers that prevent teachers from doing it. Therefore, we address as primary research questions teachers’ beliefs about the main drivers and barriers they experience when using gamification in their courses:

RQ1: which are the main drivers that teachers serving in Higher Education institutions find when using gamification in their courses?

RQ2: which are the main barriers that teachers serving in Higher Education institutions find when using gamification in their courses?

4. Method

A phenomenology approach was used in this research. Phenomenology aims to understand the meaning that daily events and experiences have for individuals (Maykut and Morehouse, 1994) and allow researchers to understand how individuals build up their own reality of the world. This reality is subjective, based on each individual meanings and interpretation of the world through experiences, and expressed through natural language. Data was gathered through online structured interviews on a sample of teachers serving in Higher Education institutions. Snowball sampling (Goodman, 1961; Biernacki and Waldorf, 1981) was used for selecting respondents in this study. Although snowball sampling is unlikely to obtain a representative sample because there is no real control of the snowball effect, this form of sampling is often used when it is impossible to identify beforehand all those who might fall into the project’s category of interest (Hall and Hall 1996).

The researchers forwarded an email to colleagues and acquaintances serving in Higher Education institutions asking for collaboration in this research. Respondents who have used gamification at least once in their classes were asked to answer an online structured interview (see Appendix 1) via a link provided in the email. Respondents were also asked to forward the email to colleagues and acquaintances serving in Higher
Education institutions. The researchers used constant comparative analysis along with identified keywords via text mining to cluster the main themes. Intercoder reliability was 100% as all disagreements were discussed by the researchers until an agreement was reached.

4.1 Sample

A final sample of 16 online structured interviews of teachers serving in Higher Education institutions was analysed. Only interviews from teachers that reported having used gamification in their courses were analysed. Respondents’ age range is from 26 to 65, the average age of participants is 43.75 years old, and 56.25% are female. Of the sample, most of the respondents teach in the Degrees of Marketing (37.5%) and Business (25%). The average years of experience in using gamification is 2.25 years. Table 1 shows sample information.

Table 1: Sample information

<table>
<thead>
<tr>
<th>GAMIFICATION EXPERIENCE</th>
<th>MAIN SUBJECT BEING TAUGHT</th>
<th>DEGREE</th>
<th>AGE</th>
<th>GENDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years</td>
<td>Principles of Marketing</td>
<td>Business</td>
<td>55</td>
<td>Female</td>
</tr>
<tr>
<td>5 years</td>
<td>Marketing Research</td>
<td>Business</td>
<td>37</td>
<td>Male</td>
</tr>
<tr>
<td>1 year</td>
<td>International Law</td>
<td>Law</td>
<td>46</td>
<td>Male</td>
</tr>
<tr>
<td>1 year</td>
<td>Marketing Research</td>
<td>Marketing</td>
<td>60</td>
<td>Male</td>
</tr>
<tr>
<td>1 year</td>
<td>Introduction to Advertising</td>
<td>Advertising</td>
<td>31</td>
<td>Female</td>
</tr>
<tr>
<td>1 year</td>
<td>Marketing Research</td>
<td>Marketing</td>
<td>35</td>
<td>Female</td>
</tr>
<tr>
<td>4 years</td>
<td>Psychology of Education</td>
<td>Education</td>
<td>41</td>
<td>Male</td>
</tr>
<tr>
<td>3 years</td>
<td>Clinical Psychology</td>
<td>Psychology</td>
<td>36</td>
<td>Female</td>
</tr>
<tr>
<td>4 years</td>
<td>Marketing Research</td>
<td>Marketing</td>
<td>26</td>
<td>Female</td>
</tr>
<tr>
<td>1 year</td>
<td>Consumer Behaviour</td>
<td>Marketing</td>
<td>34</td>
<td>Male</td>
</tr>
<tr>
<td>3 years</td>
<td>International Marketing</td>
<td>Marketing</td>
<td>56</td>
<td>Male</td>
</tr>
<tr>
<td>2 years</td>
<td>Research Methods</td>
<td>Odontology</td>
<td>48</td>
<td>Female</td>
</tr>
<tr>
<td>2 years</td>
<td>Marketing Research</td>
<td>Business</td>
<td>65</td>
<td>Male</td>
</tr>
<tr>
<td>1 year</td>
<td>Destination Marketing</td>
<td>Tourism</td>
<td>37</td>
<td>Female</td>
</tr>
<tr>
<td>1 year</td>
<td>Principles of Marketing</td>
<td>Marketing</td>
<td>51</td>
<td>Female</td>
</tr>
<tr>
<td>1 year</td>
<td>Econometrics</td>
<td>Business</td>
<td>42</td>
<td>Female</td>
</tr>
</tbody>
</table>

5. Results

Data was analysed using text mining software Wordstats 7.0.11. RQ1 addressed teachers’ main drivers to use gamification in their courses. A word frequency analysis revealed that the most commonly used terms when teachers were asked about the main drivers they find when using gamification in their courses was students (number of cases=8) and motivation (n=8), followed by creativity (n=5), and entertainment (n=3). Top eleven keywords are shown in Table 2.

Table 2: Results of the words frequency analysis for drivers

<table>
<thead>
<tr>
<th></th>
<th>% PROCESSED</th>
<th>% TOTAL</th>
<th>NO. CASES</th>
<th>TF • IDF*</th>
</tr>
</thead>
<tbody>
<tr>
<td>STUDENTS</td>
<td>4.19%</td>
<td>1.63%</td>
<td>8</td>
<td>6.2</td>
</tr>
<tr>
<td>MOTIVATION</td>
<td>4.19%</td>
<td>1.63%</td>
<td>8</td>
<td>6.2</td>
</tr>
<tr>
<td>CREATIVITY</td>
<td>2.62%</td>
<td>1.02%</td>
<td>5</td>
<td>4.9</td>
</tr>
<tr>
<td>ENTERTAINMENT</td>
<td>1.57%</td>
<td>0.61%</td>
<td>3</td>
<td>3.6</td>
</tr>
<tr>
<td>EASY</td>
<td>1.57%</td>
<td>0.61%</td>
<td>2</td>
<td>4.1</td>
</tr>
<tr>
<td>ATTENTION</td>
<td>1.05%</td>
<td>0.41%</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>DEVELOPMENT</td>
<td>1.05%</td>
<td>0.41%</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>DYNAMISM</td>
<td>1.05%</td>
<td>0.41%</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>EMPATHY</td>
<td>1.05%</td>
<td>0.41%</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>INNOVATION</td>
<td>1.05%</td>
<td>0.41%</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>INTERACTIVITY</td>
<td>1.05%</td>
<td>0.41%</td>
<td>2</td>
<td>2.7</td>
</tr>
</tbody>
</table>

*Term frequency weighted by inverse document frequency
Top keywords were clustered in four themes which emerged as the main drivers for teachers’ use of gamification in their courses: i) attention-motivation, ii) entertainment, iii) interactivity, and iv) easiness to learn. The attention-motivation theme is expressed by a respondent as follows:

‘Gamification increases student motivation because of the entertainment provided by the game’ (F1/48)

Innovation is related to this theme as teachers perceive that the novelty of using innovative methodologies (such as educational video games) in the classroom can increase students’ attention and motivation.

Entertainment is considered as intrinsic to games by teachers and they link the entertainment capacity of video games as a main driver to motivate students and draw attention to the learning activities. Interactivity is also an important theme linked to other constructs such as empathy and dynamism:

‘Using gamification in the classroom is more dynamic and interactive than traditional teaching methodologies’ (F2/55)

Finally, easiness is also a driver for some respondents to use gamification in their courses. Nevertheless, this easiness is not related to how easy it is for teachers to use gamification in their courses but how gamification facilitates students’ learning (easiness to learn):

‘It is easier for students to learn using this methodology’ (F3/42)

RQ2 addressed teachers’ main barriers when using gamification in their courses. A new word frequency analysis was run to answer this question. Results revealed that the most commonly used term when teachers were asked about the main barriers they find when using gamification in their courses was time (number of cases=9), followed by resources (n=5), methodology (n=4), students (n=4), and activities (n=4). Top eleven keywords are shown in Table 3.

<table>
<thead>
<tr>
<th>Keyword</th>
<th>% PROCESSED</th>
<th>% TOTAL</th>
<th>NO. CASES</th>
<th>TF • IDF*</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIME</td>
<td>1,88%</td>
<td>1,12%</td>
<td>9</td>
<td>6,5</td>
</tr>
<tr>
<td>RESOURCES</td>
<td>1,25%</td>
<td>0,74%</td>
<td>5</td>
<td>5,8</td>
</tr>
<tr>
<td>METHODOLOGY</td>
<td>0,83%</td>
<td>0,50%</td>
<td>4</td>
<td>4,3</td>
</tr>
<tr>
<td>STUDENTS</td>
<td>0,83%</td>
<td>0,50%</td>
<td>4</td>
<td>4,3</td>
</tr>
<tr>
<td>ACTIVITIES</td>
<td>0,83%</td>
<td>0,50%</td>
<td>3</td>
<td>4,8</td>
</tr>
<tr>
<td>TECHNICS</td>
<td>0,63%</td>
<td>0,37%</td>
<td>3</td>
<td>3,6</td>
</tr>
<tr>
<td>CLASSES</td>
<td>0,63%</td>
<td>0,37%</td>
<td>3</td>
<td>3,6</td>
</tr>
<tr>
<td>SUBJECT</td>
<td>0,63%</td>
<td>0,37%</td>
<td>3</td>
<td>3,6</td>
</tr>
<tr>
<td>MATERIALS</td>
<td>0,63%</td>
<td>0,37%</td>
<td>3</td>
<td>3,6</td>
</tr>
<tr>
<td>CONTENTS</td>
<td>0,42%</td>
<td>0,25%</td>
<td>2</td>
<td>2,7</td>
</tr>
<tr>
<td>COSTS</td>
<td>0,42%</td>
<td>0,25%</td>
<td>2</td>
<td>2,7</td>
</tr>
</tbody>
</table>

* Term frequency weighted by inverse document frequency.

Top keywords were clustered in four main themes which emerged as the main barriers for teachers’ use of gamification in their courses: i) lack of resources (time, training, classroom setting, and economic support), ii) students apathy (lack of interest), iii) subjects, and iv) classroom dynamics. Perceived lack of resources is expressed by a respondent as follows:

‘Much more time is needed in the process of designing and planning the (gamified) teaching activities. Moreover, you need many more resources to deliver these activities’ (M1/41)

Several respondents reported physical classroom setting as a barrier for gamified classes:

‘Case room type settings or classrooms with fixed seating are not conducive for simulations I use’ (M2/60)

The second identified theme –students’ apathy– is related to teachers’ beliefs about students’ lack of interest in gamified courses as a consequence of students’ lack of perceived usefulness of gamified courses:

‘I just used gamification once in my courses because students felt they were wasting their time’ (F4/51)
This “perceived waste of time” was the most used concept to describe students’ lack of interest in gamified courses:

“So many times the students are not used to gamified classes and they behave reluctantly to gamification because they feel they are wasting their time or they misunderstand the objectives addressed in the session when using gamification” (M3/34)

Another important theme is related to the subject being taught. Teachers referred to the subject they are teaching as an important barrier to using gamification:

‘I lack the knowledge to adapt gamification to the subject I teach’ (F5/35)

‘Gamification can be useful for some subjects but not for all. For me it is difficult to use gamification in subjects in which I must teach complex maths-related elements’ (M4/37)

Along with the specific characteristics of the subject being taught and teachers’ lack of knowledge to achieve the learning goals through gamification, another subject-related issue was teachers’ beliefs that gamification can prevent them from complying with the teaching schedule:

‘Tight learning schedule that does not allow for enough gamification’ (M5/46)

‘That there is often not the time for it, as bachelor students have a full calendar and we have a lot of material to go through together’ (F6/31)

Finally, classroom dynamics was also considered a main barrier for some respondents:

‘When I use gamification in my courses my colleagues teaching in classrooms nearby criticise the laughter and noise coming from my classroom’ (M6/56)

One respondent broadened the effects of classroom dynamics to managers:

‘Managers do not like gamification because they think students should be seated and quiet while listening to the lecture’ (F7/36)

Table 4 summarises the main identified drivers and barriers.

<table>
<thead>
<tr>
<th>THEME</th>
<th>ITEMS</th>
<th>THEME</th>
<th>ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention-motivation</td>
<td>Increases student attention to learning materials</td>
<td>Lack of resources</td>
<td>Lack of time</td>
</tr>
<tr>
<td></td>
<td>Increases student motivation</td>
<td></td>
<td>Lack of training</td>
</tr>
<tr>
<td>Entertainment</td>
<td>Learning while having fun</td>
<td>Students’ apathy</td>
<td>Perceived waste of time</td>
</tr>
<tr>
<td>Interactivity</td>
<td>Active learning</td>
<td>Subjects</td>
<td>Does not fit subject</td>
</tr>
<tr>
<td>Easiness to learn</td>
<td>Empathy</td>
<td>Classroom dynamics</td>
<td>Does not fit subject schedule</td>
</tr>
<tr>
<td></td>
<td>Easier than traditional learning</td>
<td></td>
<td>Disturbs classroom/university atmosphere</td>
</tr>
</tbody>
</table>

6. Discussion

Our findings suggest four main drivers that encourage teachers to use gamification in their courses. The first one, attention-motivation, assumes that gamification is able to draw students’ attention to the learning materials and increase students’ motivation to learn. This finding is consistent with previous research that found that educational games draw attention and increased motivation of learners (Su and Cheng, 2015) and is linked to the intrinsic entertaining nature of games. Attention and motivation are key factors in the learning
process (Keller, 1987) so a main driver for teachers seems to be achieving higher student attentional and motivational levels through gamification because of the entertaining nature of games, which is, “learning while having fun”. Teachers also assume that the interactivity needed when playing a game is an important driver to increase students’ involvement with their learning process. This finding is consistent with previous research suggesting that playing games supports active learning (Oblinger, 2004). This finding is also consistent with more recent studies that found teachers believe that educational video games can contribute to students’ learning through interactive learning via trial-and-error processes (Demirbilek and Tamer, 2010). Teachers also assume that gamification can facilitate students’ learning (easiness to learn) as they feel it is easier for students to learn through gamification than through traditional methodologies (e.g. lectures) probably because the extra motivation and attention elicited by games. This is consistent with High School teachers’ perceptions found in Ince and Demirbilek (2013) in which perceived effortlessness and student motivation provided by computer games ranked the highest in teachers’ positive perceptions to use a gamification approach in their courses. Regarding the main barriers preventing teachers from using gamification in their courses, results suggest that the lack of resources is a major barrier. Teachers’ perceptions of lack of resources involves: i) lack of time to prepare gamified classes, ii) lack of materials for gamified courses, and iii) lack of specific training to teach using gamification. Lack of economic support was also mentioned by teachers as a barrier, suggesting that maybe teachers assume that gamification involves the use of expensive hardware (e.g. computers or tablets) and software (e.g. custom-made video games). Our findings are consistent with previous research which found lack of time, training, and economic support as key factors preventing teachers’ use of information and communications technologies in the classroom (for a review see: Mumtaz, 2000). More recently, Demirbilek and Tamer (2010) also found that teachers believed they lack appropriate education on how to use educational video games. This can be applied to a broader gamification context (not only the use of educational video games) with teachers lacking appropriate training in how to use online gamification solutions such as Kahoot! One surprising result is that teachers’ perception of students’ lack of interest in gamified courses also prevent them from using gamification in their courses as they feel their effort in preparing gamified classes is not worth it because students do not value it properly. Previous research already pointed out that teachers were concerned about students’ lack of interest in using computer games with educational features based on a perceived inappropriateness within the course content (Can and Cagiltay, 2006). Another major concern for teachers is the feeling that gamification just does not fit their subjects suggesting that maybe some subjects are more suitable than others for gamification. This is consistent with Ince and Demirbilek’s (2013) findings among High School teachers. Emin-Martinez and Ney (2013) also found teachers look for consistency of the game-based learning activities they use with the curriculum they teach. The ‘need to fit the schedule of the subject’ suggests that some teachers consider gamification as a kind of extra activity that can be of interest because its novelty but it is not central to the learning process of the subject. Broadly speaking, gamification seems to be considered as a cool innovation but ‘borrows time’ for the real task of learning the subject. This seems a wrong approach to gamification which does not consider gamification among other classroom methodologies designed to learn the subject but just as some kind of innovative or surprising activity per se. One surprising barrier identified in this research is classroom dynamics as some teachers feel that the excitement and playful atmosphere driven by gamified classes can disturb colleagues teaching in classrooms nearby. Previous research found a positive effect of gamification in classroom atmosphere from a student perspective (Yang, 2012), but our findings suggest that the impact of gamification in classroom atmosphere, as perceived by teachers, can be a much more complex factor that might be analysed using a multidimensional approach.

7. Conclusions, limitations, and future research

The main goal of this research was to explore teachers’ main drivers and barriers when using gamification in their courses. Four main drivers and four main barriers were found suggesting that teachers can perceive gamification both as a benefit but also as a potential harm. More specifically, four main drivers were identified as contributing to teachers’ intentions of using gamification in their courses: i) teachers’ beliefs about the capacity of gamification to draw students’ attention, ii) teachers’ beliefs that the entertaining nature of gamification can motivate students to learn, iii) teachers’ beliefs that gamification can contribute to a more interactive learning, and iv) teachers’ beliefs that gamification can facilitate students’ learning. This research also identified four main barriers that can prevent teachers from using gamification in their courses: i) lack of resources (including time to prepare gamified activities and classroom setting), ii) students’ lack of interest in gamification, iii) teachers’ beliefs about the suitability of gamification for the subjects they teach, and iv) classroom dynamics (exciting and playful atmosphere) that eventually might harm college atmosphere.
On the one hand, teachers perceive that gamification can increase students’ attention and motivation for learning. This seems of special relevance to teaching younger generations of students who are no longer interested in traditional pedagogical approaches to learning. Therefore, teachers perceive that by using gamification they can better attract students’ attention and enhance their motivation to learn. Moreover, this motivation comes from the entertaining nature of gamification itself providing students with an intrinsic motivation to learn (learning is fun). The interactive nature of gaming can also benefit students’ trial-and-error learning processes and might increase students’ involvement during the learning process. This learning approach is aligned with a constructivist approach to learning which places students at the centre of the learning process and fosters learning by doing in an increasing trend of a competencies-based education. Finally, teachers also believe that gamification facilitates students’ learning better that other teaching methodologies. On the other hand, teachers perceive that gamification challenges them in several ways. One main barrier for teachers to use gamification in their courses is the perceived lack of resources including time to prepare gamified activities, lack of knowledge on gamification, and inappropriate classroom setting for gamified activities. Teachers seem to need organizational support (including Teacher Training Programmes) to overcome these limitations. Another main barrier is teachers’ beliefs that students do not always value the effort they put into introducing gamified activities in their courses. Teachers’ perceptions of students’ lack of interest in gamified activities deserves further research, but it might be related to students’ beliefs that they are “not learning, just playing”. Therefore, teachers should carefully design gamified activities so students can perceive the learning value in the activity and respond to the activity in the way teachers expect, that is, highly motivated towards the gamified activity. Subject fit seems another barrier for teachers as some teachers perceive gamification is not suitable for all subjects. Nevertheless, academic literature suggests that a gamification approach to education can be used in a wide range of subjects including Newtonian physics (Shute, Ventura and Kim, 2013), health education (Sung, Hwang and Yen, 2015), veterinary education (De Bie and Lipman, 2012), energy education (Yang, Chien & Liu 2012), language teaching (Reinders and Wattana, 2014), citizenship education (Lim and Ong, 2012), and nanotechnology (Blonder and Sakhnini, 2012) to name a few. Our findings suggest that teachers might not be totally aware of the potential of gamification in education believing that gamification can be applied only to a limited number of subjects. Therefore, Teacher Training Programmes can be used to broaden teachers’ perspective and applications of gamification. Finally, although enhancing classroom dynamics is a positive outcome of gamified classes, our findings also suggest that some teachers seem to feel that excessive excitement and fun provided by gamified activities can affect negatively overall atmosphere in the university. Moreover, gamified activities might damage teachers’ relationships with other colleagues who disapprove the use of gamification in the classroom when uncontrolled noise arises during gamified activities. Teachers seem to believe that if they are not carefully controlling gamified activities these events could become a potential source of conflict with colleagues.

From a managerial point of view, managers in Higher Education institutions should pay attention to all barriers identified in this research if they are interested in implementing gamified courses at their institutions. Previous research found that it is important for teachers to feel supported by their institution’s leadership (Kingston et al., 2012). In this case, leadership support could come in the shape of more resources to use gamification in the classroom including special Teacher Training Programmes focused on the use of gamification in education. Otherwise, teachers might perceive that managers promote traditional teaching methods, that is “students seated and quiet while listening to the lecture”, over more active methodologies that can alter classroom atmosphere. Managers can also provide resources in the shape of classroom settings suitable for gamification activities.

One main limitation of this exploratory study is the convenience sample used. Because snowball sampling does not allow controlling the sample at a demographic level, the average age of participants is high therefore providing a biased perception of teachers’ drivers and barriers when using gamification in Higher Education institutions. Future research should control this variable to overcome this limitation using a wider age range that better represents the target population. Another sample limitation is that most of the respondents teach in Marketing and Business Degrees (62.5%) with other Degrees being underrepresented in the sample. Future research should control this variable to overcome the bias in this study.

Other variables besides those identified in this exploratory study can affect teachers’ use of gamification in their courses. Previous research found that personal factors such as teachers’ perceived compatibility of Information and Communication Technologies (ICT) with teaching, teachers’ attitude towards ICT, and teachers’ openness towards ICT affects teachers’ adoption of educational video games (Hamari and
Nousiainen, 2015). Therefore, teachers’ openness towards new pedagogical approaches, teachers’ innovativeness, and teachers’ teaching style might affect their use of gamification. Culture affects human behaviour, so future research should consider culture as a moderating variable to replicate this study on a cross-cultural basis. This seems especially important because gamification usually involves students playing group activities. Because some cultures rank higher in individualism versus collectivism (Hofstede, 1991) more research is needed to gauge the cultural differences that affect the use of gamification as a teaching-learning methodology.

Acknowledgements

This work was supported by Laureate International Universities through the David A. Wilson Award for Excellence in Teaching and Learning under Grant LIU-WIL2015.

References

Appendix 1. Interview questions

1. Have you ever used gamification in your courses? (filter question)
2. How long have you been using gamification in your courses?
3. Please describe in your own words the type/s of gamification activity you mostly use in your courses
4. Please describe the main drivers that encourage you to use gamification in your courses
5. Please describe the main barriers that prevent you from using gamification in your courses
Western Cape Subject Advisors’ Perception of Their Preparedness for Connected Classrooms

Agnes Chigona
Faculty of Education, Cape Peninsula University of Technology, South Africa

Abstract: In South Africa, the Western Cape government (WCG)’s current broadband strategy aims to ensure that all schools will be connected to broadband service within a reasonable time-frame. According to the WCG integration of ICTs and broadband will remove the digital divide and enhance curriculum delivery in schools. To achieve this, sensible long-term planning must be in place to ensure that subject advisors are adequately trained and equipped to participate in the connected schools environment and effectively assist teachers integrate digital resources into classrooms. The aim of this paper is to explore how subject advisors perceive of their preparedness to embrace new technologies for their advisory job; to ensure effective teaching and learning. A qualitative research approach was used; randomly selected education districts in the Western Cape Province provided subject advisors to be participants in the study. Results show that most subject advisors perceive their complex knowledge of how to effectively integrate ICTs into curriculum delivery as inadequate hence are hesitant to advise teachers on effective technology integration into classrooms.

Keywords: connectivity, subject advisor, integration, curriculum delivery, 21st Century, South Africa

1. Introduction

Connectivity in the classroom is an exciting innovation in education in the 21st Century. Where such technologies have been effectively used, stakeholders testify to an enhanced quality of education. The Western Cape government (WCG)’s current broadband strategy aims to ensure that all schools will be connected to broadband service within a reasonable time-frame. According to the WCG integration of ICTs and broadband can remove the digital divide and enhance curriculum delivery in schools.

Educators’ pedagogical beliefs and practices in curriculum delivery are central to all teaching and learning activities using new technologies (Pamuk, 2012). In an effective curriculum delivery scenario, educators may consider a number of factors (i.e. instructional content, student background, instructional activities) to compose a pedagogical approach and to plan effectively curriculum delivery (Mishra & Koehler, 2006). The onset of ICTs for teaching and learning in the 21st Century requires subject advisors to assist teachers to integrate ICTs into the classrooms; taking advantage of the ICTs and connected classrooms. Studies on “early adopters' uses of technology indicate that this is not an easy task that educators can accomplish through simple changes in approach” (Pamuk, 2012:425). Mishra & Koehler (2006) argue that lack of Technological Pedagogical and Content Knowledge (TPACK) (i.e. the skill and knowledge on how to integrate the digital technologies into curriculum delivery), hinders effective adoption of ICTs for teaching and learning. Knowledge on how to operate and when to integrate new technologies into teaching is important to appropriate use of new technologies for curriculum delivery. Educators need three basic knowledge namely technology, pedagogy and content; and be able to integrate these in a way that could enhance the teaching and learning of subject matter.

For the WCG to realise the benefits of connected classrooms, sensible long-term planning must be in place to ensure that subject advisors are adequately trained and equipped to participate in the Connected Schools environment so they can effectively play their role of assisting teachers to integrate digital resources into classrooms. Subject advisors have the responsibility of providing guidance and mentorship to in-service teachers within their fields of specialisation. In the face of technology integration into curriculum today, in-service teachers tend to look to subject advisors for guidance on how to teach with new technologies effectively. Subject advisors need to be prepared adequately because “we ask much more of teachers today than even a decade ago. Today teachers are asked to achieve significant academic growth for all students at the same time that they instruct students with ever-more diverse needs. Teaching has never been more difficult, it has never been more important, and the desperate need for more student success has never been so urgent” (Greenhill, 2010:5). Are the subject advisors in the Western Cape adequately prepared to support and mentor teachers to win this battle?
Given the critical responsibility of the subject advisors to ensure appropriate teaching and learning is taking place in schools, this paper aims at exploring the advisors’ perceptions of their preparedness to embrace new technologies for their job. The research question for the study is:

*How do subject advisors regard their preparedness for connected classrooms in the Western Cape?*

To answer this question, qualitative research approach was employed; in-depth interviews with conveniently selected subject advisors from the Western Cape Province comprised primary data collection techniques. TPACK theoretical framework was adopted to guide the processes of the study. Results show that most subject advisors perceive their complex knowledge of how to effectively integrate ICTs into curriculum delivery to be inadequate. Subject advisors are hesitant to advise teachers on effective technology integration into classrooms. In this study, terms such as connectivity, e-learning and ICTs are used interchangeably.

2. Literature Review

2.1 Teaching and learning in the digital age

The world we are living in today is immersed by digital technologies and this is impacting on teaching and learning. Beck and Hughes (2014: 311) define the digital age as a “time frame in history that the use of digital technology became prevalent and of common use throughout the world. The digital age began in earnest with the widespread use of the Internet”. With the onset of digital age, teaching and learning environment is changing from simply chalk-and-talk to digital where learners are not only dependent on their teachers alone for new knowledge acquisition (Bates, 2015). Similarly, the workplace has also been affected by the digital age where digital technologies have transformed the work environment and what it means to work (LittleJohn, Beetham & McGill, 2012).

For teaching and learning in the digital environment to be effective, both teachers and learners need to adopt and integrate the new technologies into curriculum delivery successfully (NZTECH 2013). This requires that teachers and their trainers and/or advisors should acquire skills for profiency and fluency with digital tools (NCTE 2013). In addition to the skills and fluency, teachers need to possess a multifaceted complex skill on how to integrate the digital technologies into their teaching if they are to teach the digital citizens successfully (Koehler & Mishra, 2013).

In line with the argument, Bates (2015: 1) suggests that in order to assimilate digital modes into the classroom, “teachers and instructors need a base of theory and knowledge that will provide a solid foundation for their teaching, no matter what changes or pressures they face”. Such knowledge leads to successful adoption and use of the digital technologies for effective classroom use. For authors like Saade & Bahli (2005) successful adoption and implementation of new technologies requires a solid understanding of user acceptance, processes and ways of persuading them to engage with these technologies. It should be noted that:

“technology integration is, however, not a simple act. What people understand from technology integration is greatly affected by their understanding of education and technology separately and educational technologies as a whole. Broadly, technology integration policies and philosophy can be grouped into two camps: (a) a techno centric view that takes a deterministic view of technology as the agent of change and (b) a more ‘integrationist’ view that assigns usefulness to tools depending on their necessity in a given context (i.e. Technological Pedagogical Content Knowledge” (Akcaoglu, Gumus, Bellibas, & Boyer 2014:3).

When digital technologies are well integrated into curriculum delivery, the role of the teacher becomes less invisible. However, this does not entail reduced or simple pedagogy, if anything, this means teaching with and through digital technologies becomes challenging as learning takes on a strong constructivist approach (Barber & King, 2016). Teachers, therefore, need professional development that equips them with skills necessary for effective integration of digital technologies into their teaching (Mishra & Koehler, 2006). Teachers depend on subject advisors whose responsibility is to facilitate curriculum delivery in schools for quality teaching and learning (Mbanjwa, 2014).
2.2 The role of subject advisors in the digital age

In this digital age, subject advisors need to be in the forefront assisting teachers to integrate digital technologies into classrooms. According to the Department of Education (2013: 11), subject advisors are “specialist office –based educators in a district office or circuit office whose function is to facilitate curriculum implementation and improve the environment and process of learning and teaching by visiting schools, consulting with and advising school principals and teachers on curriculum matters”. For subject advisors to execute their responsibilities in the digital age, there is a need for them to be digitally fluent and possess a skill on how to integrate digital technologies into classrooms. In other words, the subject advisors need to have “a deeper knowledge of how to introduce technology from a pedagogical perspective; that is, the theory and practice of how best to teach” (NZTECH 2016: 4).

It should be noted that, the digital environment is forcing the pedagogy to shift towards constructivist strategies, hence the roles of the teachers and learners become reciprocal (Mishra & Koehler, 2006). Vast availability of information and wide use of internet means learners are also able to access new knowledge easily but this facility requires digital fluency in order to be able to separate relevant information from a plethora of information sources. Again, one needs to have a skill for making choice of tools to be used to achieve desired outcomes of the curriculum. Barber & King (2016) argue that pedagogy has shifted in nature due to the digital environment. Teaching and learning requires such skills such as “the development of creativity, self-motivation, innovation, problem-solving and collaboration skills” (Barber & King, 2016: 236).

Mbanjwa (2014) shows that subject advisors need to develop a mutual relationship with teachers for conducive teaching and learning environment that could yield to quality 21st Century education. The subject advisors are required to accelerate the uptake and integration of the digital resources into curriculum delivery. Although it is expected that newly graduated teachers will join the teaching professional adequately prepared for connected classrooms, many in-service teachers need to be supported to be able to adopt and integrate digital technologies into their pedagogies (Chigona 2015; NZTECH 2016). Earlier on, Anderson (2013) emphasised that “if we want educators to be able to be discriminatory about whether or not the use of technology will ‘assist or impede’ learning, educators have to have some high level knowledge in this area alongside their pre-existing Content and Pedagogical Knowledge”. Subject advisors, need to take a pro-active stance in facilitating ICT connectivity in schools to ensure the adoption and appropriate use of digital tools for effective teaching and learning (Department of Education, 2013).

2.3 Benefits of digital technologies for teaching and learning

According to Mbarek & Zaddem (2013:423), teaching and learning with digital technologies allow learners to acquire new knowledge and skills without worrying about the space-time shift. NAACE (2004) and Dagada (2009) are also of the opinion that the development of digital technologies and e-learning should help to make learning more differentiated and customised to individual needs, and deliver a more engaging, exciting and enjoyable learning process that encourages better learning outcomes. Nonetheless, Lwoga (2014:4) shows that:

- e-learning has various benefits, such as personalized learning, increased access to information, effective means to standardize and deliver content, on-demand content availability, interactivity, self-pacing and building confidence. It consequently provides flexible, convenient and diverse learning environments to meet the disparate needs of learners. The e-learning approach can open the knowledge pipelines which instil a culture of inquisitiveness and enquiry in students and graduates that is critical for life-long learning.

UNESCO (2017) concurs with the quote above by showing that digital technologies can enhance universal access to quality teaching and learning resources. This is especially true in disadvantaged communities where school libraries may not be in existence (Chigona, 2011). Teachers and learners can take advantage of connected classrooms to access information. Again, teachers can take advantage of the connectivity attending on-line courses for their own professional development, and use digital technology for more efficient education management, governance and administration (UNESCO, 2017).

The ability to make sensible choices about when and how to use new technologies to enhance, extend and enrich e-learning reflects the increasingly digital-rich environment in which we live and learn (Pamuk, 2012;
Mishra & Koehler, 2006). It is nevertheless argued that “although skepticism remains about technology use in education, there is a broad agreement among educators that technology can be effective and support learning only if it is meaningfully adopted and integrated into teaching (ibid:426).

2.4 Challenges of digital technologies in education

Many education departments globally are working hard to rollout connectivity to schools and other institutions of learning, yet there are a number of challenges facing educators that hinder them from benefiting from digital technologies (NZTECH 2016; Koehler et al, 2013). Such challenges could be categorised into three groups: lack of resources, lack of confidence and pedagogical difficulties in integrating technology into instruction (Sime & Priestley, 2005:131). Lwoga (2014) notes that lack of digital technological resources in developing countries is a huge challenge to technology integration into education. According to NZTECH (2016: 6), building capability with regards to teacher professional development where the teachers could be equipped with new 21 century pedagogies should be implemented alongside digital technologies for teaching and learning. Nonetheless, for the capacity building to be effective in this regard, teachers need to change their mind set and accept that the ways of teaching in this digital age need to embrace the new technologies (Chigona, 2011). In line with the argument, Sime & Priestley (2005:131 citing Zhao & Cziko (2001) listed intrinsic conditions that teachers need harbour in order to accelerate integration of digital technologies into their pedagogies:-

- Teachers must believe that by using technology they are more likely to achieve a higher-level goal than through other means used (‘effectiveness’).
- They must believe that if used, technology will not disturb the other high-level goals that they want to achieve (‘disturbances’).
- Finally, teacher must believe that they are in control, having the ability and resources to use ICT effectively (‘control’).

Although today there is still a concern about challenges regarding digital technology integration into curriculum delivery, Sahasrabudhe & Kanungo (2014:237) claim that there has been recommendable progress in understanding the set of parameters that can influence the effectiveness of the digital technologies in education. Nonetheless, there are still gaps in the comprehending the differences in the learning outcome. For Lwoga (2014 citing Tai et al., 2012) the success of digital technologies in education relies on both its early adoption and its sustained usage (Lwoga 2014: 5). This necessitates an understanding of relevant factors that predict educators’ (including subject advisors’) intention to domesticate and integrate the digital technologies into their professionals (Chigona, 2013).

3. Theoretical Framework

As indicated earlier in Section 1 above, Technological Pedagogical and Content Knowledge (TPACK) was adopted for this study as a theoretical framework to guide the processes of the study. According to TPACK effective technology integration into curriculum delivery entails an understanding and negotiating the relationships between technological skill, pedagogical knowledge, and subject matter (content knowledge) (Mishra & Koehler, 2006). TPACK emphasises that teachers need to develop the skills and knowledge to thoughtfully integrate subject matter, pedagogy and technologies in their curriculum delivery. In other words, effective technology integration into classrooms can be realised if the teacher is able to skilfully fuse the three knowledge domains. Mishra & Koehler (2006) call this a complex knowledge that enables teachers to effectively teach with and through new technologies.

In this study, the subject advisors would need the TPACK knowledge to be able to assist teachers on how to integrate the new technologies available into their teaching. Thus, the subject advisors need this complex knowledge –TPACK- to demonstrate to teachers the fusing of the pedagogical knowledge (PK) content knowledge (CK) and technological knowledge (TK) for effective teaching in the 21st century (Pamuk, 2012). Figure 1 below indicates how a combination of the different knowledges necessary to teach in the 21st Century yield to TPACK environment.
The TPACK environment or condition concede effective teaching and learning outcomes in connected classrooms (Koehler & Mishra, 2009). Teachers need to develop the skill and confidence in each of the component that make up TPACK. But more importantly they need to understand the interactions among the components (TK, PK, and CK) for effective integration of the digital technologies into classrooms. Such integration means that ICTs may not be applied to every subject matter uniformly, hence educators should come to understand that the various affordances and constraints of technologies differ by curricular subject-matter content or pedagogical approach (Archambault & Crippen, 2009: 83). In this study, the assumption is that the subject advisors have the understanding of PK, CK and PCK. However, the study will reveal their competences of the rest of the TPACK components namely: TK, TCK, TPK and TPACK.

Adapting from Koehler & Mishra (2009), the components that the subject advisors need to assist their teachers especially with regards to teaching with digital technologies are explained and applied in this study as follows:

- **Technological knowledge (TK):** skill on how to use digital technologies. Being able to know when a particular technological tool could be necessary to use or not.
- **Technological content knowledge (TCK):** the understanding of specific digital technologies that can enhance curriculum delivery.
- **Technological pedagogical knowledge (TPK):** the awareness of how the method of teaching with particular technological tools can impact on the teaching and learning outcomes. Thus the understanding of pedagogical affordances and constraints when integrating digital technologies or not.
- **Technological pedagogical content knowledge (TPACK):** Angeli and Valanides (2009: 154) define TPACK as a unique body of knowledge that result from the interaction of individual knowledge bases explained above. This knowledge is required for effective curriculum delivery when using digital technology. This knowledge requires “an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones” (Koehler & Mishra, 2009:66). TPACK is central to teaching with digital technologies. This means teachers should have the understanding of: (i) the subject-matter to be communicated to learners; (ii) how best to communicate the subject matter to the intended learners; (iii) the digital tools to be used to enhance the teaching and learning process of the subject-matter; (iv) how the three components could be integrated in an amicable way to achieve the best learning outcomes.
4. Research Designs

An interpretive qualitative research approach was used to gather and analyse data collected through focus group interviews and one-on-one in-depth interviews with subject advisors in the Western Cape. Interpretive methods were preferred so as to understand how the participants in the study perceive and experience the phenomenon under study.

4.1 Sampling and data collection

The WCED has eight education districts which are divided into circuits. Four of the districts serve the rural population and the other four serve the urban population. Two districts from rural segments and other two from urban areas were randomly selected for this study. Subject advisors from the districts were conveniently included in the study. Thus, three subject advisors from each of the randomly selected districts were conveniently asked to take part in the one-on-one in-depth interviews which lasted for 55 minutes on average. After the four one-on-one in-depth interviews, was the focus group interview took place; each of the groups consisted of five conveniently selected subject advisors. This process was replicated in all the four districts. Each of the four focus group interviews lasted for an hour and forty minutes on average. The participants were conveniently included in the study as those who were available at the district offices on the day of the interviews were ones asked to respond to the interview questions.

Twelve subject advisors took part in one-on-one in-depth interviews. Another 20 conveniently sampled subject advisors from the randomly picked district, participated in four focus group discussions for the study. The participating subject advisors from the four districts were those that had had received training from the WCED on how to use new technologies in education.

The two types of interviews were conducted to solicit data on the participants’ perceptions and experiences of the training and how prepared they thought they were to assist teachers in their fields of specialisation. Examples of questions used during interviews were:-

1. To what extent has the training influenced you as a subject advisor to adopt ICTs for e-learning?
2. What has been the impact of training as a subject advisor on your computer efficacy and self-efficacy?
3. How has the training equipped you and other subject advisors to confidently assist teachers when teaching with the ICTs?
4. How has the training affected advisors’ perceptions to adopt ICTs for e-learning?
5. What did you like about the ICT training?
6. What ICT training weaknesses did you observe?
7. What do you think could be done to improve the ICT training for subject advisors to adopt and use e-learning in their work?

An important feature of successful teaching is to have control over a situation. Teachers are expected to deliver curriculum effectively. The interviews solicited data on changes in subject advisors’ perceptions of their control over events in their lives as educators, and understand the extent to which “teaching with technologies” contributes to the control over the advisory situation. All the interviews were audio recorded and transcribed for data analysis. The recording of the conversations was done following the participants’ consent to do so.

4.2 Trustworthiness

All interviews with subject advisors were audio-recorded following the consent from the participants. As indicated above, the audio-recorded interviews were then transcribed verbatim. To ensure the trustworthiness on the data collected, focus group interviews were triangulated with one-on-one interviews (Shenton, 2004). Again, triangulation was achieved through the use of a wide range of informants that included 32 participants from four different (both rural and urban) education districts. In order to enhance trustworthiness in the study, themes developed from the data collected were compared with a member on the project which this study is part of. The themes were compared until there was an agreement on the themes which best represented the data collected (Noble & Smith, 2015).
4.3 Data analysis

Qualitative data analysis was used while bearing in mind TPACK as a framework for the study; both inductive and deductive approaches were used. From the data, I was interested in understanding the technological knowledge, technological content knowledge, technological pedagogical knowledge of the subject advisors. I was also interested in their capabilities to assist in-service teachers to integrate different technologies into their curriculum delivery. While ensuring not to miss the respondents’ views in the data collected the constructs of the TPACK framework provided an explicit and transparent way for interpreting the interview responses. From the analysis, the following themes were identified:- Subject advisors technological knowledge; Subject advisors’ use of ICTs in their work; and Subject advisors’ perception of their ability to integrate ICT into pedagogy.

4.4 Ethical considerations

Permission to conduct such a study in the Western Province was obtained from the WCED and Research Ethics Committee in the Faculty of Education at Cape Peninsula University. Privacy and confidentiality concerns were given the deserved consideration at all times (Cohen, Manion, and Morrison, 2007). Again, permission to record conversations with the participants was also obtained from each of the individuals taking part in the interviews. The participants were assured of anonymity when reporting the findings. Consequently, no identifications of the interviewees were used in the paper.

5. Findings and Discussions

An interpretive qualitative research approach was used to gather and analyse data collected through focus group interviews and one-on-one in-depth interviews with subject advisors in the Western Cape. Analysis of data collected shows that, despite undergoing training on how to use new technologies in education, most subject advisors still lack the complex knowledge needed to integrate information communication technologies effectively into curriculum delivery. They are not sure how to assist teachers to benefit fully from the connected classrooms in the province. The following themes were identified during analysis and are used to organise and present the findings of this study:

1. Subject advisors’ technological knowledge
2. Subject advisors’ use of ICTs in their work
3. Subject advisors’ perception of their ability to integrate ICT into pedagogy

5.1 Subject advisors technological knowledge

The Western Cape Government (WCG) has invested considerable resources into digital inclusion issues for educators and learners in the province. The Education Department through the Khanya project equipped all public schools in the province with various types of information and communication technologies as well as training educators on how to use the ICTs for teaching and learning (Chigona, 2011). Many educators, including subject advisors, acquired technological skills on how to operate computers and other ICTs in education. However, there are some subject advisors who compared to their colleagues have higher computer self-efficacy (the judgment of one’s capability to use a computer) (Compeau, & Higgins, 1995); and other advisors whose confidence to use the different technologies for teaching and learning is very low. One of the few confident subject advisors in the study said:

_i am invited at school to assist with technology. Teachers often say, I have got a new white board, or I have this new technology, can you please show me and so on… I am able to help._

However, meta-analysis of the data collected shows that, while there were some participants who confidently talk about their confidence to operate most of the technologies deployed in schools, their skill did not necessarily translate to teaching with the ICTs effectively. The fact is, many schools can access internet through tablets or PCs in their classrooms, yet some subject advisors lack the technological skills on how to use such ICTs for teaching. For instance, when asked if the ICT training that the subject advisors have received so far was enough to equip them to be able to advise teachers to teach with technologies available in schools, one respondent said,

_as far as ICT training is concerned, not really. The technologies that I encounter in schools for instance, are the different white boards they have and very specific software and specific demands. You need to_
be able to use the smart software or the mimeo software, last week I was in a school with IQ software which was the very first time that I had to encounter that. That is the technology that are usually in schools... how to put them on or off..., those are the nitty gritty

This means such subject advisors could not to assist teachers and learners on how best to take advantage of the digital technologies available in schools. There is a need for the Department of Education to ensure that all subject advisors are adequately skilled to work with the technologies available in schools before they attempt to assist teachers accordingly.

5.2 Subject advisors’ use of ICTs in their work

Subject advisors as educators need to work effectively in the 21st Century’s teaching and learning environment, which is characterized by complex, information-rich and knowledge based. Subject advisors are therefore, required to competently work and use educational technologies. However, analysis of the data for this study shows that many subject advisors do not utilizing the Moodle platforms and other technologies available in the province for curriculum delivery. Subject advisors perceive themselves as incompetent to use the technologies for their job. It may be assumed that subject advisors are more competent than in-service teachers regarding integration of new technologies into the classrooms to enhance teaching and learning. But many subject advisors are not even using the ICTs to communicate and assist their teachers to teach effectively with and through the new technologies. They do not have enough confidence and skill to integrate the new technologies in their work despite some ICT training offered to them (Chigona 2015). Most of them are stuck in their old ways of communication and teaching. They are not willing to adopt and use new ways of teaching in which technology enhances teaching and learning processes. During data collection one subject advisors said:

As we speak people are being trained to use the digital classes, the problem is not the training but they have to change the mindset ... because you can be trained and you are not willing to change your mindset then there is nothing that can be done. Most don’t agree with me because of the harsh statement that I make I say if you are not prepared to use digital then we don’t need you ...

In line with the argument above, other authors such as Jung recommend that “to use these tools effectively and efficiently, educators need visions of the technologies’ potential, opportunities to apply them, training and just-in-time support, and time to experiment; only then can educators be informed and confident in their use of new technologies” (Jung, 2005). This means that, although subject advisors may have access to computers and internet in their offices that cannot easily translate to communicating and assisting their teachers to adopt and effectively teach in connected classrooms. They need adequate and effective training on how to integrate the technologies into their advisory and teacher modelling job. They need TPACK to be able to assist teachers to teach with the technologies effectively. Subject advisors complained that the training they had received so far, was not adequate. Regarding the training they have received, most of the subject advisors stated like:

No, there I don’t think so because I don’t think the ICT training was really focused enough on of cause I’m thinking from my subject’ view there I would say so it was general, when it comes on the pedagogy itself I think we need to develop that on our own.

Some are of the opinion that they need to be proactive to train themselves to teach and work with the technologies because the training they are receiving is not addressing their needs. For instance one advisor lamented like:

when I heard for the first time about Moodle, I was not that excited, simply because Moodle does not really allow collaboration the same way that a google doc does. My need at this stage is to work with a teacher together on the same document not to send it to and fro and have 500 versions of the same document.

This subject advisor claims she prefers working with the teachers using google docs and is not in favour of using Moodle which the Department of Education is training teachers to use for curriculum delivery. From narratives such as these, it can be deduced that some subject advisors are unable to appropriate connected classrooms effectively into their work because they have not been exposed to appropriate training which is in line with their needs as subject advisors and the needs of their teachers.
5.3 Subject advisors’ perception of their ability to integrate ICT into pedagogy

Most subject advisors participating in this study perceived themselves having low computer self-efficacy which is negatively affecting on their confidence and abilities to assist teachers to teach with and through technologies available in their schools. According to some subject advisors, technologies have been sometimes deployed into schools without their knowledge. In such instances teachers may have been trained on how to use the ICTs but not modelled to teach with them effectively. The problem rise when such teachers need help from their subject advisors on how to teach with the technologies.

While subject advisors feel less competent to integrate technology in their teaching, most of them have the perception that they could have been in a better position to assist their teachers regarding teaching effectively with the ICTs if the training was not generic. Most of them stated:

_I wish the training the department offered to us was subject specific as opposed to generic._

_It is sometimes frustration sitting in the training because individuals with different levels of competence in using the technology are grouped together, and so the needs of others are not addressed._

Looking at the narratives above, subject advisors regret attending the training which focused on the operation of the technology and did not focus on how to integrate the technology into curriculum delivery. In this digital age, educators are expected to have the skill to judge when and where to use technology for effective teaching and learning outcomes. Teachers and their specialist subject advisors need to acquire TPACK to teach effectively with and through ICTs. Subject advisors need the skill to be able to assist their teachers who during their pre-service teacher education did not have a chance of being modelled on how to teach with and through technologies.

6. Conclusions

Subject advisors are expected to be the masters of pedagogy and content knowledge in curriculum delivery. They were made subject advisors because they have expertise in a particular subject matter. However, for many of the subject advisors, technology knowledge is not their everyday area of expert knowledge; they are still expected to assist teachers to do their job well within connected classrooms. Subject advisors need the support of the WCED in order to facilitate development of their skills and show teachers how to integrate digital technologies into curriculum delivery effectively (Anderson, 2013).

Analysis of this study has shown that most subject advisors perceive their complex knowledge of how to effectively integrate ICTs into curriculum delivery as inadequate. They are hesitant to advise teachers on effective technology integration into classrooms. Some subject advisors are not even using the technologies to communicate to their teachers. They are not in a position to take advantage of the Connected Schools environment so they cannot play their role of assisting teachers to integrate digital resources into the classroom. The under-preparedness of subject advisors is due to lack of proper and adequate training to use the connectivity for their work. From analysis of the data, it is evident that the subject advisors are experts in their content area as well as the pedagogy (PCK) for delivering the content in a non-digital classroom. However, subject advisors need to acquire knowledge on how to integrate technology with their PCK so they can effectively assist teachers to teach with and through the technologies available in classrooms. In order to assist teachers embrace the technologies, besides PCK, subject advisors need to acquire other knowledge domains which include TPK, TCK TPACK. They need to understand how technology affects teaching and learning outcomes. They need to be aware of pedagogical affordances and constraints when using technologies for teaching. They need to acquire TPK. Subject advisors also need TCK to understand and use specific technologies that can enhance presentation of particular content in class. Subject advisors need to know how to integrate the three knowledge domains – PCK, TPK and TCK; this is what they need to be able to assist their teachers to embrace and use the connected classrooms effectively.

The Education Department needs to ensure that subject advisors are well enough trained to support and advise teachers on how best to participate in connected schools environment. The training on how to integrate ICTs into pedagogy should not be delivered as a generic course to subject advisors but should be subject specific. Thus, the training for subject advisors regarding ICT integration into pedagogy should be
offered while focusing on how to teach specific subjects. Elliot (2010:2) shows that “ICTs should not stand alone in course delivery, but rather be connected to the wider issue of learning for the knowledge age, and to broader issues of education quality and standards and learning outcomes”. Trainers should have adequate knowledge of the content, pedagogies of the specific subjects and how technology can be integrated for effective teaching and learning.

As long as subject advisors are inadequately trained on how to integrate the technologies into curriculum delivery, they are not able to assist teachers on how best to take advantage of the connected classrooms. This results in teachers and learners not being able to realise the benefits of the connectivity in their classrooms.

References


Department of Basic Education. 2013. Policy on the organisation, roles and responsibilities of Education Districts.


Elliot, A., 2010 Equity, pedagogy and inclusion. Harnessing digital technologies to support students from low socio-economic backgrounds in higher education. The Journal of Community Informatics, 6 (3) pp. 1-9


<www.ejel.org> ISSN 1479-4403
Better Learning of Chinese Idioms through Storytelling: Current Trend of Multimedia Storytelling

Ee Hui Li and Soon Hin Hew
Faculty of Creative Multimedia, Multimedia University, Cyberjaya, Malaysia
ehui614@yahoo.com
shhew@mmu.edu.my

Abstract: Storytelling plays a vital role to impart a nation’s tradition, cultural beliefs and history to future generation. It is frequently used for the purpose of sharing or exchanging information as it enables the messages to be conveyed to the audience easily. Storytelling acts as a tool of human social interaction and is commonly used in education for learning, explaining and entertaining. Due to the learning effectiveness brought up by storytelling, this study is aimed to compare and differentiate the feasibility of traditional storytelling and multimedia storytelling in motivating and leveraging the non-native novices’ learning of Chinese idioms. A total of 83 non-native novices who have attended the Chinese as Foreign Language Course in a local private university of Malaysia were selected as the research sample and divided into two groups. 43 participants were placed in the experimental group and studied the Chinese idioms with a developed multimedia storytelling prototype (MSP), whereas the other 40 participants in the conventional teaching group learned the new knowledge through traditional storytelling. A Chinese idiom test and survey questionnaires were distributed to the non-native novices to examine their learning achievement and preferences towards the learning approaches. Results showed that the students in the experimental group scored higher and had greater satisfaction towards the Chinese idiom learning than the learners from the conventional group.

Keywords: multimedia storytelling; traditional storytelling; foreign language learning; Chinese idiom learning; non-native novices

1. Introduction

Story can be in real or virtual form. It can be utilized as a way to deliver messages, knowledge, values and wisdom to the audience (Xu, Park & Baek, 2011). Storytelling is the act of presenting stories (Cambridge Dictionaries Online, 2015). It has been existed for thousands of years and serves as the oldest form of education (Hamilton & Weiss, 2005). Storytelling is often adopted to share or exchange the information as well as to improve a person’s comprehension (Malita & Martin, 2010). It is a valuable form of human expression and social interaction which is commonly exploited in communication, learning and entertainment (Hamilton & Weiss, 2005; Xu, Park, & Baek 2011). Storytelling links up the interaction between the storyteller and listeners. The tight connection between both sides has led to better communication as the messages are transmitted directly and easily (Yang & Wu, 2012).

Nowadays, the traditional storytelling has been transformed and expressed in the form of digital storytelling due to the development of advanced technology (Malita & Martin, 2010). This new edition of storytelling makes use of the combination of narration and multimedia elements, such as words, pictures, animation and video to convey the information to the audience (Li, Hew & Choo, 2016). The usage of digital storytelling is found increasing in various aspects of academic, including language, history, science, medicine and religion owing to its potential of providing multi-sensory learning environment to the learners (Han, 2007; Malita & Martin, 2010). For instance, Tsou, Wang and Tzeng (2006) had developed a digital storytelling website to assist the students of primary school in English learning. The experiment indicated that the students were motivated and able to recall their learning contents easily with the aid of digital storytelling.

Yang and Wu (2012) had also supported the using of digital storytelling in English as foreign language learning. The investigation showed that the students who completed their coursework projects through digital storytelling performed better and had greater interest to explore. A similar study conducted by Razmi, Pourali and Nozad (2014) shown that the application of digital storytelling had successfully developed the undergraduate students’ English learning skills. The learners’ motivation and creative thinking improved as they have to create their own digital stories with multimedia elements for the English lesson. Since the using of digital storytelling had led to effective learning, Thang, Sim, Mahmud, Lin, Zabidi and Ismail (2014) had sought out the educators and learners’ opinions towards digital storytelling as an alternative tool in learning. The
teachers and students responded positively that learning through digital storytelling would drive the students to participate actively in their learning process and worked independently.

Due to the various benefits brought about by digital storytelling in learning, a multimedia storytelling prototype was captured and created to aid the non-native novices to learn Chinese idioms in this study. Chinese idiom is part of Chinese language. It is usually formed by four Chinese characters and mostly originated from a Chinese history or ancient literature. A Chinese idiom consists of a terse meaning which can be used to explain a circumstance concisely (Stellard, 2011). It is prevalent and commonly used in Chinese communication as the messages can be conveyed from the speakers to the listeners vividly and quickly. As Chinese idiom is one of the priceless cultural legacies and contributes in Chinese vocabulary learning, it should be spread and popularized among the Chinese language learners, including the non-native learners. As the enormous development of China has heightened the popularity of Chinese traditional culture, Chinese language is now widely studied by foreigners and non-Chinese background learners (Chen, Wang, Chen & Chen, 2014). There are a lot of non-native speakers or enthusiasts attending Chinese language classes offered by numerous educational institutes to improve their Chinese speaking, listening, reading and writing abilities. In Malaysia, most of the higher education institutes allow the non-native speakers to take Chinese as foreign language learning due to its wide usage among the multiracial Malaysian communities (Yin and Ho, 2013). Despite the fact that the Chinese idiom is part of Chinese language, it is usually not included at the beginning level of Chinese language learning due to its complexity in structure. Therefore, the Chinese idiom is mostly studied by the advanced or native learners (Stellard, 2011). In Malaysia, the Chinese language classes are still restricted to traditional teaching and learning method. This educational approach is an one-way communication as the instructors will present the information according to their paces and talk continuously for a lesson. This monologue presentation ensues insufficient interaction between the instructors and learners, which causes the learners to become passive and negative in their learning (Zin, Latif, Bhari, Sulaiman, Rahman, Mahdi, Jamain, 2012). Chinese idiom is included in the Chinese language syllabus, Apart from Chinese idiom, the learners will also study the Chinese characters, pinyin, vocabulary, grammar and literature during the Chinese language classes (See, 2013). Hence, the Chinese language teachers have to cover all teaching syllabuses during the classes. However, the given period for a lesson is insufficient for the instructor to teach all the syllabuses. In order to complete teaching within the time limit, the teachers will usually deliver the important information to the students rather than presenting the backstory of Chinese idioms in detail as many teachers think that storytelling is a time consuming process. The students are less likely to fully understand the origins of Chinese idioms and the derived cultural traits from the history.

In this study, Chinese idiom is introduced to the non-native novices and this new information will enhance the learners’ interest and understanding in Chinese language and culture learning. Comparatively, the traditional teaching and learning method is less effective to motivate the learners’ willingness to explore for new knowledge due to the factors discussed above. Despite that many Chinese idiom learning systems can be found online and accessed easily by the learners, however, the learning mechanisms are mostly created for the native learner. This has caused the learning difficulty to the non-native novices as they are still new and unfamiliar to Chinese language. There are only a handful of Chinese idiom learning websites can be accessed by the non-native learners, including e-Chinese Learning (http://www.echineselearning.com), ForeignerCN (http://www.foreignercn.com), Chinese Scholar (http://www.chinese.hm68.com), Better Chinese (http://www.betterchinese.com) and Just Learn Chinese (http://www.justlearnchinese.com). These websites are created by the Chinese culture enthusiasts to share their Chinese experiences with the foreigners and non-native learners. However, some limitations are found and identified by Mayer’s multimedia learning theory (Mayer, 2009), which include the content presentation in static web pages with only printed words and static pictures, the separated presentation of animation and English explanation has caused the learners to study redundant information successively which has resulted to the cognitive overloads in learners working memories. In order to solve the abovementioned problems, a multimedia storytelling prototype is designed and developed purposely based on the limitations reviewed from the exiting websites for the non-native novices in the learning of Chinese idioms.

2. Purpose of the Study

This study is aimed to enhance the non-native novices’ learning interest towards the Chinese language and culture through appreciating Chinese idioms by using the developed multimedia storytelling prototype (MSP).
In order to examine the feasibility of the developed prototype, an experiment has been implemented to determine and differentiate its effectiveness with the traditional storytelling in ordinary classroom.

The experiment was conducted according to the following research questions:

1. How did the multimedia storytelling prototype (MSP) enhance the traditional teaching and learning method in Chinese idioms?

2. Why is the multimedia storytelling prototype (MSP) feasible to be served as a self-learning tool for non-native novices to study Chinese idioms?

2.1 Concept for the Development of Multimedia Storytelling Prototype (MSP)

A multimedia storytelling prototype (MSP) was developed and subsequently hosted into internet for the purpose of investigation. The concept for the development of MSP was shown in Figure 1. In order to aid the non-native novices to comprehend Chinese idioms in an easy way, the origins of Chinese idioms were composed and designed into digital stories based on the five essential story elements, include setting, plot, characters, conflict and resolution (Kent, 2015; Yang & Wu, 2012). By determining the story elements, the learners were able to understand the derivation of Chinese idioms in detail.

A Chinese dynasty timeline was created to provide the non-native novices a better understanding towards the setting (time and location) of the happened historical event. The dynasty timeline will help the non-native novices to understand “where” and “when” the historical incident of the Chinese idiom occurred. The backstory of the Chinese idiom was presented in the form of digital storytelling. During the story presentation, the plot, characters, conflict and resolution of the backstory would be illustrated. Thus, the learners were able to study the background of Chinese idiom through knowing “what” was the incident about, “who” were the characters of the incident, “why” was the Chinese idiom named in such a manner, and “how” the incident generated the Chinese idiom. The studying of the historical incident would facilitate the non-native novices to comprehend the literal translation and exact meaning of the relevant Chinese idiom. Apart from that, the cognitive theories of multimedia learning, including multimedia principle, redundancy principle, modality principle, temporal contiguity principle, coherence principle, personalization principle, signaling principle and voice principle (Mayer, 2009; 2014) were applied to the composing of digital story to assist the learners for better Chinese idiom learning.

![Figure 1: Concept for the development of MSP](image)
3. **Method**

Quantitative and qualitative methods were adopted in this study to obtain numerical data and opinions from the selected samples. A Chinese idiom test and survey questionnaires were given to all participants to examine their comprehension of the learned Chinese idioms and preferences towards the learning approaches.

3.1 **Sample**

A total of 83 participants are selected to run this study. There are the undergraduate students who have attended the Chinese as Foreign Language Course in a local private university. The course is only offered to the non-native novices. Thus, these selected participants are non-Chinese and considered Chinese language as their foreign language. All of them have no prior knowledge and experience with Chinese language, neither speaking, reading, writing nor listening. After their registration for the Chinese as Foreign Language Course, they are assigned randomly by the university into two classes to attend the Chinese language lessons. There are 43 students in the first classroom, and 40 students are placed in the second classroom.

3.2 **Experimental Procedure**

An experiment was carried out to compare the learning effectiveness between MSP and traditional storytelling in the learning of Chinese idioms. 43 students from the first classroom were assigned in the experimental group, while the other 40 participants in the second classroom were allocated to the conventional teaching group. The participants from both groups studied the same Chinese idioms but with different learning approaches. The learners in the conventional teaching group studied the origins of Chinese idioms through traditional storytelling and they were given a lecture by the instructor using white board and lecture notes. At the same time, the students of the experimental group learned the Chinese idioms via MSP. By interacting with the prototype, the students of the experimental group could access the Chinese idiom lesson through multimedia storytelling (as shown in Figure 2 and Figure 3). Three Chinese idioms have been chosen for the learning, which were “百发百中 (bai fa bai zhong),” “刮目相看 (gua mu xiang kan),” and “胸有成竹 (xiong you cheng zhu)”. The meaning, pronunciation, historical background, characters and the usage of Chinese idioms were taught in the learning content. Although the Chinese idioms were randomly picked for the learning, however, the selection was based on two key factors: historical values and applicability. As mentioned earlier, most of the Chinese idioms have their own historical values and impacts on Chinese cultural heritages. Hence, the selected Chinese idioms are classical allusions originated from historical events and the stories had indeed happened during the ancient times. While appreciating the Chinese idioms, the non-native speakers can also understand the precious Chinese cultures and histories through the stories. Apart from historical values, the chosen Chinese idioms are also commonly used in the Chinese community nowadays.

In order to avoid bias and ensure the validity of data, the backgrounds of the 83 participants have been verified with the university and also their Chinese language lecturer. They have proved that the participants were indeed novices and new to Chinese language. As mentioned previously, the participants have been divided into two groups for the investigation. Both groups were tested and examined in two different situations at the same time. The researcher and assistant researcher served as the storyteller and facilitator during the investigation. When the researcher works as storyteller to share the idioms and relevant classical allusions to the students of conventional teaching group, the assistant researcher plays the role as the facilitator to guide the participants of the experimental group to learn Chinese idioms through the developed prototype in the computer lab. The participants from both groups were given 30 minutes to complete the Chinese idiom learning. Subsequently, a Chinese idiom test with 15 questions is given to all students within 15 minutes to examine their understanding of the learned Chinese idioms during the short timeframe of learning. After the test, the students were required to evaluate their learning process through survey questionnaires in 30 minutes. Two sets of different survey questions were designed respectively for each group. The students of the experimental group evaluated their learning process through MSP, while the students of the conventional teaching group assessed the traditional storytelling and lecture by the instructor. The investigation of both groups started and ended at the same time. Thus, all participants have no chance to discuss with each other the contents and learning materials. The results acquired from both groups were examined and analyzed.
4. Results and Analysis

The Chinese idiom test aims to examine the participants’ knowledge of the learned Chinese idioms. It is divided into three sections, namely meaning and pronunciation, history and characters, and the using of Chinese idioms. The test consists of 15 questions, including 11 multiple choice questions and 4 writing questions. Each question carries one mark, i.e. a total of 15 marks for the Chinese idiom test.

4.1 Results of Chinese Idiom Test

A Shapiro-Wilk normality test was utilized to examine the normality of data for the Chinese idiom test. It was discovered that the scores of Chinese idiom test for the experimental group and the conventional teaching group did not have a normal distribution (p < 0.05). Thus, a non-parametric test, Mann-Whitney U test was exploited to analyze the data findings.

Table 1: U-test result of Chinese idiom test

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean Rank</th>
<th>Sum of Rank</th>
<th>Median</th>
<th>U</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td>43</td>
<td>56.31</td>
<td>2421.5</td>
<td>14</td>
<td>244.5</td>
<td>-5.725</td>
<td>.000</td>
</tr>
<tr>
<td>Conventional teaching group</td>
<td>40</td>
<td>26.61</td>
<td>1064.50</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 indicates the results of Chinese idiom test. A Mann-Whitney U test is carried out to determine the hypothesis that the non-native novices of the experimental group score higher in average than the conventional teaching group in the Chinese idiom test. Descriptive statistics reveals that the students of the experimental group (Md\(n = 14\); mean rank = 56.31) indeed score higher in the Chinese idiom test than the students of the conventional teaching group (Md\(n = 12\); mean rank = 26.61). The result is statistically
significant as $U = 244.5$ ($z = -5.725$), $p < 0.01$, and the difference between the experimental group and the conventional teaching group is large ($r = -0.628$).

From the results, it can be stated that the non-native novices of the experimental group who learned the Chinese idioms through multimedia storytelling can perform better in the Chinese idiom test rather than the non-native novices of the conventional teaching group who study the learning contents via traditional storytelling in ordinary classroom.

### 4.2 Evaluation Results

Five-point likert scales, with 5 being the best and closed-ended questions are applied in the survey questionnaires. The questions are categorized into three sections, namely learning motivation, interactivity and communication, and content presentation. Each participant is given an evaluation sheet and required to rate for the learning approach. In addition, open-ended questions are also utilized to obtain the opinion and feedback in fuller statements from the participants.

Table 2: Results for Students’ Learning Motivation

<table>
<thead>
<tr>
<th>No</th>
<th>Section 1: Learning Motivation</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Percentage of agreed and strongly agreed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I enjoyed learning with multimedia storytelling.</td>
<td>4.67</td>
<td>0.56572</td>
<td>95%</td>
</tr>
<tr>
<td>2</td>
<td>I found that multimedia storytelling was interesting and engaging.</td>
<td>4.72</td>
<td>0.45385</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>Multimedia storytelling helped me to understand the Chinese idioms better.</td>
<td>4.53</td>
<td>0.50468</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>Interacting with the application increased my motivation to learn.</td>
<td>4.42</td>
<td>0.69804</td>
<td>88%</td>
</tr>
<tr>
<td>5</td>
<td>I can apply what I have learned from multimedia storytelling in real-life.</td>
<td>4.16</td>
<td>0.68765</td>
<td>84%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Section 1: Learning Motivation</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Percentage of agreed and strongly agreed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I enjoyed learning with traditional storytelling in ordinary classroom.</td>
<td>3.78</td>
<td>0.83166</td>
<td>75%</td>
</tr>
<tr>
<td>2</td>
<td>I found that traditional storytelling in ordinary classroom was interesting and engaging.</td>
<td>3.6</td>
<td>1.00766</td>
<td>65%</td>
</tr>
<tr>
<td>3</td>
<td>The lecturer’s explanation helped me to understand the Chinese idioms better.</td>
<td>4.03</td>
<td>0.76753</td>
<td>90%</td>
</tr>
<tr>
<td>4</td>
<td>Traditional storytelling in ordinary classroom increased my motivation to learn.</td>
<td>3.55</td>
<td>1.01147</td>
<td>55%</td>
</tr>
<tr>
<td>5</td>
<td>I can apply what I have learned from the class in real-life.</td>
<td>3.6</td>
<td>0.90014</td>
<td>52%</td>
</tr>
</tbody>
</table>

Table 2 shows the evaluation results of the students' learning motivation from both experimental group and conventional teaching group. According to the table, it can be seen that the non-native novices of the experimental group have shown higher learning motivation than the learners of the conventional teaching group. 88% of the students from the experimental group agree and strongly agree (question 4, under experimental group) that the MSP has increased their motivation to learn Chinese idioms, and a mean score of 4.42 ($SD = 0.698$) is rated for this statement. Conversely, there is merely 55% of students from the conventional teaching group agree and strongly agree (question 4, under conventional group) that their learning interest and enthusiasm are enhanced through traditional storytelling. A mean score of 3.55 ($SD = 1.011$) is given for this statement by the students from the conventional teaching group.

www.ejel.org 460 ©ACPI L
Meanwhile, 95% of students from the experimental group agree and strongly agree (question 1, under experimental group) that they enjoy the Chinese idiom learning through multimedia storytelling ($M = 4.67$, $SD = 0.566$). All the students find that multimedia storytelling is interesting and engaging (question 2, under experimental group) by giving a mean score of 4.72 ($SD = 0.454$). In addition, the students are also consented with the multimedia storytelling which has assisted them to better understand Chinese idioms (question 3, under experimental group), where a mean score of 4.53 ($SD = 0.505$) is rated for this statement. On the other hand, 75% of students from the conventional teaching group agree and strongly agree (question 1, under conventional teaching group) that they enjoy the Chinese idiom learning through traditional storytelling by giving a mean score of 3.78 ($SD = 0.832$). 65% of them agree and strongly agree (question 2, under conventional teaching group) that learning through traditional storytelling is interesting and engaging ($M = 3.6$, $SD = 1.008$). Besides that, 90% of the students in the conventional teaching group agree and strongly agree (question 3, under conventional teaching group) that the lecturer’s explanation has assisted them to understand the Chinese idioms better. A mean score of 4.03 ($SD = 0.768$) is given for this statement.

The use of learned knowledge is vital in learning process. There is 84% of the students from the experimental group agree and strongly agree (question 5, under experimental group) that they can apply their learning knowledge in their real life by giving a mean score of 4.16 ($SD = 0.688$). In the conventional teaching group, there is only 52% of students agree and strongly agree (question 5, under conventional teaching group) that they can employ Chinese idioms in their daily lives ($M = 3.6$, $SD = 0.900$).

**Table 3:** Results for Students' Interactivity and Communication

<table>
<thead>
<tr>
<th>Experimental Group</th>
<th>No</th>
<th>Section 2: Interactivity and Communication</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Percentage of agreed and strongly agreed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The quiz in the multimedia storytelling prototype enhanced my knowledge about Chinese idioms and histories.</td>
<td>4.56</td>
<td>0.58969</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The message was delivered clearly through the multimedia storytelling.</td>
<td>4.49</td>
<td>0.5925</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The application allowed me to learn in my own paces.</td>
<td>4.44</td>
<td>0.70042</td>
<td>89%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conventional Teaching Group</th>
<th>No</th>
<th>Section 2: Interactivity and Communication</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Percentage of agreed and strongly agreed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I could understand the meaning and history of the Chinese idioms very well through traditional storytelling.</td>
<td>3.78</td>
<td>0.8912</td>
<td>71%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The message was delivered clearly through the lecture.</td>
<td>4.0</td>
<td>0.84732</td>
<td>83%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I could learn the contents in my own paces.</td>
<td>3.45</td>
<td>1.08486</td>
<td>56%</td>
<td></td>
</tr>
</tbody>
</table>

Interaction facilitates a better communication between learners and learning contents. According to Table 3, 95% of the students in the experimental group agree and strongly agree (question 1, under experimental group) that the added quiz in the MSP has boosted their knowledge in Chinese idioms by giving a mean score of 4.56 ($SD = 0.590$). In the conventional teaching group, 71% of the students agree and strongly agree...
(question 1, under conventional teaching group) that they can understand the learning contents through traditional storytelling ($M = 3.78$, $SD = 0.891$).

A successful delivery of message will speed up learning. The information is expressed clearly through multimedia storytelling, where a mean score of 4.49 ($SD = 0.593$) is rated by the students of the experimental group. 95% of them agree and strongly agree with the statement (question 2, under experimental group). However, the explanation of learning contents by the instructor through lecture and storytelling is also complimented by the students of the conventional teaching group. 83% of the students agreed and strongly agreed (question 2, under conventional teaching group) with the statement and a satisfactory mean score of 4.0 ($SD = 0.847$) is rated for this statement.

Meanwhile, 89% of the students in the experimental group agree and strongly agree (question 3, under experimental group) that the MSP allows them to study in their own paces. A mean score of 4.44 ($SD = 0.700$) is rated by the students for this statement. Despite the conveying of learning contents through traditional storytelling in lecture class has satisfied the students in the conventional teaching group, but only 55% of them agree and strongly agree that they can control their own learning paces (question 3, under conventional teaching group). This is evident by the mean score of 3.45 ($SD = 1.085$) given by the students.

**Table 4: Results for Content Presentation**

<table>
<thead>
<tr>
<th>Experimental Group</th>
<th>Section 3: Content Presentation</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Percentage of agreed and strongly agreed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The information is clear, concise and easy for me to understand.</td>
<td>4.44</td>
<td>0.58969</td>
<td>96%</td>
</tr>
<tr>
<td>2</td>
<td>The animation and graphics enhanced my understanding about the story of Chinese idioms.</td>
<td>4.67</td>
<td>0.56572</td>
<td>95%</td>
</tr>
<tr>
<td>3</td>
<td>The application is well presented.</td>
<td>4.37</td>
<td>0.61811</td>
<td>93%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conventional Teaching Group</th>
<th>Section 3: Content Presentation</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Percentage of agreed and strongly agreed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The information is clear, concise and easy for me to understand.</td>
<td>3.93</td>
<td>0.65584</td>
<td>80%</td>
</tr>
<tr>
<td>2</td>
<td>I could visualize the story of Chinese idioms when listened to the lecturer’s storytelling.</td>
<td>3.58</td>
<td>0.87376</td>
<td>58%</td>
</tr>
<tr>
<td>3</td>
<td>The teaching contents were well-presented.</td>
<td>3.85</td>
<td>0.69982</td>
<td>73%</td>
</tr>
</tbody>
</table>

A well-presented learning content allows the information to be delivered to the students easily. As shown in the Table 4, 93% of the students in the experimental group agree and strongly agree (question 3, under experimental group) that the learning content is well-presented. A mean score of 4.37 ($SD = 0.618$) is recorded for the presentation of the MSP. In addition, the message is clear, concise, and easy to understand ($M = 4.44$, $SD = 0.590$), where the statement is agreed and strongly agreed by 96% of them (question 1, under experimental group).

On the other hand, a mean score of 3.85 ($SD = 0.700$) is rated by the students in the conventional teaching group for the content presentation. 73% of the students agree and strongly agree (question 3, under conventional teaching group) that the teaching content is well-explained by the lecturer. Furthermore, 80% of the students also agree and strongly agree (question 1, under conventional teaching group) that they can understand the information easily and clearly. A satisfactory mean score of 3.93 ($SD = 0.656$) is given in this assessment. Based on the aforementioned evaluation results, it can be seen clearly that the students in the conventional teaching group felt satisfied with the content presentation too.

Animation and graphics are utilized in the MSP to stimulate the users’ sense of vision. The outcome indicates that 95% of the students in the experimental group agree and strongly agree (question 2, under experimental...
group) that the animation and graphics have improved and upraised their understanding towards the story of Chinese idioms by rating a mean score of 4.67 ($SD = 0.566$). However, in the conventional teaching group, there is only 58% of the students agree and strongly agree (question 2, under conventional teaching group) that they can visualize the stories and characters of the Chinese idioms by listening to the lecturer. A mean score of 3.58 ($SD = 0.874$) is given by the students in this evaluation.

4.3 Student Feedback towards the Learning Approaches

Table 5: Student Feedback of the Experimental Group

<table>
<thead>
<tr>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section 1: Motivation</strong></td>
</tr>
<tr>
<td>- Multimedia storytelling is helpful and increases my motivation in learning Chinese idioms.</td>
</tr>
<tr>
<td>- The graphics and animation attract my attention and enhance my efficiency of Chinese idiom learning.</td>
</tr>
<tr>
<td><strong>Section 2: Interaction &amp; Communication</strong></td>
</tr>
<tr>
<td>- I can slowly pick up and learn based on my own pace and own way through the prototype.</td>
</tr>
<tr>
<td>- The prototype is user friendly and easy to navigate. I can repeat or skip the learning contents according to my learning curve.</td>
</tr>
<tr>
<td>- The well-presented graphics and animation helped me to visualize and imagined the histories better and easily.</td>
</tr>
<tr>
<td>- The presentation of the learning content is simple and direct which has enhanced my understanding about the Chinese idioms and their origins.</td>
</tr>
<tr>
<td>- I have gained extra knowledge through the dynasty timeline. It helps me to understand the period and place of the story better.</td>
</tr>
<tr>
<td><strong>Section 3: Content Presentation</strong></td>
</tr>
<tr>
<td>- The prototype is suitable for beginners like us to learn better.</td>
</tr>
<tr>
<td>- The prototype is engaging and interesting as it is well-organized and informative.</td>
</tr>
<tr>
<td>- The using of graphics and animation makes me focus more on learning contents.</td>
</tr>
<tr>
<td>- The prototype is suitable for self-learning. I can access the learning whenever I want.</td>
</tr>
<tr>
<td>- The meaning, stories and examples provided have helped me to understand and memorize easily.</td>
</tr>
<tr>
<td>- The Chinese pinyin and English translation have helped me to read and understand the learning contents.</td>
</tr>
</tbody>
</table>

Table 6: Student Feedback of the Conventional Teaching Group

<table>
<thead>
<tr>
<th>Conventional Teaching Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section 1: Motivation</strong></td>
</tr>
<tr>
<td>- Traditional storytelling and lecture class are a bit boring for me and they don't motivate me much.</td>
</tr>
<tr>
<td>- I don't prefer this learning method as I always have to catch up the lecturer’s teaching paces.</td>
</tr>
<tr>
<td>- The learning is funny, but it's hard for me to visualize and imagine the histories.</td>
</tr>
<tr>
<td><strong>Section 2: Interaction &amp; Communication</strong></td>
</tr>
<tr>
<td>- Learning through traditional storytelling and lecture class help me to memorize. I can write down the important points when I listen to the teaching contents.</td>
</tr>
<tr>
<td>- This method fosters live communication as the students can interact with the lecturer.</td>
</tr>
<tr>
<td>- The lecturer explains the information and tells the story very well.</td>
</tr>
<tr>
<td>- I prefer study through traditional learning method as Q&amp;A session is always available during the class. I can question whenever I have any doubt towards the learning.</td>
</tr>
<tr>
<td>- The Chinese idiom learning is interesting, but I couldn’t imagine the stories very well.</td>
</tr>
<tr>
<td><strong>Section 3: Content Presentation</strong></td>
</tr>
<tr>
<td>- The messages and stories were presented clearly by the lecturer.</td>
</tr>
<tr>
<td>- The storytelling has helped me to understand the background of Chinese idiom better and the lecture enhances my understanding.</td>
</tr>
<tr>
<td>- The learning contents and stories are easy to understand and well-presented.</td>
</tr>
</tbody>
</table>
Table 5 and Table 6 conclude the students’ feedback from both experimental group and conventional teaching group. The students have shared their opinions or comments towards their learning approaches through the open-ended questions which were given to them. The students’ feedbacks are divided into three parts, including motivation, interaction & communication and content presentation. According to their feedback, the students of the experimental group compliment and satisfy with their learning through multimedia storytelling. They enjoy learning Chinese idioms through MSP as the creative presentation has grabbed their attention and evoked their learning interest successfully (referred to Table 5, under the section of motivation).

The adding of the interactivity in the prototype enables them to interact with the learning contents and they can control their own learning paces (referred to Table 5, under the section of interaction & communication). Besides that, the students indicate that their learning process has become easy with the aid of animation and graphical contents as the visual elements have assisted them to imagine and visualize the stories of Chinese idioms. The use of dynasty timeline has also helped them to understand the time and location of the derived historical incidents better. In addition, the students reveal that the prototype is well-organized and informative (referred to Table 5, under the section of content presentation). They declare that the message is delivered in a direct and simple way which is easy to understand. The aids of the English translation and Chinese pinyin have also facilitated the students’ Chinese pronunciation and comprehension towards the learning contents.

In the conventional teaching group, the students learn Chinese idioms through traditional storytelling and lecture class. With the lecturer’s explanation, they have learned the Chinese idioms successfully. The evaluation result of the conventional teaching group is considered as an overall satisfaction. However, the students of the conventional teaching group have different points of view towards the traditional storytelling in ordinary classroom. Most of the students preferred learning Chinese idiom by attending a lecture class. They agree that this teaching method has fostered live communication as they can consult with the lecturer about their doubt anytime during the lesson (refer to Table 6, under the section of interaction & communication). Additionally, the students have also complimented on the given lecture and storytelling by the instructor (refer to Table 6, under the section of content presentation). The information is delivered clearly and the lecturer’s explanation has facilitated the students for better understanding. However, there are students saying that they are interested to study Chinese idioms, but the monologue presentation by the lecturer has made them unmotivated as they have to follow the lecturer’s teaching paces instead of their own learning paces (refer to Table 6, under the section of motivation). The students also reveal that the stories are hard to be imagined and visualized due to their unfamiliarity of the Chinese history and culture.

5. Discussion

Storytelling fosters better communication as it enables the interaction between the teller and audience (Li, Hew & Choo, 2016). From the results obtained, it can be seen that the use of storytelling has facilitated the non-native novices to study Chinese idioms as well as to enhance their learning interest towards the Chinese language. The non-native novices from the experimental group and the conventional teaching group were motivated and satisfied with their Chinese idiom learning. However, it can be seen that the students of the experimental group have higher learning motivation and greater satisfaction towards Chinese idiom learning than the students of the conventional teaching group. They also achieved higher scores in Chinese idiom test than the non-native novices of the conventional teaching group. In the experimental group, the students have to interact with the MSP to access the Chinese idiom lessons. The interactive buttons allow the students to decide and control their learning paces without proceeding too fast. Thus, the students are able to repeat and recall their learning according to their willingness. In addition, the use of visual elements during the storytelling has assisted the students to visualize and understand the backstory better, especially the circumstance and characters. The narration which is used as an aider in the story description has also made the storytelling vividly and lively. The information is therefore garnered in the students’ working memories for a longer time due to the stimulation of visual and auditory senses simultaneously (Mayer, 2005; 2009; 2014).

Although face-to-face communication is allowed in the conventional teaching group during the Chinese idiom lesson, the non-native novices of the conventional teaching group responded as passive information receivers most of the time. Due to the large class size, the lecturer is unable to interact with every student and allow every one of them to ask questions as the lecturer has to complete the teaching syllabus within the given period. The lack of personal interaction between the lecturer and the students has led to less and insufficient intercommunication and learning motivation in the class. Apart from that, the students have to study the contents and listen to the stories according to the lecturer’s teaching pace instead of their own. Hence, the
students may encounter learning difficulties if they have missed out any part of the storytelling and lecture unintentionally as they cannot repeat or recall the learning by themselves. For students who are below average level in Chinese language learning, they may also not be able to catch up with the lecturer’s teaching pace if the teaching is too fast. This will result in a longer learning curve and less effective learning. Additionally, the students may also confront difficulty of visualization during the storytelling as they are still unfamiliar with the Chinese culture and history. Thus, the students are not able to synchronize their imagination with the narration in their brains during the storytelling.

6. Conclusion

This study aims to enhance the non-native novices’ interest towards learning Chinese language and culture through appreciating Chinese idioms by using the developed multimedia storytelling prototype (MSP). An experiment has been conducted to examine the feasibility of MSP and traditional storytelling in teaching Chinese idioms in ordinary classroom. From the investigation, it can be seen that learning Chinese idioms through multimedia storytelling is more feasible and should be recommended to the non-native novices. Storytelling has the ability to deliver messages and information to the audience easily and effectively (Li, Hew & Choo, 2016). Nevertheless, the traditional storytelling is less effective in Chinese idiom learning if compared to multimedia storytelling in this study. An active participant can learn better than a passive information receiver. In order to facilitate the learners to be responsible and work independently during their learning process, motivation and interaction are considered and applied in every instructional method as these elements have prompted the learners to study actively and initiatively. When the learners are successfully changed from passive to active status, they will bear their responsibilities and take the initiative to learn independently. Regarding this, a better intercommunication and understanding can be cultivated, and the learners’ motivation will be evoked when they are able to control and decide their learning direction. In addition, the prototype which is developed based on the cognitive theories of multimedia learning (Mayer, 2009) has also assisted the students to learn better as these multimedia instructional principles studied the human cognitive and understand the functionality of brain. The MSP is evident to evoke the learning motivation of the non-native novices in the experimental group successfully as well as to leverage their knowledge and comprehension of the Chinese idioms. Henceforth, the MSP is feasible to be served as a self-learning tool and used by the non-native novices to learn Chinese idioms.

7. Limitation and Future Work

Owing to the small sample of this study, the results obtained from the test and evaluations were regarded as references for Chinese idiom teaching and learning. A bigger scope of samples is suggested for future studies to make the data findings more precise and reliable. In addition, the MSP is planned to serve and act as a complete learning system for Chinese idioms. The system will be improved with other language translations to cater the needs of people from different races. A game-based learning system is also aimed to be integrated into the prototype to facilitate more interaction and communication between the users and learning contents. It is recommended that the enhanced prototype can be envisaged as a new and different approach for the non-native novices to learn Chinese idioms in the near future.

References


