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# Message from the Editor-in-Chief

Dear Colleagues,

TOJET welcomes you. TOJET looks for academic articles on the issues of educational technology and may address assessment, attitudes, beliefs, curriculum, equity, research, translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations, and integration of subjects. The articles should discuss the perspectives of students, teachers, school administrators and communities. TOJET contributes to the development of both theory and practice in the field of educational technology. TOJET accepts academically robust papers, topical articles and case studies that contribute to the area of research in educational technology.

The aim of TOJET is to help students, teachers, school administrators and communities better understand how to use technology for learning and teaching activities. The submitted articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET. TOJET provides perspectives on topics relevant to the study, implementation and management of learning with technology.

I am always honored to be the editor in chief of TOJET. Many persons gave their valuable contributions for this issue.

TOJET, Sakarya University, TASET and Governor State University will organize International Educational Technology Conference (IETC 2017) in August, 2017 in Harvard University, Boston, USA.

**Call for Papers**
TOJET invites article contributions. Submitted articles should be about all aspects of educational technology and may address assessment, attitudes, beliefs, curriculum, equity, research, translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations, and integration of subjects. The articles should also discuss the perspectives of students, teachers, school administrators and communities.

The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET.

**July 01, 2017**

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# Academic and Social Media Practices of Arabic Language among Malaysian Students

**Wail Ismail[1], Muhammad Azhar Zailani[2], Zakaria Alcheikh Mahmoud Awad[3], Zaharah Hussin [4], Mohd Faisal [5], Rahimi Saad [6]**

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## ABSTRACT
Nowadays, more and more countries are paying attention to graduates' language skill and sending their students abroad to learn languages. As an Islamic country, Malaysia has sent many students to learn Arabic language and Islamic knowledge. This paper aims at examining the level of practice of Arabic language among Malaysian students in Jordanian universities. The study seeks to answer the following questions: What is the level of practice of Arabic language (academic, social media) among Malaysian students of Jordanian universities? Do any significant differences exist in the level of Arabic language practiced by Malaysian students of Jordanian universities in relation to certain variables? Results indicate that the Malaysian students had a medium level of practice of Arabic language. Significant differences were observed among gender, marital status, and field of study variables, whereas no significant difference was identified among university, level of study, distance of residence to the university, previous school, housemate qualities, nor CGPA.

## INTRODUCTION
Many nations have acknowledged the need to produce more graduates who are multilingual in the effort to compete in the global society. Malaysia has confirmed the importance of proficiency in a third language in order to develop human capital that helps the economy besides remaining competitive in the international arena (Zubairi & Sarudin, 2009 ; Pufahl, Rhodes & Christian, 2000). As an Islamic country, Malaysia is one of the countries paying most attention to the study and preservation of Arabic language, and it provides scholarships to support a large number of students to study abroad in different fields related to the study of Arabic (Latifah binti Abdul Latiff, 2004).

According to Oberg (2006) students studying abroad undergo four stages in their adjustment and practice of the target language. In the first few weeks, most of the students were observed to have a fascination with the new environment and language. This stage may last from a few days or weeks to six months depending on circumstances. The second stage is characterized by a hostile and aggressive attitude toward the host country, resulting in troubles at home and school, in language study, transportation, and shopping, whereas the people in the host country are largely indifferent to all these troubles. The consequence is aggression and the tendency of the students to join their fellow countrymen in criticizing the host country. People who overcome the second stage stay in the host country; otherwise, they leave before reaching the stage of a nervous breakdown. If the students succeed in obtaining knowledge of the language, which is a basic requirement in learning, and begin to use the language, their learning will be facilitated. In acquiring a complete adjustment at the fourth stage, one not only adapts to the food, drinks, habits, and language, but also begins to enjoy them. Students who are in the process of practice and understanding will attain enjoyment in time.

The language acquisition process does not involve a conscious or organized effort, but it is a tradition and simulation dependent on social learning theory. According to Bandura, a basic role of social learning theory is an individual obtaining opportunities in various life situations and spontaneously as required in social communication. For example, the children acquire language by exposure to many opportunities involving the practice of the language with the community and learning the origins of the language and its rules (Abdulsalam, 2012; Lightbown & Spada, 2002).

So, the high interaction within a group will result in an individual learning the target language more rapidly than an individual performing self-learning because of the continued use and practice of the language. Alternatively, a student who does not engage in interaction will fall behind because of inadequate practice and use of the language (David, 1997).

De Keyser (2007) indicated that practice has a central importance in skill acquisition in both cognitive and educational psychology. In cognitive psychology, Anderson (2000) mentioned the adaptive control of thought theory that hypothesizes practice as the driving force behind skill acquisition and the vehicle that can transform declarative knowledge to procedural and then to automatized knowledge. In educational psychology, Ericsson, Krampe, and Tesch-Romer (1993), Ericsson and Charness (1994), and Ericsson (1996) demonstrated the effect of deliberate practice in developing expert skills in a wide range of domains. In addition, numerous hours of specific practice and training are necessary in reaching the highest levels of performance (Ericsson, 2006). Contrary to common belief, the effects of extended deliberate practice are highly extensive. Performers can acquire skills that circumvent the basic limitations on working memory capacity and sequential processing. Deliberate practice also induces anatomical changes as a result of adaptation to intense physical activity. The study of expert performance has important implications for our understanding of the structure and limits of human adaptation and optimal learning. The scientific study of deliberate practice will enhance our knowledge about how experts optimize the increase in performance and motivation through a high level of daily practice continued for days, months, and years (Ericsson, 2004).

De Keyser (1998) viewed the relevance of practice in second language learning as an essential skill to be acquired, and the engagement in deliberate practice predicted higher performance ratings (Sonnentag and Kleinc, 2000). Ushida (2005) identified students who are most successful in learning a second language as those who consistently speak the language and integrate with the culture connected with the language. This is strongly associated with the personality of the individual (Smith and Renk, 2007).

On the other hand, we are currently surrounded by new technology, such as computers, the Internet, e-mail, voice mail, compact discs, and fax machines, which create meaningful and relevant contexts for learning language. According to modern language principles and practice, the use of ICT can bring people directly into contact/practice with others from around the world, and provide real-life contexts that motivate students and young people and help them to see a purpose to their language learning and help them to develop their knowledge, understanding and appreciation of the culture surrounding the language being studied (Education Scotland, 2015).

In this study, we discuss about social media, Grahl (2013) revealed that social media can be divided into six different which include: 1.social networks (e.g., Facebook, LinkedIn); 2.bookmarking sites (e.g., Delicious, StumbleUpon); 3.social news (e.g., Digg, Reddit); 4.media sharing (e.g., Instagram, YouTube, Flickr); 5.microblogging (e.g., Twitter); and 6.blogging, particularly comments and forums. The popularity of social media tools has increased dramatically over the past years.

Hillman and Säljö (2016) advocated that academic learning was not only limited in the school, the use of social media is also one important resource. Hence, the practice of Arabic language learners does not only depend on the academic aspect, that is, the atmosphere of learning and teaching in the field of education, but also on the direction and extent of practice in various areas, such as random exposure, involvement in the social community, culture and customs, participation in different clubs and activities, and use of media or television (Ahmed, 2011). Moreover, Mikal and Grace (2012) commented that social media and electronic connections to family members can reduce stress and help students with psychological adjustment in living abroad. Emotionally well-adjusted students find it easier to enjoy their experience in a foreign culture and to be more satisfied when engaging with locals (Mikal, Yang, & Lewis, 2014).

Álvarez Valencia (2015) declared that “social networking has compelled the area of computer-assisted language learning (CALL) to expand its research palette and account for new virtual ecologies that afford language learning and socialization”.

New technical possibilities result in new types of text and then to new social possibilities, as people find different means of communicating and practicing a language with each other (Shortis, 2001). Gray et al. (2007) revealed that students overall have a positive perception on the use of Internet tools in language study. A computer-mediated communication environment was revealed to decrease the psychological barriers of students, enabling them to freely express their opinions and to actively communicate on the Internet, while their critical thinking, problem-solving, and communication skills are enhanced by online activities or class homepage construction. The criterion of success is whether students have a strong and authentic sense of development and evolution in their language practice, their understanding of their language practice, and the situations in which they practice (Atweh et al., 2002).

Godwin-Jones (2016) discussed in his study the personal and learning benefits of technology use while abroad, the formation of second-language identities, the affordances for pragmatic language development, the integration of mobile devices for place-based language learning, and the opportunities for enhancing intercultural communication competence; all of this explained that social media help students in language learning while abroad.

Only a few studies have discussed the impact factors on language learning abroad, for example: gender (Kinginger, 2013; Pellegrino Aveni, 2005), age, racial or ethnic characteristics (Simon & Ainsworth, 2012) and Social class and economic status also can be factors as well (Kinginger, 2004). A major contributor to success or failure is motivation, or the degree to which students are invested in becoming part of the target linguistic and cultural community (Godwin-Jones, 2016).

Hence the purpose of this study is to investigate the level of practice of Arabic language (academic, social media) among Malaysian students in Jordanian universities. And to see if any significant differences exist in the level of Arabic language practice of Malaysian students in Jordanian universities in relation to gender, university, field of study, level of study, marital status, distance of residence to the university, previous school, housemate qualities, and CGPA.

## METHODS

### Participants and Sampling

The participants of this study comprised Malaysian students who are studying in Jordanian universities. After researchers refer to some of the studies (Harmer, 1991; Raban, Brown, Care, Rickards & O'Connell, 2011). The language practice questionnaire covered 35 items and the researchers distributed them to a random sample of 386 students from the following institutions see [Table 1]

**Table 1.** Frequency and percent scores on variables

| Study Variables | variables levels | Frequency | Percent |
|---|---|---|---|
| Gender | Male | 170 | 44.0 |
| | Female | 216 | 56.0 |
| University | University of Jordan | 15 | 3.9 |
| | University of Yarmouk | 160 | 41.5 |
| | University of Mu'tah | 53 | 13.7 |
| | Jordan University of Science and Technology | 37 | 9.6 |
| | Al Bait University | 121 | 31.3 |
| Field of Study | Study of Islam (Shariah/Usuluddin/Islamic Economics...) | 260 | 67.4 |
| | B.A. (Language/Literature Arabic...) | 87 | 22.5 |
| | Science (Medical/Dental/Pharmacy...) | 39 | 10.1 |
| Level Of Study | Year 1 | 189 | 49.0 |
| | Year 2 | 86 | 22.3 |
| | Year 3 | 68 | 17.6 |
| | Year 4 | 43 | 11.1 |
| Marital Status | Single | 371 | 96.1 |
| | Married | 15 | 3.9 |
| Distance of residence to the university | About 500 meters | 223 | 57.8 |
| | Around 1000 meters | 60 | 15.5 |
| | More than 1000 meters | 103 | 26.7 |
| Previous School | National Religious Secondary School | 92 | 23.8 |
| | Religious Government Aided School | 149 | 38.6 |
| | People of Religious school | 65 | 16.8 |
| | National Secondary/Boarding School | 80 | 20.7 |
| Housemates | From one country (Malaysia) only | 106 | 27.5 |
| | the various states (Malaysia) | 263 | 68.1 |
| | A variety of countries, including Jordan | 17 | 4.4 |
| C. Percentage G.P.A. | 84 to | 20 | 5.2 |
| | 68-75 | 177 | 45.9 |
| | 76-83 | 162 | 42.0 |
| | 68 and below | 27 | 7.0 |
| | **Total** | **386** | **100.0** |

Table 1 shows the details of the participants. From this table we can see that the number of female students (216) exceeds the male students (170); University of Jordanian (10 males and 5 females), Yarmouk (72 males and 88 females), Mu'tah (12 males and 41 females), Science and Technology (22 males and 15 females), and Al Bait (12 males and 41 females). Some 96.1% of participants are single and 67.4% participants study in field of Islam. Furthermore, around 80% participants' previous schools are religious schools and around 96% participants' housemates are Malaysian.

**Reliability of the Instrument**

According to Pallant (2007), reliability refers to internal consistency, which denotes the extent of cohesion among the items of the instrument; that is, how the items measure the same underlying construct (language practice). The results are shown in [Table 2]

**Table 2.** Coefficient reliability of the language practice scale

| Cronbach's alpha | N of Items |
|---|---|
| .94 | 36 |

Among various statistical references, the main test used to check the reliability or the internal consistency of the instrument was the Cronbach's alpha coefficient, which should have a value of more than .7 (Pallant, 2007). With the Cronbach's alpha coefficient of .94 for the entire instrument (36 items) of the language practice scale, therefore the instrument is acceptable and has good internal consistency ( .94 > .7).

**FINDINGS**

The study answers the following three questions:

1. What is the level of Arabic language practice (academic and social media) of Malaysian students in Jordanian universities?

To answer this question, the researcher analyzed the language practice score from SPSS. Means and standard deviations scores were used to clarify the level of Arabic language practice of Malaysian students in Jordanian universities.

**Table 3.** Means and standard deviations scores on the practice item

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Academic Practice | 386 | 3.4624 | .59768 |
| Social media Practice | 386 | 3.2205 | .75220 |
| Valid N (list wise) | 386 | | |

Table 3 shows that students have a medium level of academic practice (M=3.46, SD=0.59), and social media practice (M = 3.22, SD = 0.75) for Arabic language. And the participants practice using social media less than academic practice.

2. Do any significant differences exist in the level of Arabic language practice of Malaysian students in Jordanian universities in relation to gender, university, field of study, level of study, marital status, distance of residence to the university, previous school, housemate qualities, and C. percentage G.P.A.?

The following Table 4 gives the mean and standard deviation scores on the practice language according to variables of the study.

**Table 4.** Means and standard deviations scores on the practice language by variables of the study

| Study Variables | Variables levels | Mean | Std. Dev. |
|---|---|---|---|
| Gender | Male | 3.40 | 0.61 |
| | Female | 3.38 | 0.61 |
| University | University of Jordan | 3.19 | 0.45 |
| | University of Yarmouk | 3.34 | 0.62 |
| | University of Mu'tah | 3.45 | 0.59 |
| | Jordan University of Science and Technology | 3.01 | 0.59 |
| | Al Bait University | 3.56 | 0.56 |
| Field of Study | Study of Islam (Shariah/Usuluddin/Islamic Economics...) | 3.38 | 0.57 |
| | B.A. (Language/Literature Arabic...) | 3.62 | 0.61 |
| | Science (Medical/Dental/Pharmacy...) | 2.97 | 0.58 |

| | | | |
|---|---|---|---|
| Level Of Study | Year 1 | 3.37 | 0.62 |
| | Year 2 | 3.28 | 0.54 |
| | Year 3 | 3.57 | 0.53 |
| | Year 4 | 3.41 | 0.73 |
| Marital Status | Single | 3.37 | 0.60 |
| | Married | 3.92 | 0.55 |
| Distance of residence to the university | About 500 meters | 3.41 | 0.63 |
| | Around 1000 meters | 3.39 | 0.45 |
| | More than 1000 meters | 3.34 | 0.65 |
| Previous School | BC National Religious | 3.42 | 0.53 |
| | Religious BC Government Assistance | 3.41 | 0.62 |
| | SM Agama Rakyat | 3.45 | 0.64 |
| | BC National/Residential | 3.26 | 0.64 |
| Housemates | From one country (Malaysia) only | 3.29 | 0.55 |
| | the various states (Malaysia) | 3.39 | 0.62 |
| | A variety of countries, including Jordan | 3.95 | 0.47 |
| C. Percentage G.P.A. | 84 to | 3.21 | 0.66 |
| | 68-75 | 3.37 | 0.63 |
| | 76-83 | 3.47 | 0.57 |
| | 68 and below | 3.17 | 0.61 |

As shown in Table 4, significant differences were observed between the averages of second language practice among the respondents, considering the previously mentioned variables. To examine the significance of these statistical differences, nine-way ANOVA without interaction analysis was performed, and the results are presented in Table 5.

**Table 5.** 9-way ANOVA without Interaction on the practice Arabic language by variables of the study

| Source | Sum of Squares | df | Mean Square | *F* | Sig. |
|---|---|---|---|---|---|
| Gender | 2.561 | 1 | 2.561 | 8.297 | 0.004 |
| University | 2.448 | 4 | 0.612 | 1.982 | 0.097 |
| Field of Study | 3.631 | 2 | 1.816 | 5.882 | 0.003 |
| Level of Study | 2.484 | 3 | 0.828 | 2.682 | 0.047 |
| Marital Status | 3.013 | 1 | 3.013 | 9.761 | 0.002 |
| Distance of Residence | 0.375 | 2 | 0.188 | 0.608 | 0.545 |
| Previous School | 0.706 | 3 | 0.235 | 0.762 | 0.516 |
| Housemates | 4.746 | 2 | 2.373 | 7.687 | 0.001 |
| C Average GPA | 2.908 | 3 | 0.969 | 3.140 | 0.025 |
| Error | 112.366 | 364 | 0.309 | | |
| Total | 142.396 | 385 | | | |

Table 5 shows the statistically significant differences among the following variables at the level of $\alpha \geq 0.05$ in the second language practice: there are no significant difference $\alpha \geq 0.05$ among universities, Distance of residences and Previous schools. Moreover, there are significant difference $\alpha < 0.05$ in male ($M$ =3.40, $SD$ = 0.61) and female (M = 3.38, SD = 0.61) the results favored male respondents, Marital status married ($M$ = 3.92, $SD$ = 0.55) and not married ($M$ = 3.37, $SD$ = 0.60) the results favored respondents who were married.

To derive the statistically significant difference field of Study (Study of Islam or B.A. or Science), Level of Study (Year 1 or Year 2 or Year 3 or Year 4), Housemates (From one country (Malaysia) only or the various states (Malaysia) or A variety of countries, including Jordan), C Average GPA (84 to or 68-75 or 76-83 or 68 and below) the researcher conducted the Levene test to check the homogeneity of variances, power and robust to non-normality (Gastwirth & Miao, 2009), the results are shown in [Table 6].

Table 6. Levene test results of practice by variable (Field of Study, level Of Study Housemate, C. Average GPA)

| F | df1 | df2 | Sig. |
|---|---|---|---|
| 1.387 | 254 | 131 | 0.018 |

The results indicated a violation of the homogeneity of variance at the significance level of α = 0.05 because of the variables of the study, which include field of study, level of study, housemate qualities, and CGPA. Hence (α<0.05). Thus, the researchers implemented the Games–Howell test to detect significant differences between the arithmetic mean which include field of study, level of study, housemate qualities, and CGPA. Hence. The Games-Howell is essentially a *t*-test for unequal variances that accounts for the heightened likelihood of finding statistically significant results by chance when running many pairwise tests (Howell, 2012). The results of this test are presented in Tables 7, 8, 9, and 10.

To detect significant differences between Field of Study (Study of Islam or B.A. or Science), the researcher used the Games –Howell test to analysis the language practice scores and the results are shown in Table 7.

**Table 7:** Games –Howell test the degree of practice by variable Field of Study

| **Field of Study** | | **Science (Medical/Dental/ Pharmacy...)** | **Study of Islam (*Shariah*/ *Usuluddin*/ Islamic Economics...)** |
|---|---|---|---|
| **Games-Howell** | Mean | 2.965 | 3.376 |
| Study of Islam (*Shariah*/*Usuluddin*/Islamic Economics...) | 3.376 | 0.411 | |
| B.A. (Language/Literature Arabic...) | 3.618 | 0.653 | 0.242 |

The findings demonstrate a statistically significant difference at the level of α ≥ 0.05 for the arithmetic mean of field of study, which favored students of B.A. in Language/Literature Arabic (*M* = 3.62, *SD* = 0.65) compared with those specializing in Science (Medical/Dental/Pharmacy) (*M* = 2.97, *SD* = 0.41) and *Shariah/Usuluddin*/Islamic Economics (*M* = 3.37, *SD* = 0.24) . By contrast, the differences were more favorable to students of *Shariah/Usuluddin*/Islamic Economics than to students of Science (Medical/Dental/Pharmacy) in Arabic language practice.

To detect significant differences between Level of Study (Year 1 or Year 2 or Year 3 or Year 4), the researcher used the Games-Howell test to analysis the language practice scores and the results are shown in [Table 8].

**Table 8.** Games –Howell test the degree of practice by variable level of Study

| Level Of Study | | Year 2 | Year 1 | Year 4 |
|---|---|---|---|---|
| Games-Howell | Mean | 3.279 | 3.368 | 3.410 |
| Year 1 | 3.368 | 0.089 | | |
| Year 4 | 3.410 | 0.131 | 0.042 | |
| Year 3 | 3.574 | 0.295 | 0.206 | 0.164 |

As shown in Table 8, a statistically significant difference for level of study was observed, favoring Year 3 students (*M* = 3.57, *SD* = 0.29) more than Year 4 students (*M* = 3.41, *SD* = 0.13), Years 2 students (*M* = 3.28, *SD* = 0.09) and Year 1 students (*M*=3.36, *SD* = 0.042) in Arabic language practice.

To detect significant differences between Housemates (From one country (Malaysia) only or the various states (Malaysia) or A variety of countries, including Jordan), the researcher used the Games-Howell test to analyze the language practice scores and the results are shown in [Table 9].

**Table 9.** Games –Howell test the degree of practice by variable Housemate

| Housemates | | From one country (Malaysia) only | The various states (Malaysia) |
|---|---|---|---|
| Games-Howell | Mean | 3.286 | 3.395 |
| the various states (Malaysia) | 3.395 | 0.108 | |
| A variety of countries, including Jordan | 3.946 | 0.660 | 0.551 |

The differences that appeared of housemates as in the Table 9 were in favor students of variety of countries including Jordan (*M* = 3.95, *SD* = 0.66) compared with from one country (Malaysia) (*M* = 3.29, *SD* = 0.11) and the various states (Malaysia) (*M* = 3.39, *SD* = 0.55) in Arabic language practice.
To detect significant differences between CGPA (84 and above or 68-75 or 76-83 or 68 and below), the researcher used the Games-Howell test to analysis the language practice scores and the results are shown in [Table 10]

**Table 10.** Games –Howell test the degree of practice by variable C. Average GPA

| **C. Percentage G.P.A.** | | 68 and below | 84 and above | 68-75 |
|---|---|---|---|---|
| Games-Howell | Mean | 3.172 | 3.206 | 3.373 |
| 84 and above | 3.206 | 0.034 | | |
| 68-75 | 3.373 | 0.201 | 0.167 | |
| 76-83 | 3.466 | 0.294 | 0.260 | 0.092 |

Table 10 presents a statistically significant difference for CGPA, which favored students of 76 to 83 (*M*=3.47, *SD*=0.29) compared with 68-75 (*M*=3.37, *SD*=0.09), 84 to (*M*=3.21, *SD*=0.17), 68 and below (*M*=3.17, *SD* = 0.03) in Arabic language practice.

## CONCLUSIONS

The overall result showed that participants have a medium level in practice (academic and social media) Arabic language. Michael and Ibrahim (2013) described Malaysians as naturally simple, calm, timid, and low in initiative compared with Jordanians who Malaysian students perceived as having a strong and serious personality. Simultaneously, the findings in the present study are similar to those of Michael and Ibrahim (2013) who argued that Malaysian students are weak in using the Arabic language and practice this language less intensively than native speakers. Moreover, Malaysian students tend to avoid conversing in Arabic with others.
According to Ismail, Mahmod, Qadous, and Mohamed (2013), the Malaysian students who study abroad said during the interviews conducted by the researchers, one challenge they face in the academy is the language, because the lecturers, local students and the university staff do not use the standard Arabic language in their communication. This makes the Malaysian students confused and anxious as they read books and references in standard Arabic. Thus, they will refrain from participating and interacting with classroom climate or outside the classroom. (Barron, 2006; Saghir, 2001; Tinto, 1996). In this regard, Macintyre (1998) suggested that to address this weakness, a comfortable environment should be established inside the classroom to increase the confidence of students and encourage them to communicate in Arabic with others. Concurrently, teachers should create suitable classroom conditions for Malaysian students to motivate and promote communication with others inside the classroom. Malaysian students will subsequently develop a positive attitude toward Arabic language practice (Ushida, 2005). Furthermore, Haron, Ahmad, Mamat, and Mohamed (2010) suggested that from the academic practice side knowledge of vocabulary and grammar seem to be inseparable and indispensable to speak a second language, because in order to say something learners must have the knowledge of vocabulary and grammatical structure to form sentences correctly. The result also found that students prefer to do academic practice on Arabic language more frequently than social media practice. The reason more likely academic language is typically found in textbooks, it always used in the classrooms for education purpose (Bailey, 2007), probably because the participants are residing outside their countries, so they resort to using social media much more to connect with relatives and friends in their own language. Thorne (2010) declared that the upsurge of online social interaction may be attributed in part to a desire to connect with new people, to share opinions, to stay in touch with old friends and colleagues, and to share different types of information with a widespread community of followers. Mikal and Grace (2012) commented that social media and electronic connections to family members can reduce stress and help with psychological adjustment in those living in abroad. And emotionally well-adjusted students find it easier to enjoy their experience in a foreign culture and more satisfying to engage with locals (Mikal, Yang, & Lewis, 2014).

This study concluded that there are significant difference in Malaysian male and female students in practice, with the results favoring male respondents. This finding differed from that in Malek, Noor-Azniza, and Farid, (2011) where the results revealed no gender differences. With regard to this, Cook's (1995) study shows that female students face a lot of the problems during the adjustment and the establishment of relations on campus compared with male students.

Ismail, Mahmod, Qadous, and Mohamed (2013) resulted that it is clear that the marital status factor has a great role in the adjustment and is very important for the students who are under pressure during their studies. This study results favored respondents who were married in practice Arabic language. Although (Ismail, Zailaini,

Mohamed, Ali & Xuan, 2015; Poyrazli & Kavanaugh, 2006) concluded that unmarried students reach higher levels of adjustment compared to married students, because most of the married students living abroad leave their wives behind. But the Malaysians students in the current study are residing in Jordan with their wives so the factor of marital status is a positively contributing factor in helping them to adjust and cope with the difficulties.

As for the result on the statistical differences, we can see that students whose housemate come from a variety of countries (including Jordan) were favored in Arabic language practice more than students living with housemates from the same country. Bergström, Klatte, Steinbrink, and Lachmann (2016) described "Immersion appears to be a successful method for early second language learning; it fosters second language receptive skills without any cost for the first language."
Additionally, Cohen (1990) supports the teaching context should with the intent that learners become active, independent users of the strategies wherever they see opportunities to do so; this can make students became self-regulated learners and help them to overcome the challenges they meet and acquire the language. Ushida (2005) emphasized that teachers should create a unique class culture that will affect student motivation and attitude toward second language study. Teachers should also demonstrate the skills at a high degree, better than those practicing language at the low level.

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# Acceptance of Technology and its Impact on Teacher's Activities in Virtual Classroom: Integrating UTAUT and CoI into a Combined Model

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## ABSTRACT
This study examines the acceptance and use of learning management systems (LMS) among higher-education teachers and the relation between their use of such systems and their teaching approaches in the context of online learning, following the community of inquiry (CoI) framework. A total of 326 teachers at University of Ljubljana completed a questionnaire. Our main research goal was to examine the impact of a basic Theory of Acceptance and Use of Technology (UTAUT) structural model, with the CoI framework as a complement. The latter adds three new aspects to the use of LMS for educational purposes, representing complex cognitive and social dimensions of teaching in the virtual space. We found that the crucial factor for LMS acceptance by university teachers is the immediate social influence at work, but the formation of the learning process largely depends on the characteristics of the LMS tools and the perceived usefulness of the application.

**Keywords:** Community of Inquiry; Technology acceptance; Blended Learning; Technology in education; Teachers; Higher Education; UTAUT

## INTRODUCTION
The development and widespread availability of technology in the last decades has had an important impact on society. One of the fields that has seen significant changes at the institutional level due to rapid technological advance is education (Halverson et al., 2014; Lei & Zhao, 2007; Mažgon et al., 2015; Radovan & Dinevski, 2012; Yang, 2012). As a result of technological advancement, many higher education institutions are incorporating ICT into their teaching process as a way to transform traditional pedagogy and improve existing teaching strategies (Halverson et al., 2014; Mažgon et al., 2015). The uniqueness of new technologies can be found in their multidimensional ways of facilitating communication and interaction between students and teachers in virtual environments. Students are at the same time alone and detached from their groups and from the teacher, although they are communicating among themselves in more than one way. The teacher, in this context, plays a crucial role throughout the learning process in managing and monitoring students' activities. To understand the processes and efficacy of learning in online learning environments, Garrison, Anderson, & Archer (2000) developed a theoretical framework called community of inquiry (CoI) as a conceptual tool for supporting an educational experience in virtual learning environments. The success of introducing these new models and teaching concepts that are based on new technologies is inextricably related to teachers' acceptance and willingness to use those technologies. Davis (1989), who proposed the Technology Acceptance Model (TAM), believed that the key factors in adopting new technology (e.g., a new method of delivering online educational content) are its perceived usefulness and ease of use.

In our study, we examine if the determinants of UTAUT model (Venkatesh et al., 2003) can offer some insights on the CoI model (Garrison, Anderson, & Archer, 2000), more specifically: i) what are the main determinants of the e-learning environment among teachers at the university, and ii) how is teaching presence influenced by the frequent use of online learning environments?

## COMMUNITY OF INQUIRY FRAMEWORK IN ONLINE LEARNING
The community of inquiry (CoI) is a theoretical framework designed more than 20 years ago by Garrison et al. (2000) with the intention of providing a conceptual tool for using computer-mediated communication in supporting educational experiences. The results of meta-analysis carried out by Zhen et al. (2014) indicated that technology support of collaborative learning is one of the major research topics in the field of computed-

supported collaborative learning (Zheng, Huang, & Yu, 2014). The CoI concept was not new; it was first introduced by philosophers C.S. Peirce and John Dewey, concerning the nature of knowledge formation and the process of scientific inquiry (Pardales & Girod, 2006). The concept of "community of inquiry" was later extensively developed by Lipman (2003). Peirce used the terms "community" and "inquiry" to refer to a group of individuals employing an interpersonal method for achieving results (Pardales & Girod, 2006). Amore recent definition of community of inquiry is a group of individuals that participate in critical discussions and reflection in order to create their own meanings and confirm shared understandings of the topic under discussion (Garrison et al., 2000). The main assumption of CoI is that effective online learning is not simply a consequence of cognitive factors and the teacher; rather, the social aspect is equally important, which means that effective online learning requires the existence of a community. Starting from Dewey's work and the constructivist paradigm, the authors place educational experience in the centre of the learning process, with the latter being the result of the interaction of three independent presences of learning: cognitive, social, and teaching presence (Garrison et al., 2010).

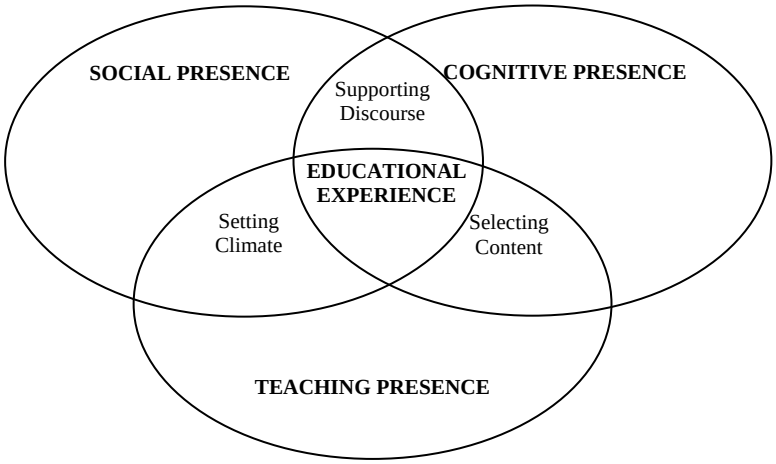


**Figure 1.** Community of inquiry framework (Garrison et al., 2000)

**Cognitive presence** is defined as the extent to which learners are able to construct and confirm their notions through reflection and discourse (Garrison et al., 2001), and it partially depends on encouraging or limiting communication by medium. The cognitive presence of the CoI model is defined by the psychological or sociological dimension of the educational process on the vertical axis, presenting the individual's constant opposition of the private world to the community, and divergent or convergent processes of the construction of meaning and perception on the horizontal axis.

**Social presence** is described as the degree to which online learning participants feel effectively connected to one another, or "as the ability to project one's self and establish personal and purposeful relationships" (Garrison & Arbaugh, 2007) with other participants. The key concepts of social presence in education, generally, are emotions, interaction, and cohesion. Social presence in online learning has received the most research attention from the authors as well as other researchers, especially because of the limits imposed by online learning environments on communicating, developing a sense of belonging to a group, and expressing emotions.

**Teaching presence** is defined as "the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (Anderson et al., 2001). The dimensions of teaching presence represent teachers' responsibility in online learning and are divided into three categories:

1. design and organization referring to the activities that a tutor does before the learning activities begin, that is, the preparation of the learning environment, such as learning materials, activities, instructions, etc.;
2. facilitating student-to-student discourse with the purpose of maintaining the interest, motivation, and engagement of students;
3. direct instruction to provide "intellectual and scholarly leadership and share their [the teachers'] subject matter knowledge with students" (Anderson et al., 2001).

Authors of the CoI model (Garrison et al., 2000) base the development of a critical community of inquiry on teaching presence as much as on cognitive and social presence. They ground their theses on the significance of the teacher's presence in online learning on previous research, which confirms the positive influence of the teacher on students' learning activities. At the same time, the teacher has proven to be the key factor in establishing and facilitating discussion, which the authors (Anderson et al., 2001) believe to be a particularly important goal of higher education.

## FACTORS AFFECTING TEACHERS' USE OF TECHNOLOGY

There have been several studies that have examined the factors influencing teachers' use of ICT (Baz, 2016; Buchanan, Sainter, & Saunders, 2013; Marcinkiewicz, 1993; Mumtaz, 2000; Pynoo et al., 2011; Wichadee, 2015; Wong et al., 2016). Pynoo et al. (2011) identified two main directions of research on the acceptance of technology in education: on the one hand are acceptance studies that measured teachers' acceptance of technology operationalized as the intention to use (e.g. Teo, 2011), and on the other is research that examined teachers' attitudes toward computers, beliefs, and the integration of computers in the classroom (Hermans et al., 2008).

Theories of technology acceptance are typically multidisciplinary (Dillon & Morris, 1996), as researchers have strived to understand how and why users either accept or reject new technologies (Stefl-Mabry, 1999). In addition to the technological aspect (characteristics of technology, ease or complexity of use, etc.), their multidisciplinary approach also focuses on the sociological (the impact of closer and wider environments on acceptance, voluntariness of use, etc.) and psychological (perceived usefulness, perceived ease of use, etc.) aspects. Technology acceptance theories have been bases for the models, which start by quantifying technology acceptance so that it becomes a measurable and comparable phenomenon. Consequently, researchers look for cause-and-effect relationships to predict the level of acceptance for a specific technology, which is useful for both identifying the causes of rejecting technology and predicting its use (Venkatesh et al., 2003).

Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT), which combines the findings of all the theories and models. They employed a comprehensive meta-analysis of existing empirical studies to define a precise framework of independent constructs originating from the theories. The framework aims to explain and predict use behaviour or monitor changes in the factors that affect technology use behaviour through time.

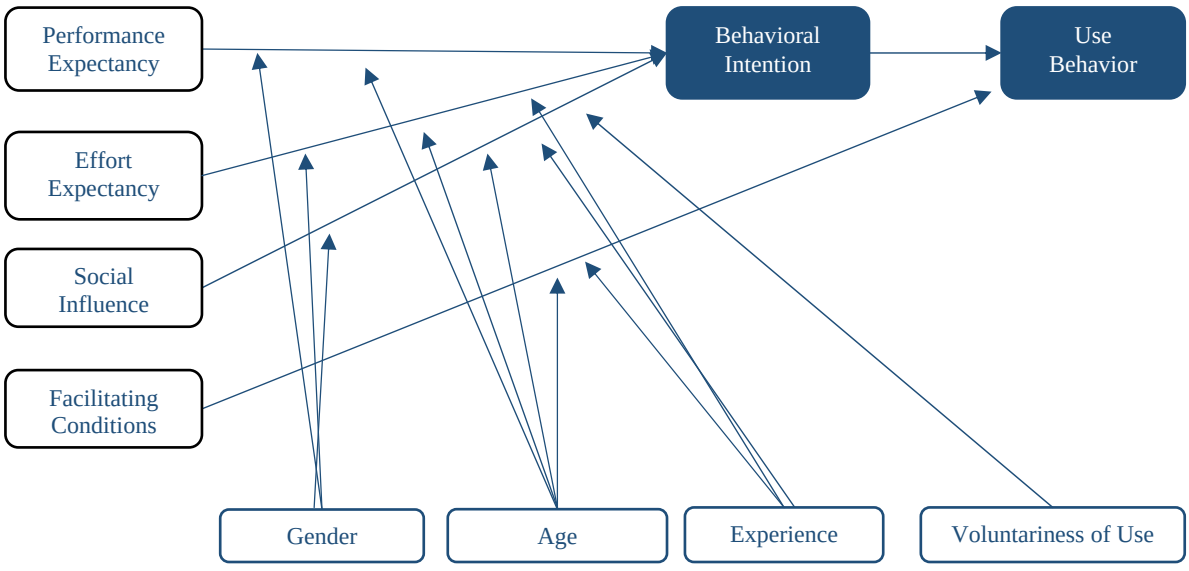


**Figure 2.** The basic UTAUT model (Venkatesh et al., 2003)

They identified four core constructs and four key moderators that have a significant influence on technology acceptance and use. According to the model, performance expectancy, effort expectancy, social influence, and facilitating conditions are the core determinants of behavioural intention or use behaviour on the acceptance of the technology. Gender, age, experience, and voluntariness of use are the moderators, which have no direct influence on the intention or the use of technology, but have indirect effects on cognitive behavioural factors (see Fig. 2). Performance expectancy shows the degree to which teachers believes that using e-learning environment

will help them to perform better professionally. This construct is the most significant indicator of intention, regardless of whether or not technology use is voluntary. The effort expectancy is teachers' belief level about how easy it is to use technology in an e-learning environment, or whether this technology is user-friendly. Social influence is defined as the degree to which an individual teacher perceives that his or her colleagues and others see that the use of e-learning as significant. Facilitating conditions include the teacher's beliefs that an organizational and technical infrastructure exists to support the use e-learning environment. In other words, this is an individual's view of whether he or she has the available resources (tools, equipment, expertise, etc.) he or she needs to use the system. Dependent variables in this model include behavioural intention, which represents teachers' intention of using the e-learning environment in the future, and use behaviour, which represents how much teachers use the e-learning environment.

## PURPOSE OF THE STUDY

The purpose of this study is to develop a conceptual model that will describe the determinants or the dimensions of CoI by predicting of readiness to use (i.e., behavioural intention) and the actual use (i.e., use behaviour) of learning management systems (LMS) among teachers at the University of Ljubljana (UL). The majority of the UL faculty uses Moodle LMS, a tool for blended learning, but there are also cases where other LMS systems or tools are used. In the introduction of this article, we suggested that CoI is a model that enables us to describe and understand teaching in virtual learning environments that enable students to be engaged in creative and collaborative learning activities. Among the three elements of CoI, teaching presence is believed to be the key element that promotes the development of social and cognitive presences (Anderson et al., 2001). Our main hypothesis is that the formation of the teaching presence is directly influenced by the acceptance of new approaches of blended teaching in higher education and the acceptance and usability of the university's LMS. To test this assumption, we used the UTAUT model with the CoI model. Combining both models, we developed a model (see Fig. 3) in which we assume that perceived usefulness, effort expectancy, and social influence will have an important influence on the readiness to use, and that the readiness will impact use frequency, on which teaching presence in an online learning environment depends.

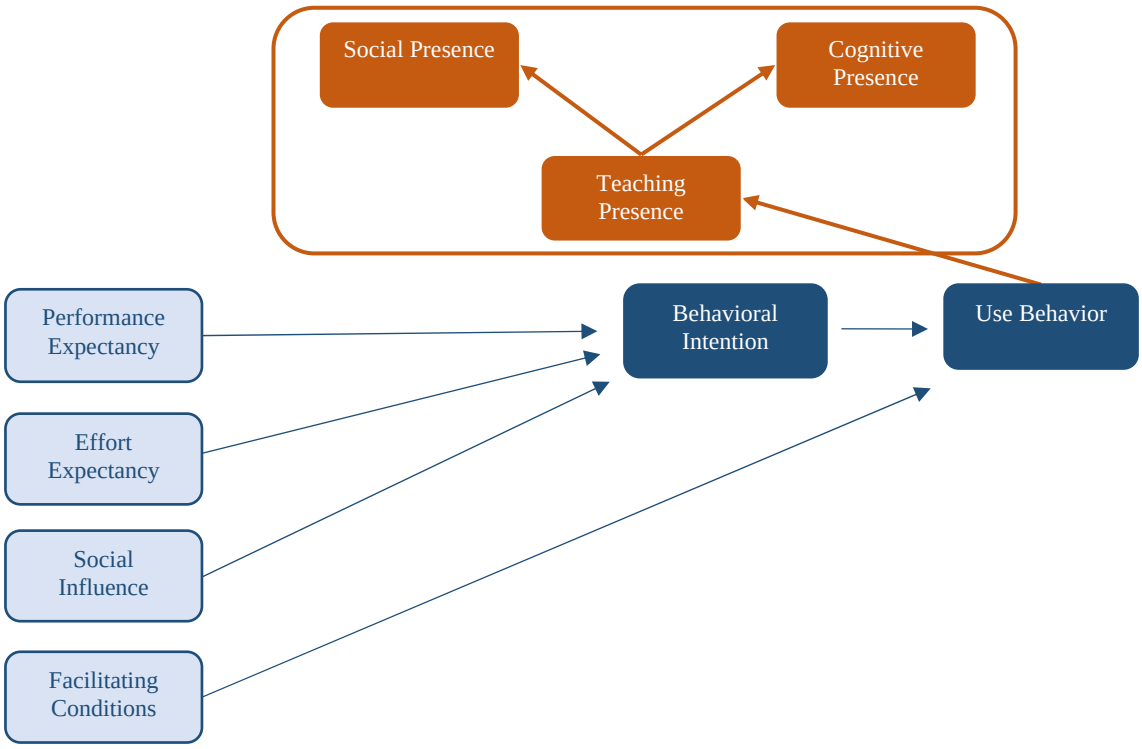


**Figure 3**: The proposed theoretical model

## METHODOLOGY

### Participants

The sample in our study included teaching staff (N = 326) employed at the University of Ljubljana. The sample included 51% male and 49% female respondents. The majority of respondents were between 31 and 50 years old (59%), and 30% were between 41 and 50 years. Respondents over 60 years old and younger than 30 years shared

the same percentage at 9% and 10%, respectively. The sample included all 26 higher education institutions within the University of Ljubljana. The majority of respondents came from the arts faculty (18%), followed by respondents in the biotechnical faculty (9%), the mathematics and physics faculty (7%), the medicine and education faculties (both 6%), and the social science faculty (5%). Other higher education institutions represent less than 5% of the sample.

Measures and procedure

**Instruments and procedures**

The data was collected via web survey and analyzed using quantitative empirical research methods, which included univariate and multivariate research methods in order to describe, explain, and predict the studied phenomena. Structural equation modeling was the main technique used for data analysis. It was performed with SPSS and AMOS statistical packages.

The web survey was divided into three sections:

1. The first part contains items from the standardized UTAUT questionnaire; this section includes 5 constructs made up of 20 items and 5 additional questions, presenting 4 additional moderators in the model, which are also the socio-demographic indicators. This section also includes the question about the frequency of e-learning environment use (Venkatesh et al., 2003).
2. The second part comprises items following the CoI theoretical framework; the section includes 3 constructs made up of 34 items (Arbaugh et al., 2008).
3. The third part consists of 3 additional socio-demographic questions (not used in this article).

The respondents expressed their (dis)agreement with the statements on a 5-point Likert scale (1= I strongly disagree; 5= I strongly agree).

**Data analysis and validation**

The exploratory factor analysis (EFA) was performed in order to (1) identify dimensionality of constructs and (2) to test whether there are any factor cross-loadings. Due to the complexity of the model, the determination of the possibility of existence of a multicollinearity among exogenous latent variables was a high priority. The EFA included 54 observed variables and was performed separately on UTAUT and CoI framework's variables. The variables, which were low-loading (factor loadings less than 0.4) or were cross-loading multiple factors were excluded from further analysis due to their potential harm to the validity of the measurement model. The retained observed variables had high loadings on factors, which they theoretically represent. It turns out that teaching presence is a multidimensional construct and not unidimensional, as theoretically assumed (Garrison et al., 2000), but consisting of two dimensions – (1) planning and organization of learning (TPa) and (2) guidance and facilitating discussions (TPb). All other constructs were identified as unidimensional. Based on the EFA results, twelve variables were excluded from further analysis, and nine constructs were extracted.

The Cronbach's alpha indicates good internal consistency of constructs:

**Table 1:** Construct's structure and their reliability

| **Construct name** | **Cronbach's Alpha** |
|---|---|
| Performance Expectancy (PE) | 0,821 |
| Effort Expectancy (EE) | 0,874 |
| Social Influence (SI) | 0,815 |
| Facilitating Condition (FC) | 0,779 |
| Behavioral intention (BI) | 0,970 |
| Planning and Organization of Learning (TPa) | 0,904 |
| Guidance and Facilitating Discussions (TPb) | 0,890 |
| Social Presence (SP) | 0,944 |
| Cognitive Presence (CP) | 0,965 |

The KMO coefficient (0.90) of sampling adequacy is satisfactorily high, and the $\chi^2$ of Bartlett's test of sphericity (9595.97; df = 1431; $p<0.001$) is statistically significant as well. In addition to the constructs already mentioned, the model also has one measured variable, which represents the use (frequency of use) of the LMS.

Once the dimensionality of construct was identified, the measurement model was built in AMOS. A confirmatory factor analysis (CFA) was used to test the convergent and discriminant validity of constructs in the model and the model fit, where the average variance extracted (AVE) measure and the squared interconstruct correlation (SIC) was used in order to conclude the convergent and discriminant validity. Convergent validity occurs when AVE values for each individual construct reach or exceed 0.5, while SIC values among the constructs must be lower than the AVE – only then can we infer discriminant validity (Hair, Black, Babin, & Anderson, 2009). AVE values are the arithmetic mean of the squared standardized factor loadings of observed variables on each factor (Fornell & Larcker, 1981), and SIC values are squared interconstruct correlation coefficients. AVE and SIC values were calculated for each construct separately and are shown in Table 2.

**Table 2**: Convergent and discriminant validity

| | | **PE** | **EE** | **SI** | **FC** | **BI** | **TPa** | **TPb** | **SP** | **CP** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **AVE** | 0,61 | 0,71 | 0,63 | 0,55 | 0,92 | 0,84 | 0,52 | 0,75 | 0,72 |
| **PE** | 0,61 | | | | | | | | | |
| **EE** | 0,71 | 0,24 | | | | | | | | |
| **SI** | 0,63 | 0,23 | 0,05 | | | | | | | |
| **FC** | 0,55 | 0,24 | 0,24 | 0,26 | | | | | | |
| **BI** | 0,92 | 0,48 | 0,14 | 0,37 | 0,44 | | | | | |
| **TPa** | 0,84 | 0,20 | 0,06 | 0,09 | 0,14 | 0,23 | | | | |
| **TPb** | 0,52 | 0,14 | 0,03 | 0,03 | 0,02 | 0,07 | 0,37 | | | |
| **SP** | 0,75 | 0,07 | 0,02 | 0,00 | 0,00 | 0,02 | 0,12 | 0,45 | | |
| **CP** | 0,72 | 0,20 | 0,03 | 0,03 | 0,09 | 0,12 | 0,29 | 0,37 | 0,22 | |

Both convergent and discriminant validity of construct were reached, as values of AVE exceeded 0.5 and no SIC values exceeded the AVE of each construct. The CFA results were used to develop a structural model that met the criteria of model fit indicators, and was theoretically adequate. The maximum likelihood method was used for SEM, which reduces the differences between observed and expected covariance among variables to the lowest possible value.

## RESULTS

Based on CFA results, the suitability of the proposed theoretical model was tested, but as internal correlations between latent variables were also the matter of interest, modification indices were considered in order to build the optimal model. Based on the modification indices, modified structural model was built, where content suitability was also considered. It was built to better explain e-learning environment use and teaching in an online learning environment.

Figure 3 shows the number of observed variables models the latent constructs. What has changed from the test model is the number of exogenous latent constructs (SI), and the other originally anticipated exogenous constructs (PE, EE, FC) have become endogenous. Some other relations among constructs have also been changed, and no statistically non-significant relations are contained in the model. The model fit indices remain within valid values, although the measures $\chi 2/df$ and NFI have worsened slightly. Nevertheless, the modified model explains the greater shares of construct variability. Additionally, the increase of the strength of interconstruct relations was succeeded. The modified model is, however, slightly more parsimonious than the theoretical model.

**Table 3**: The modified structural model fit indices

| | $\chi^2$ | **df** | ***p*** | $\chi^2$**/df** | **RMSEA** | **NFI** | **CFI** | **PNFI** |
|---|---|---|---|---|---|---|---|---|
| valid values | | | | $\leq 3.0$ | $\leq 0.05$ | $\geq 0.8$ | $\geq 0.9$ | $\geq 0.6$ |
| structural model | 2091.55 | 849 | 0.00 | 2.46 | 0.05 | 0.84 | 0.90 | 0.76 |

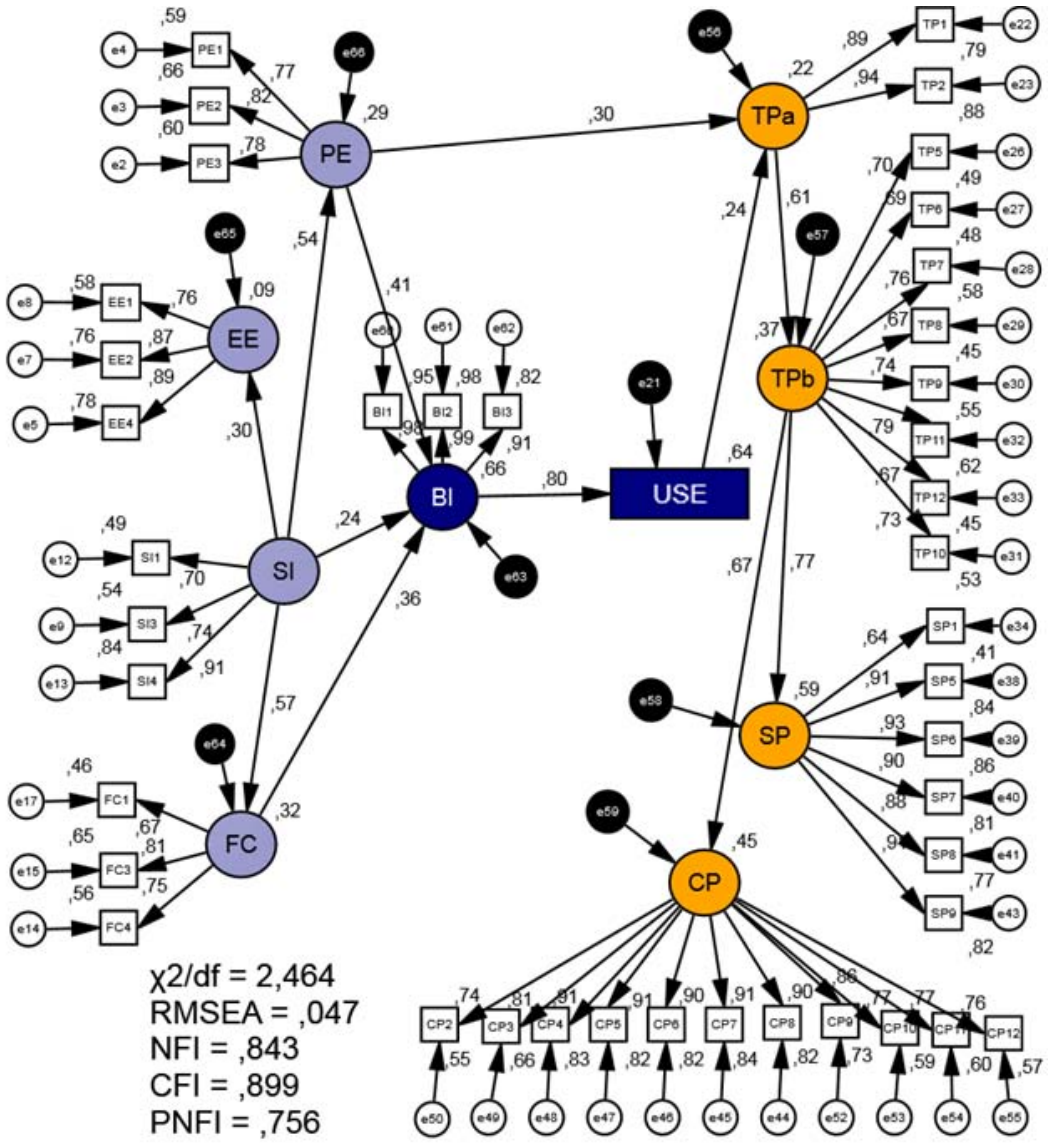


**Figure 4:** Modified structural model

In the modified model, too, the behavioral intention construct is dependent on performance expectancy and social influence, but the relation to effort expectancy has been eliminated, and the relation to facilitating conditions has been added. *Social influence* is the only exogenous latent construct in the model which has a moderate influence on *facilitating conditions* ($\beta$ = 0.568) and *performance expectancy* ($\beta$ = 0.537), while it also explains – together with these two endogenous constructs – 65.7% of the variance of the behavioral intention construct. The strongest influence on behavioral intention is exerted by performance expectancy ($\beta$ = 0.414).
Effort expectancy or ease of e-learning environment use did not prove to be important for either behavioral intention or actual use behavior. It was only found that use is mostly influenced by the environment, which are the viewpoints of important individuals in the e-learning environment ($\beta$ = 0.297), but this cannot adequately explain the variability of *the effort expectancy construct* (8.8%).

**Table 4: Relation characteristics in the modified structural model**

| Relation | | β | $R^2$ |
|---|---|---|---|
| SI → | PE | 0.537*** | 0.289 |
| SI → | EE | 0.297*** | 0.088 |
| SI → | FC | 0.568*** | 0.323 |
| SI → | BI | 0.24*** | 0.657 |
| FC → | | 0.361*** | |
| PE → | | 0.414*** | |
| BI → | USE | 0.801*** | 0.642 |
| USE → | TPa | 0.242*** | 0.222 |
| PE → | | 0.297*** | |
| TPa → | TPb | 0.612*** | 0.375 |
| TPb → | SP | 0.769*** | 0.591 |
| TPb → | CP | 0.668*** | 0.446 |

*Note.* → Direction of path; β – standardized regression coefficient; R2 – R squared, the coefficient of determination; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

The primary exogenous constructs explain 64.2% of the variance of the use behavior construct indirectly through behavioral intention. Besides, use frequency has a statistically significant influence on the teaching presence, which relates to designing and organizing learning, although the relation is weak ($\beta = 0.242$). At the same time, this section of teaching presence is also influenced by performance expectancy ($\beta = 0.297$) or expected benefit of e-learning environment use, which is a better predictor of organizing and designing learning. Together, they explain only 22.2% of the variability of this construct, which leaves 77.8% of the variance to be explained by other factors, which our model does not include. In such a model, structuring the relation between use frequency and the teaching presence which relates to facilitating discussion and direct instruction (TPb) does not appear to be statistically significant; however, this teaching presence is related to the previous (TPa), which explains 37.5% of its variance and has a moderate influence on it ($\beta$=0.612). The relations between designing and organizing learning (TPa), social presence, and cognitive presence do not prove to be statistically significant. Nevertheless, we do conclude that the teaching presence which relates to direct instruction and facilitating discussion (TPb) has a statistically significant and relatively strong influence on social presence ($\beta = 0.769$) and cognitive presence ($\beta = 0.668$).

## DISCUSSION

### Determinants of LMS use

In our study, we examined how acceptance and use of the learning management system (LMS) among teachers at the University of Ljubljana influences their approaches to teaching online. The main purpose of the article is to demonstrate the cause-and-effect relationships between teachers' use of LMS and the realization of various pedagogical aspects of education as represented in CoI model (Garrison et al., 2000). In order for us to answer the research questions, we used two well-formed and empirically validated models that tested the acceptance and use of the LMS and the presence of pedagogical dimensions in online learning.

*Performance expectancy*

Our results indicate that the usefulness of LMS (measured as performance expectancy) was the main predictor of acceptance of LMS. These results conform to other studies that showed that the increase in perceived usefulness leads to greater intention to use learning technology (Pynoo et al, 2011; Wang & Wang, 2009). Pynoo et al. (2011) actually reported that performance expectancy was (along with social influence) the main reason for digital learning environment acceptance. Teachers' use of technology for teaching can be seen also through as their cost-benefit analysis (Howard, 2013). She found out that their decisions might originate from risk perception and uncertainty in which they appraise technology integration (Howard, 2013). It is interesting that PE was mostly influenced by the social influence construct.

*Effort expectancy*

We found that ease of use (EE) is not a major determinant of intention to use e-learning environment (BI). This result contradicts to findings of Gupta et al. (2008) or Venkatesh et al. (2003), who found positive impact of EE on BI. Our results are therefore more consistent with Gruzd, Staves, and Wilk (2012) and Pynoo et al. (2011),

who reported no or even negative impact of EE on BI. A greater impact on accepting the e-learning environment is a belief in the usefulness of its use (PE). We can suspect that this is because modern LMS environments are already very user-friendly and effort expectancy among digitally literate teachers is generally low.

*Social influence*

The demonstrated social influence (SI) leads us to believe that it has a significantly greater role in accepting the LMS as a tool to conduct online learning than might be gathered from the theoretical model. The results of our study showed that SI directly influences acceptance of LMS use, with no direct influence to actual use. This is congruent with Venkatesh's theoretical model (2003) and confirmed by other empirical studies. The social influence construct appears in our model as an indirect and direct predictor of LMS acceptance. The social environment first influences views of usefulness of use and then the perceptions of the adequacy of one's conditions for LMS use. These findings were consistent with previous studies that showed that social environment and perceived ease of use increased perceived usefulness of web-based learning system (Wang & Wang, 2009). These two constructs indirectly influence LMS acceptance. These findings are aligned with other studies that revealed that higher levels of social presence determine teacher's engagement in use of ICT or LMS tools (Pynoo et al., 2011). Social environment is the biggest influence on the perceptions of individuals' available resources for LMS use – on perceiving the adequacy of LMS software and hardware and the necessary expertise. The social environment, thus, is where the use of LMS begins. Namely, the more the social environment supports LMS use, the more it is recognized as a useful tool for teaching.

*Facilitating conditions*

Facilitating conditions turn out to be another influential factor in accepting the LMS (BI), although the original theoretical model (UTAUT) does not anticipate them as such (Venkatesh et al., 2003). In our modified model, facilitating conditions are not directly related to use behavior, but they reflect individuals' views on whether they have the basic resources required for use. The higher the individual's belief that he or she has the knowledge and equipment to use the LMS, the higher its acceptance will be. Our findings support findings from Venkatesh et al. (2012) in his UTAUT2 model that facilitating conditions directly influence behavioral intention.

*Behavioral intention*

E-learning environment use acceptance (BI) turns out to be a good predictor of actual use – we found that the more an individual favors the use of the LMS as a tool for online learning, the more frequently he or she will use it. This finding is congruent with other empirical validation UTAUT model (Lee et al., 2010; Venkatesh et al., 2003).

**Determinants of teacher presence in online classroom**

The second research question of our study deals with the frequency of LMS use and its impact on the formation of teacher presence as defined in the CoI model. The results of structural modeling revealed that LMS use is only a partial predictor of realizing pedagogical aspects of learning in an online learning environment – only when we compare daily and weekly use frequency with monthly and yearly use frequency. We cannot expect that in LMS use, which occurs only once per year, we could look after, say, social contacts among the participants and teacher in the same manner we would with weekly or daily use. Use frequency, thus, directly influences only the organizational aspect of teacher's presence (TPa) in the LMS.

One of the interesting research findings concludes that perceived usefulness (PE) of LMS use has an even stronger influence on the organizational aspect of online learning than use frequency. These findings are congruent with similar studies that confirmed the influence of usefulness and ease of use with respect to the intention to use an LMS (Motaghian et al., 2013; Schoonenboom, 2014). We think this is not accidental, since learning design and organization via the LMS depends largely on the characteristics of an LMS. Thus, if someone believes that the LMS allows him or her to carry out the most fundamental activities related to education (i.e., organizational activities) he or she will better assess the usefulness of the tool. The characteristics of learning activity design and organization also point to another dimension of teaching that is related to facilitating discussion, giving instructions, and direct instruction. We conclude that learning design and organization have an important role in direct instruction and giving instructions to online learning participants and in facilitating discussion among them, but they have no influence on the social and cognitive presence of a community of inquiry.

Our findings also show that social presence—that is, enabling participants' emotional expression, communication, and building group cohesion—is strongly influenced by teaching presence, which is related to

facilitating discussion, giving instructions, and direct instruction. This means that the more the LMS enables teachers to conduct learning activities, the more cohesive student groups will be, the more open communication among them will be, and the more they will be enabled to express emotions. This is also true – to a slightly lesser degree, but still exemplarily – of cognitive presence, which also depends on teaching presence. These results confirm some previous validation of CoI framework and emphasize the centrality of teaching presence (Arbaugh et al., 2008; Garrison, Cleveland-Innes, & Fung, 2010; Kozan & Richardson, 2014; Shea & Bidjerano, 2009).

Our study showed that social presence does not influence other dimensions of the framework, which is aligned with many other studies that found that social presence does not affect cognitive presence. Annand (2011) notes that this suggested social presence is not a crucial part of achieving higher-level learning and may also be achieved through other interactions in the e-learning environment (Díaz et al., 2010; Gorsky & Blau, 2009; Shea & Bidjerano, 2009).

**Limitations and directions for further research**

This study has some limitations. Since the UTAUT theoretical model is used to predict the acceptance of all sorts of technology, we think it is conceived too broadly to capture the specifics of the e-learning environment. If we were to conceive a conceptual model, which would explain LMS acceptance to a greater extent, as well as its use, we should supplement it with the factors that relate to education. The share of unexplained variance of e-learning environment acceptance and use is lower than in the theoretically presupposed model, which suggests that there are a number of other factors which we have not encompassed, but could explain e-learning environment acceptance. Future research into e-learning environment acceptance and use will have to focus on the identification of these influences.

One of study's limitations include nonprobability sampling: due to collection of data via web survey, our research study did not include individuals who are not keen on using modern technologies. Should we wish to ensure probability sampling and a more representative sample, we would have to collect data differently. In comparison with an online survey, however, this would be more expensive and logistically more demanding. Nevertheless, it is necessary that the section of population who does not favor new technologies should be included in research during the phase of introducing online or blended learning into faculties.

## CONCLUSION

The main purpose of our research study was to develop a conceptual model that would expand our understanding of pedagogical aspects of teachers' activities in virtual classroom (LMS) with determinants of the technology use model. We can conclude that the research findings matched our expectations. They point to both the advantages and disadvantages of blended learning, which does not mean that the opportunities this learning provides cannot be used to a larger degree. We think that the more frequent use of LMS by faculty can certainly be achieved by influencing teachers' attitudes toward such use with a greater institutional promotion and direction. Consequently, that would have a positive impact on the provision teachers approaches in LMS, as well as on their quality.

The model of accepting and using the LMS as technological support for online learning offers a useful tool especially during the introductory phases. However, the phase of introducing online learning is only a transition phase, and must be followed by a focus on the quality of online learning. The quality of online teaching as a long-term process is, therefore, an area that will have to receive special attention in the future.

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# Analysis of Open Education Service Quality with the Descriptive-Quantitative Approach

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**ABSTRACT**
The concept of Open Education (OE) is based on the philosophy of e-Learning which aims to provide learning environment anywhere, anytime, and for anyone. One of the main issue in the development of OE services is the availability of the quality assurance mechanism. This study proposes a metric for measuring the quality of OE service. Based on extensive literature review about e-Learning service quality guidelines, as well as the observation of existing Open Education services, we formulated Open Education Metric (OEM). OEM consists of 37 indicators which are divided into six criteria: (1) Openness, (2) Benefit, (3) Delivery, (4) Learning, (5) Evaluation, and (6) Support. Evaluation scheme is designed to give a clear guideline in assessing the quality of OE service quantitatively. The evaluation results including score and category indicate the overall quality relative to a set of indicators. Trial of evaluation was conducted using the evaluation system based on OEM to test its performance in evaluating OE service quality in institutions. Three of OE services were evaluated with their scores.

**Keywords**: metrics; online learning; open education; service quality

## INTRODUCTION

Open Education was first introduced by David Wiley in 2011 (Pisutova, 2012). Open Education has the characteristics of e-Learning where learning activities can be done at anytime and anywhere, coupled with the concept for anyone. The application of the concept of Open Education emphasizes on the openness of access to education for everyone in a large scale, for example, is a service Massive Open Online Course (MOOC). The application of the concept of Open Education varies greatly. It is not just limited to the MOOC. According Pisutova (2012) there are at least four categories of services: Open Content, Open Courseware, Open Educational Resources, and Open Teaching. Categorization is done by what is offered by a service. Variations which occur in more detail services, such as certification, the structure of lectures, presentation of lectures, open access, standards related to the lecture material, availability of information related to the course, the availability of technical assistance, availability of tutors in the learning and so forth.

In the context of Open Education, the absence of a model as a reference will make it hard for an organization to plan the steps to be taken to implement the service (Yuan, MacNeill, & Kraan, 2008). It also requires an evaluation mechanism to measure the extent to which the implementation of Open Education has been done, so it can be compared to other services. Prospective users of the service will be better informed if there is a large selection of quality benchmark information service.

Some maturity models related to e-learning and software engineering in general have ever been studied previously, for example, the Capability Maturity Model (Paulk, Curtis, Chrissis, & Weber, 1993), e-Learning Maturity Model (Marshall & Mitchell, 2002), e-Learning Process Maturity Model (Zhou, 2012), and Online Course Quality Maturity Model (Gu, Chen, & Pu, 2011). All of the maturity models are designed as the standard in the implementation process with the main purpose of guaranteeing and promoting the quality of the products or services produced. Maturity models provide guidance and the ideal standard of the results expected from the implementation of the process. If maturity models provide a thorough benchmark based on best and ideal practice, there is also a metric that does not directly provide ideal standards regarding expected results of a process. Metric emphasizes more on the evaluation of a process of the indicators that are designed and can measure the quality of the results. Some of the metrics that have already existed and are related to this research among which the e-Government Metric and the Web-based Application Quality Metric.

However, if the reference puts much emphasis on the aspect of a well-executed and documented policies or procedures that govern the process with a high level of complexity which is commonly found on maturity

models, it can potentially discourage the institutions initiative to implement the Open Education service. In addition, the measurement or benchmarking mechanism involving internal factors/social service providers is not always easy to do, for example, the institutional readiness factor in implementing e-Learning, the regularity of the process of designing the curriculum, user satisfaction, and so on. In other words, we need a reference (simple) which can also be used as a measuring instrument (metric) practical application of Open Education (practical) based on the facts that can be accessed via the internet.

Therefore, taking into account the need for quality assurance of Open Education services (Hylen, 2006; Yuan, MacNeill, & Kraan, 2008; Yuan & Powell, 2013), this study focuses to answer the following three research questions:

1. What are the indicators used in assessing the quality of service of Open Education?
2. How to make an evaluation based on these indicators?

Based on the research problem, a few objectives have been defined to be achieved from this research. The first is to identify indicators in assessing the quality of service of Open Education. The second is to formulate the Open Education metric for evaluating Open Education service. Open Education Metric (OEMs) are expected to contribute as a reference for the development and evaluation of services Open Education.

There are many aspects that can be extracted from the application of Open Education, and certainly not all aspects are discussed in this study. Based on the research objectives that have been set, taking into account the aspect of simplicity and practicality, we would then determine the limits of the research coverage. Here are some boundaries that define the scope of this study:

1. Criteria which will be discussed in the research are those covering the external/technical aspects (instructional presentation, open access, evaluation, technical assistance etc.), and not the internal/social aspects (institutional readiness, a standard procedure of education material production, institutional satisfaction, user satisfaction, and so on.) on the application of Open Education.
2. The indicators that have been selected can be observed directly through the internet for the services concerned. This study refers to the method used by Waseda e-Government Ranking in which the assessment is based upon the characteristics of e-Government services that can be accessed via the Internet independently.

## RELEVANT LITERATURE REVIEW

### *E-Learning and Open Education*

One of the definitions of e-Lea rning from previous researchers is the combination of educational functions and the provision of teaching materials through information technology or the Internet (Tzeng, Chiang, & Li, 2007). E-Learning is widely used by educational institutions as a reference to implement distance education, which make it synonymous with the term distance learning (Welsh et al., 2003). An educational service that implements e-Learning has a set of components that are closely interwoven. Based on research Selviandro (2013) regarding the service cloud-based e-Learning, it can be concluded that the main components that make up an educational service based e-Learning are an actor, data, applications, and infrastructure.

The concept of e-Learning that use information technology in the process of teaching and learning has changed the face of education, especially for such high levels of education at the university. Starting from the concept of e-Learning, we now apply the paradigm of Open Education. The basic philosophy underlying the Open Education is the same as the underlying e-learning, which is learning anytime and anywhere, but Open Education also greatly emphasizes the aspects 'for anyone'. It represents the philosophy of openness and sharing which are also an integral part of the process of formation and dissemination of knowledge (Wiley, 2011). Therefore, Open Education aims to expand access to knowledge to all corners of the world without being limited to differences in geographical, economic and social aspects, with Internet technology as the primary means.

Figure 1 illustrates the integrated concepts that are part of the paradigm of Open Education, the Open Content, Open Courseware, Open Educational Resources and Open Teaching (Pisutova, 2012). Arrows indicate the direction of development of the concept, which initially only emphasizes the sharing of learning materials (content sharing) on the concept of Open Content, which then becomes an online educational service that is integrated in the concept of Open Teaching. The development of this concept towards the implementation of Open Education which has a wider reach and offer more benefits to its users.

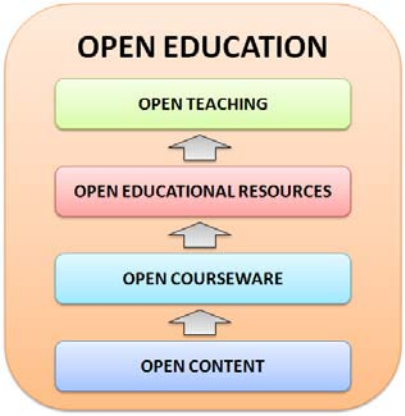



**Figure 1.** Paradigm of Open Education (adapted from Pisutova in 2012)

Furthermore, based on the existing definitions (Pisutova, 2012; Wiley, 2011), some aspects can be inferred to distinguish between the concepts of Open Content, Open Courseware, Open Educational Resources and Open Teaching. Table 1 shows two aspects that distinguish between these concepts, namely from the aspect of services presented in each concept and the benefits to be gained by an individual of service on each concept. Each concept has its own character in every aspect, and an enrichment and the refinement of the concept of the previous level.

**Table 1.** The difference between the concepts of the Open Education

| Aspect | Open Content | Open Courseware | Open Educational Resources | Open Teaching |
|---|---|---|---|---|
| Service | Learning materials, for example in the form of text, video and animations | Learning material presented in the currency of teaching | Courseware coupled with other learning resources, such as tools and infrastructure | Online educational services, including materials and evaluation of learning |
| Benefits for Individuals | Science | Set science on a course | Science enriched by learning from the experience of other learning resources | Certification or college credit |

***E-Learning Maturity Model***

Based on the work of a pioneer in the field of software engineering named Watts Humphrey, Paulk et al. (1993) creates a Capability Maturity Model (CMM). CMM is the solution to improve the quality and productivity of software development. CMM provides instructions for resolving the challenges caused by the inability of an organization to define and implement a systematic and structured development process. Based on benefits that can be obtained by applying the Capability Maturity Model, Marshall and Mitchell (2002) conducted a study to devise a maturity model for improving the quality of e-Learning. Thus, in principle, the E-Learning Maturity Model (EMM) is a modification of the CMM specifically to the field of information technology-based education items, namely e-Learning. Table 2 describes the objectives that are the focus at any level or degree of maturity EMM.

**Table 2.** Focus of Each Level in *e-Learning Maturity Model*

| Level | Focus |
|---|---|
| 0. Not Performed | There is no implementation of e-Learning |
| 1. Initial | The process is still random, improvised or ad-hoc |
| 2. Repeatable | E-Learning Objectives are clearly defined |
| 3. Defined | Process development and operation of e-Learning clearly defined |
| 4. Managed | Quality control over materials and learning outcomes of e-Learning |
| 5. Optimizing | Continuous improvement effort on the quality of e-Learning |

## METHODOLOGY

The development stages in this study are generally divided into four phases: the requirement identification, analysis, design, and evaluation. This partition is intended to provide a roadmap so that research can be done in a structured and systematic way. A number of activities are conducted at each phase sequentially to avoid overlap, following the workflow of logical thinking by deductive reasoning. The workflow of the stages of this study is

illustrated in Figure 2.

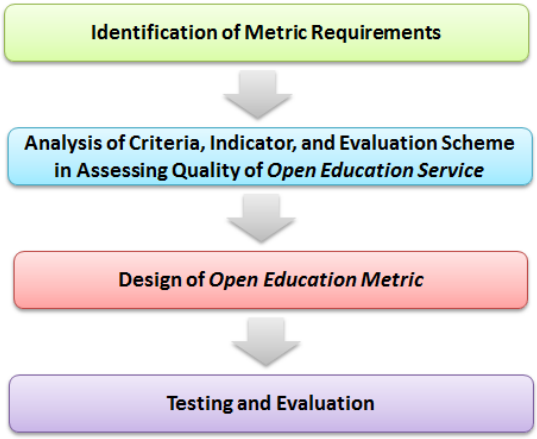



**Figure 2.** Research Workflow

***Identification of Metric Requirements***

At this stage we conduct a literature study, the observation and analysis aim to identify the things that are necessary out of a metric. This stage focuses on the existing standard of quality measurements (metric) which is related to the field of Open Education. Literature review is applied to better understand the number of concepts concerning the application of Open Education in the institutions. It also includes the observation of 'best practice' in Open Education services that already exist, for example the MIT Open Courseware, Coursera, EDX, Udacity, Futurelearn, and so forth. The analysis, synthesis, and interpretation have been made based on the literature and best practice. The results of the analysis are in the form of a number of characteristics that should be possessed by a metric created.

***Analysis of Criteria, Indicators and Evaluation Scheme in Assessing Quality of Open Education Service***

This stage is to determine the criteria that can represent the quality of Open Education service. Selection of criteria is one of the most crucial step in this study because it provides a foundation for the design metrics. The method used at this stage includes the analysis, synthesis, interpretation of literature, and observation of Open Education services that already exist as the best practice. The literature considered includes the publications in the area of Open Education, e-Learning, maturity models, metrics and evaluation of e-Learning. The literature review has been conducted to provide a reference and basic theory in the preparation of metrics.

***Design of the Open Education Metric***

Furthermore, based on the criteria and potential indicators that have been acquired, we can design an evaluation model or scheme of quantitative assessment to measure the quality of service of Open Education. Broadly speaking, the resulting metric is the result of the analysis, synthesis and interpretation of the results of the analysis in the previous stage. The results of the Open Education Metric design consist of criteria, indicators and evaluation schemes for measuring service quality of Open Education.

***Testing and Evaluation***

The trial of metrics is done assessing the quality of some Open Education services in the real world. The results of these tests are used to analyze Metric Open Education qualitatively. Furthermore, to provide an overview about the relevance and validity of indicators used in assessing OE service quality, expert and user judgment (5-10 people) was conducted. This also aims to reduce subjectivity and bias in the development of metrics, as well as giving additional perspective from the expert and user viewpoint. In this study, an expert is defined as those who have experience in e-Learning as a researcher, while also being familiar with the existing growth and features of Open Education services. In contrast, the user is defined as those who have experience in using e-Learning and Open Education services, but is not familiar with the e-Learning research field. Academic qualifications required for all experts and users is a Master degree holder, in order to ensure they have an adequate cognitive level that is required in analyzing the factors that affect the OE service quality.

## FINDINGS

***Metric Requirements***

The concept of openness to educational resources is not new, and a lot of institutions have participated in the sharing of educational resources, such as MIT Open Courseware since the early 2000s. The growing interest in the Open Education concept, as well as the increasing awareness of its benefit to all parties involved, leads to

development of Open Education services in number. However, with the number of services that have been or will appear in the future, we need a guideline to ensure the quality of this services (Hylen, 2006; Yuan, MacNeill, & Kraan, 2008; Yuan & Powell, 2013).

Maturity model is an example of a guideline that is generally interpreted qualitatively, which contains standard guidelines in the implementation process, the ideal characteristics, and the ideal results expected from a process. Meanwhile, one example of the guidelines that are usually analyzed quantitatively is metric, with a focus on measuring the quality of observed characteristics quantitatively. The research was conducted by considering a number of maturity models and metrics that have already existed, namely in the field of software development, e-Learning, and e-Government.

Table 3 summarizes a number of problems and needs to be addressed by a metric, in order to assess the quality of Open Education service. Therefore, Open Education Metric will be formulated based on this set of problems and needs.

**Table 3**. Requirements Identification of the Open Education Metric

| Problem | Need | Solution |
|---|---|---|
| Institutions do not understand the concept of service in detail but would like to try to implement the service as a pilot project | Practical guidelines for the implementation of Open Education services | *Open Education Metric* |
| Lack of standard implementation guideline for service provider or prospective service providers | Examples of standard implementation | |
| Service provider's difficulties in evaluating the implementation that has been done | Evaluation standard for service quality across relevant aspects | |
| The absence of a mechanism to compare the quality of a service with other services (benchmarking) | The mechanism to measure the quality of relevant aspects quantitatively | |
| Lack of specific guideline regarding the quality of Open Education service; although there are many references for the quality of e-Learning, we need to consider if all is relevant and to be implemented | Guidelines about the quality of the Open Education service by utilizing the e-Learning quality benchmark that is readily available and relatively well-established, as its base | |
| Users and providers who usually prefer the practical aspect is difficult to interpret qualitative evaluations | The mechanism to quantitatively evaluate the service quality | |
| Guideline about the quality of e-Learning that is intuitively also applicable for Open Education, still too abstract and too broad for interpretation | Open Education service quality guidelines with practical indicators and clear directions | |

***Key Criteria and Indicator of Open Education Service Quality***

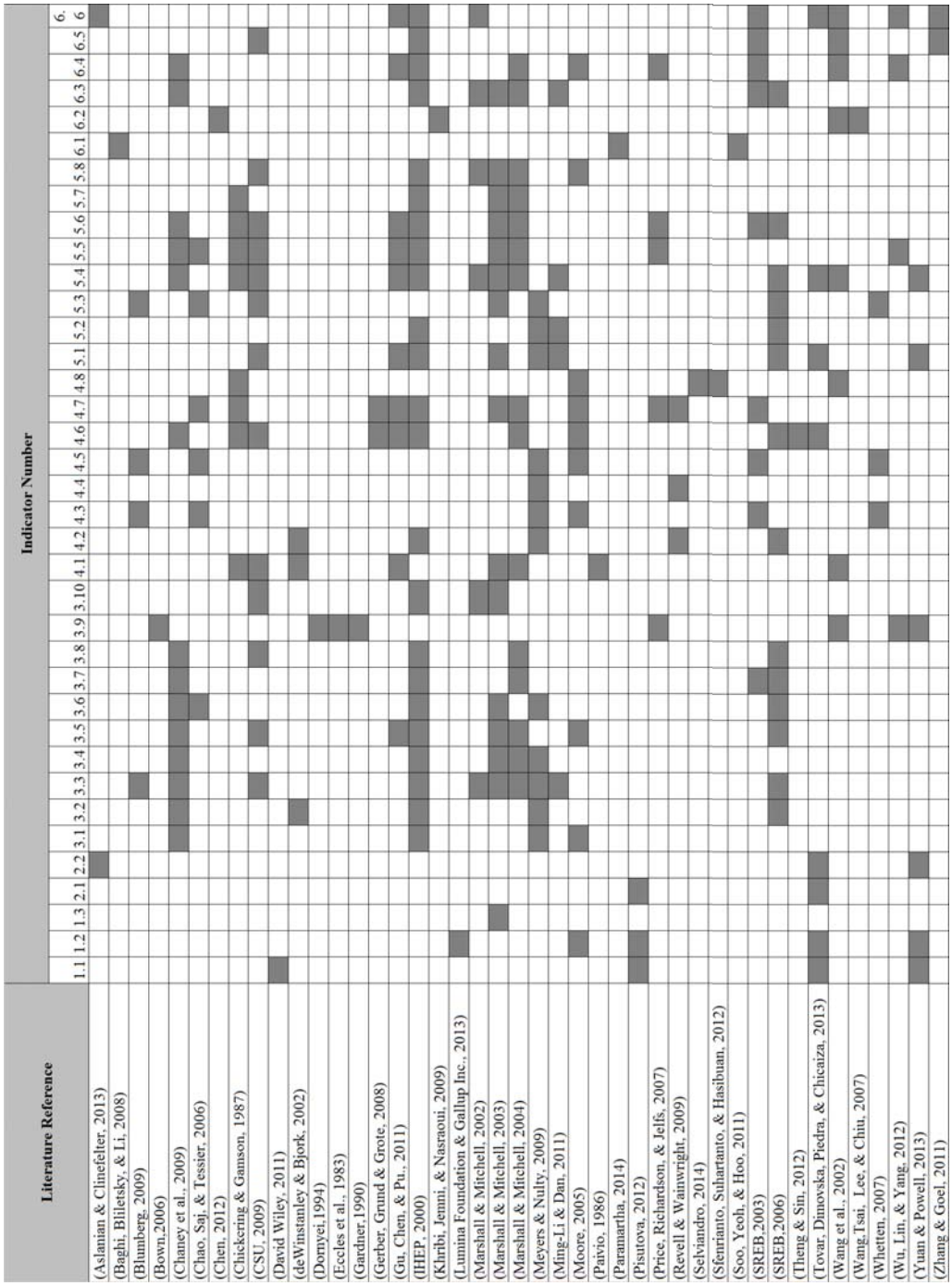
There are many different criteria that can represent several aspects of Open Education services, which can be measured and considered as the quality of a particular service from the user perspective. Among numerous criteria found on literatures (e.g., Blumberg, 2009; CSU, 2009; Gu, Chen, & Pu., 2011; IHEP, 2000; Khan, 2001; Marshall & Mitchell, 2002, 2004; Ming-Li & Dan, 2011; Moore, 2005; Pisutova, 2012; Price, Richardson, & Jelfs, 2007; Shelton, 2011; Wiley, 2011), there are six main criteria that we proposed and considered to be the focus of this study: Openness, Benefit, Delivery, Learning, Evaluation, and Support. Each criterion represents the quality of service of Open Education from different aspects. Table 4 illustrates reference from which each criterion synthesized.

**Table 4.** Literature Reference of Key Criteria

| **Literature Reference** | ***Openness*** | ***Benefit*** | ***Delivery*** | ***Learning*** | ***Evaluation*** | ***Support*** |
|---|---|---|---|---|---|---|
| (Blumberg, 2009) | | | ■ | ■ | ■ | |
| (CSU, 2009) | | | ■ | | ■ | ■ |
| (Wiley, 2011) | ■ | | | | | |
| (Gu, Chen, & Pu., 2011) | | | | | ■ | |
| (IHEP, 2000) | | | | ■ | ■ | ■ |
| (Khan, 2001) | | | | | ■ | ■ |
| (Marshall & Mitchell, 2002) | | | | | | ■ |
| (Marshall & Mitchell, 2004) | | | | ■ | ■ | |
| (Ming-Li & Dan, 2011) | | | | ■ | ■ | ■ |
| (Moore, 2005) | ■ | | ■ | ■ | ■ | ■ |
| (Pisutova, 2012) | ■ | ■ | | | | |
| (Price, Richardson, & Jelfs, 2007) | | | | | | ■ |
| (Shelton, 2011) | | | | ■ | ■ | ■ |

Then, we conduct an analysis of indicators related to each criterion. Each indicator synthesized from extensive literature review of previous work related to e-Learning, while also considering the nature of Open Education concept. Characteristics of existing Open Education service also serve as a reference to ensure that each indicator is reasonably relevant. Table 5 illustrates reference from which each indicator synthesized from previous work.

**Table** 5. Literature Reference of Indicator




Based on extensive literature review and analysis, we construct a set of criteria and indicator as a reference for assessing Open Education service quality (see Table 6). Each indicator also can be viewed as a factor to be considered when creating Open Education service. It is fair to say that these indicators might not give a complete coverage to service quality. However, we proposed that such indicators will serve as an initial step toward discussion of a more complete and detailed service quality measurement. Together with the evaluation scheme, this set of indicator form as an Open Education Metric which is expected to describe the quality of Open Education service in quantitative and quantitative manner.

**Table** 6. List of Criteria and Indicator

| Criteria | Indicator |
|---|---|
| *Openness* | 1.1. The service can be accessed by everyone |
| | 1.2. All features freely accessible |
| | 1.3. Service available in international language |
| *Benefit* | 2.1. There are comprehensive education services |
| | 2.2. There is certification or credit granted for learning effort or outcome |
| *Delivery* | 3.1. Learning materials are classified based on the field of science |
| | 3.2. Description about a course is available |
| | 3.3. There is a definition about the aim and expected outcome of a course |
| | 3.4. There is an information about knowledge or technical prequisites for a course |
| | 3.5. List of scientific resource related to a course is available |
| | 3.6. Information about learning evaluation mechanism for a course is available |
| | 3.7. Detailed schedule of learning activity for a course is available |
| | 3.8. Information to obtain guidance about a course is available |
| | 3.9. There is a mechanism to motivate student in finishing a course |
| | 3.10. Structure of each course designed in consistent manner |
| *Learning* | 4.1. There is a wide variety of learning materials |
| | 4.2. A course is structured into several topics as learning units |
| | 4.3. Topics of a course directly related to the course title and description |
| | 4.4. Topics sequentially arranged based on logical ordering |
| | 4.5. Resource available for each topic/course directly related to its topic/course |
| | 4.6. Facility for communication and discussion is available |
| | 4.7. The use of communication and discussion facility is encouraged throughout learning process |
| | 4.8. Learning is personalized to cater individual learner characteristics |
| *Evaluation* | 5.1. There are materials to evaluate learning outcomes |
| | 5.2. Evaluation material is available for each course |
| | 5.3. Evaluation material properly address the content and objective of a course |
| | 5.4. Evaluation is conducted to assess the learning outcome in each course |
| | 5.5. The service provide feedback to learner based on evaluation of learning outcome |
| | 5.6. Feedback given within a reasonable or definite amount of time since the evaluation conducted |
| | 5.7. There is a standard of learning outcome in each course |
| | 5.8. There is a mechanism for learner to give feedback to service provider |
| *Support* | 6.1. Features for searching by keywords are available for: materials, subjects, and forums |
| | 6.2. Service provide recommendation of related course or learning resource |
| | 6.3. Technical support is available |
| | 6.4. Learning tutor for a course is available |
| | 6.5. Profile of course or resource author is available for learner's reference |
| | 6.6. Course is created and guided by a competent tutor or teacher |

***Evaluation Scheme of the Quality of an Open Education Service***

In order to make the indicators of the metrics previously defined able to represent the quality of an Open Education service, it required an evaluation scheme. In this study, we have proposed a scheme on a qualitative assessment of each indicator by classifying the applicability of each indicator into four different levels that do not overlap.

Broadly speaking, four of these levels are Level 0: Not Performed (not available), Level 1: Initial (already begun

to be applied to a small extent), Level 2: Delivered (mostly already applied), and Level 3: Managed (already fully implemented). Qualitative evaluation is done by comparing the existing implementation of a service against the circumstances described in each level of an indicator. Table 7 below contains a specific description of each level of the application on each indicator.

**Table 7.** Examples of a Qualitative Assessment Scheme of Open Education Metric

| ***Criteria*** | **Indicator** | **Level 0** | **Level 1** | **Level 2** | **Level 3** |
|---|---|---|---|---|---|
| *Openness* | 1.1 The service can be accessed by everyone | Can only be accessed if becoming a member of an education institution | Yes, but not for all learning materials | Yes, for all learning materials | Yes, for all learning materials, with the right to modify and redistribute |
| *Benefit* | 2.1 There are comprehensive education services | Standalone and unstructured materials | Unstructured materials suitable for a learning purpose | Structured learning materials, packed per subject of interest | Structured learning materials complemented with a learning activity as an online class |
| *Delivery* | 3.1 Learning materials are classified based on the field of science | No classification exists | Classification exists for small fraction of all learning materials | Classification exists for most of all learning materials | Classification exists for all learning materials |
| *Learning* | 4.1 There is a wide variety of learning materials | Only textual learning materials available | Multimedia learning materials (video/audio/simulation) available for a small fraction of subjects | Multimedia learning materials (video/audio/simulation) available for most of subjects | Multimedia learning materials (video/audio/simulation) available for all of subjects |
| *Evaluation* | 5.1 There are materials to evaluate learning outcomes | No evaluation materials available | Evaluation materials available for a small fraction of subjects | Evaluation materials available for most of subjects | Evaluation materials available for all subjects |
| *Support* | 6.1 Features for searching by keywords are available for: materials, subjects, and forums | All is not available | Yes, only one out of the three items: materials, subjects, and forum | Yes, only two out of the three items: materials, subjects, and forum | Yes, all of the three items: materials, subjects, and forum |

Open Education metric also designed to be able to map a service into concepts in Open Education paradigm (Open Content, Open Courseware, etc.). The objective is to assign a proper category so that it represents characteristic of a service in general. Based on assessment of indicator 1.1, we can categorize whether a service is an open or closed service, which means whether it is open for anyone to participate or only allow a closed group of people to access. Then, based on assessment of indicator 2.1, we can categorize whether a service belong to “Content”, “Courseware” or “Teaching” provider. In context of indicator 2.1, Level 0 and 1 represent a content provider, Level 2 represent a courseware provider, while Level 3 represent a teaching provider.

Furthermore, to establish a metric that also can provide quantitative information, we have proposed a quantitative assessment scheme. The quantitative scheme is basically made by assigning a weight for each level of implementation and a maximum score for each indicator. The value of service quality on a particular indicator is calculated by multiplying the weight with the indicator’s maximum score. The value of service quality on a

particular indicator is calculated by multiplying the weight with the indicator's maximum score. The weight at every level of implementation serves as a multiplier so that the indicator's value represents the real conditions of the Open Education service.

Currently, we can only assume that each of the criteria has the same contribution to the overall quality of service, which is why each criterion has the same maximum value. Scores for individual indicator of each criterion are calculated by dividing the maximum score of each criterion by the total number of indicators related to a particular criterion. This scheme's calculation model ensures that the maximum value that can be obtained for any service remain the same, although there is a change in the total number of indicators or levels. In this study, the proposed maximum value that can be obtained for a service is 1000. Table 8 shows the example of quantitative assessment scheme details on the Open Education Metric.

**Table 8.** Example of the Quantitative Evaluation/Scoring Scheme

| Criteria | Indicator Number | Weight | | | | Score of Maximum Indicator | Score of Maximum Criteria ∑Weight*Score |
|---|---|---|---|---|---|---|---|
| | | Level 0 (min-max) | Level 1 (min-max) | Level 2 (min-max) | Level 3 (min-max) | | |
| ***Openness*** | 1.1 | 0.00-0.25 | 0.26-0.50 | 0.51-0.75 | 0.76-1.00 | 55.56 | 166.68 |
| | 1.2 | 0.00-0.25 | 0.26-0.50 | 0.51-0.75 | 0.76-1.00 | 55.56 | |
| | 1.3 | 0.00-0.25 | 0.26-0.50 | 0.51-0.75 | 0.76-1.00 | 55.56 | |
| ***Benefit*** | 2.1 | 0.00-0.25 | 0.26-0.50 | 0.51-0.75 | 0.76-1.00 | 83.34 | 166.68 |
| | 2.2 | 0.00-0.25 | 0.26-0.50 | 0.51-0.75 | 0.76-1.00 | 83.34 | |
| ***Delivery*** | *Distribute score evenly across indicators of the same criterion* | | | | | | 1000/6 |
| ***Learning*** | *Distribute score evenly across indicators of the same criterion* | | | | | | 1000/6 |
| ***Evaluation*** | *Distribute score evenly across indicators of the same criterion* | | | | | | 1000/6 |
| ***Support*** | *Distribute score evenly across indicators of the same criterion* | | | | | | 1000/6 |
| | | | | | | **Maximum Service Score :** | ~1000 |

The appropriate quantitative assessment scheme, is that the higher the level of implementation of the service, the higher the scores. Each of the indicators on the same criteria have the same maximum score. Each criterion has the same contribution to the total maximum value. The difference in the maximum value of the criteria at the second decimal digit occurs because the indicator score is rounded to two decimal points to simplify the presentation. The difference of the maximum value calculation scheme happens because of the same thing. Nevertheless, the differences are relatively insignificant on value criteria and the overall value is not more than 0.01%.

***Testing and Evaluation***

In line with the purposes of an Open Education Metric, which is to measure the quality of OE services as well as classifying them into a relevant Open Education category, we tested the metric applicability to assess existing OE services in the real world. The outcome of this evaluation includes the score and category of the OE service evaluated. The score can be viewed in overall or in detail per criterion/indicator, which depends on viewpoint intended. The category of an OE service represents which category it belongs to in Open Education concepts, which should be one of Open Teaching, Open Education Resources, Open Courseware, or Open Content. Assessment of the OE service quality was conducted manually, facilitated by the evaluation system. The OE services tested in this study hosted by two reputable educational institutions in Indonesia and have considerable number of materials available. Three of the OE services tested are:

1. Institution A's Open Courseware
2. Institution B's Massive Open Online Courses (MOOC)
3. Institution B's Enrichment Material

Then, based on the evaluation result of each OE service tested, we can rank them according to the quality score obtained. Table 9 shows the ranking, the total score, and the category of each OE service tested. This score represents the quality of each OE service toward ideal Open Education implementation.

**Table 9.** Example of Ranking of OE Services based on Evaluation Results

| Ranking | Service | Total Score | Category |
|---|---|---|---|
| 1 | Institution B's MOOC | 705.91 | Open Teaching |
| 2 | Institution A's Open Courseware | 523.97 | Open Courseware |
| 3 | Institution B's Enrichment Materials | 511.13 | Open Content |

Figure 5 shows the comparison of the quality of the three OE services tested in this study. The classification of OE services into categories is not intended to represent a hierarchy, but only to indicate the nature of OE services provided. Thus, it should not be interpreted that one category better than other categories in every aspect. For example, Institution B's Enrichment Material perceived better in terms of openness than Institution A's Open Courseware. This is because the first one provides open access for everyone to all of its materials, in comparison to Institution A's Open Courseware that only allow public access to a small fraction of subjects. Another example, Institution B Enrichment Material perceived better in terms of evaluation rather than Institution B's MOOC. This is because each material in Institution B's Enrichment Material is always accompanied by an evaluation rather than online classes in Institution B's MOOC which does not always provide an evaluation for each subject.

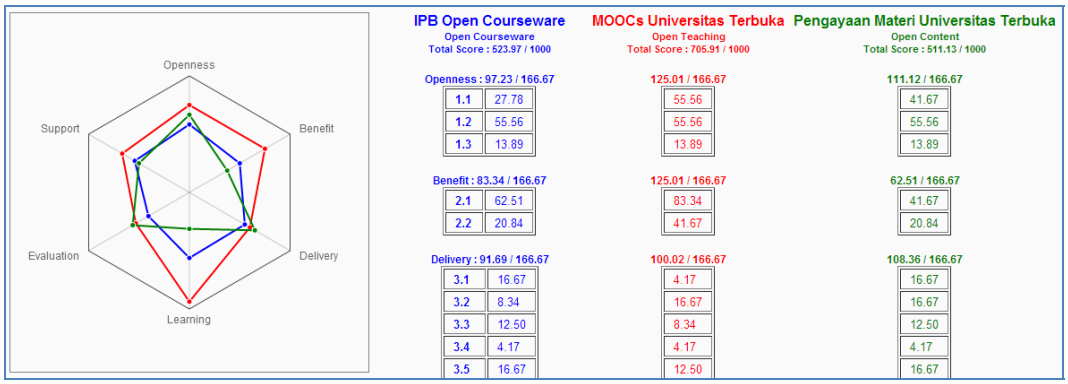



**Figure 5.** Example of Comparing OE Services Quality within Evaluation System

Performance of the *Open Education Metric* as a measurement tool can be reviewed from several aspects, such as applicability, clarity, and quantifiability. This review is considered based on metric performance in assessing quality of existing OE services that we did previously. Table 10 provides the description of the *Open Education Metric* review against these three aspects.

**Table 10.** Qualitative Evaluation towards Open Education Metric Designed

| Aspect | Explanation |
|---|---|
| *Applicability* | Evidently, the *Open Education Metric* is able to assess the quality of OE services in the real world, with the score and category of OE services as the ultimate viewpoint. |
| *Clarity* | It can be observed that the *Open Education Metric* provides a set of indicators with clear intention, and a non-overlapping indicator level which each assessor to determines the appropriate implementation level for an OE service evaluated |
| *Quantifiability* | The *Open Education Metric* is able to translates OE services quality into a quantitative score, which is useful for the benchmarking and ranking of existing OE services. |

Expert judgment data were obtained by using a questionnaire in a form of Likert-type items which contain 37 questions related to the relevance of each indicator to determine the quality of OE services. Each question consists of three types of responses: agree, neutral, or disagree. If an expert votes agree then it can be interpreted that the indicator is relevant to indicate OE service quality, and vice versa. In this study, we have obtained judgment from seven experts, and can be concluded that they all agree with the relevance of most of the indicators.

User judgment data were obtained with the same set of a questionnaire used in expert judgment collection. In this study, we have obtained judgment from six users and can be summarized that most of the indicators considered to be relevant by most of the users.

## CONCLUSIONS

One of the main issues in the development of Open Education (OE) services is the availability of the quality assurance mechanism. This research aims to proposed a guideline to evaluate the quality of OE services. This evaluation result is important as a reference in the development of services, for evaluating existing services, and for benchmarking to compare the quality among OE services.

*Open Education Metric* proposed consists of criteria, indicators, and the evaluation scheme. There are 37 indicators proposed and divided into six criteria: (1) Openness - 3 indicators; (2) Benefit - 2 indicators; (3) Delivery - 10 indicators; (4) Learning - 8 indicators; (5) Evaluation - 8 indicators; (6) Support - 6 indicators. Each criterion represents different aspects in viewing the quality of OE service, while each indicator of a criterion elaborates related aspect into specific point. Each indicator designed in such a way that it can be independently observed on OE service via internet. In this study, each criterion has been assumed to have equal contribution to the overall OE service quality, while each indicator has the same contribution to its criterion score. The maximum score proposed for each OE service is 1000, in order to make it consistent and comparable.

Furthermore, we conducted evaluation based on the *Open Education Metric* to test its performance in evaluating OE service quality in the real world. Three of OE services evaluated including Institution A's Open Courseware, Institution B's MOOC, and the Institution B's Enrichment Materials. The evaluation results including score and category that indicate the overall quality of each OE service. The advantages and disadvantages of each OE services can be inferred to in detail by doing an analysis per criterion or per indicator. These results show that the *Open Education Metric* is capable to evaluate OE service quality into quantitative notion, while providing the adequate description of quality in detail.

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# Comparative Study on the Performance of Bachelor of Secondary Education (BSE) Students in Educational Technology Using Blended Learning Strategy and Traditional Face-to-Face Instruction

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## ABSTRACT
Technology offers various tools of improving the teaching – learning process. It revolutionizes teaching from traditional face-to-face to distance and online learning. This study described and compared the performance of BSE II students in educational technology using the traditional face-to-face classroom interaction and the blended learning strategy. Two sections were used in the study, one section was exposed to traditional face-to-face and the other one was for blended learning strategy. Findings revealed that students who were exposed in the two strategies have comparable performance in educational technology. Students from both sections perform superior and excellently in their activities and very good in their quizzes and final grades. However, students from blended learning encountered challenges on lack of access to computers and internet connection. Also, the teacher spent a lot of time in the posting of activities online as well as in the retrieval of submitted activities because of very slow connectivity. In general, the use of blended learning strategy was viewed as very effective in teaching educational technology.

## INTRODUCTION
Information and Communications Technology (ICT) provides educators and students with various opportunities which are not possible in traditional face-to-face learning situation. These technologies are used as tools to improve the quality of teaching and learning process as well as to provide alternative delivery of instruction. Software such as productivity programs, educational games, tutorials, simulations, multimedia and internet are designed to support learning process in various ways. The use of internet in learning provides recent and unlimited information and tools that can be used to advance education. Moreover, it enables the teachers and students to provide opportunity for independent and individualized learning activity.

Professional competences including ICT skills, critical thinking and processing information skills are absolutely necessary for specialists of the 21st century. Such competences can and should be developed via integrating technologies into students' teaching and learning (Nazarenko, 2015). The use of ICT provides opportunity for the teachers to use technology-mediated instruction such as blended learning approach. Blended learning is a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, and at least in part at a supervised location away from home (Watson et al., 2012). In this approach, students learn through face-to-face classroom instruction with the teacher and students and partly through the delivery of content and assessment via digital and online media at students' control of time, place, path and pace (Clark, 2003). This includes the use of web applications, multimedia presentations and video lessons with hands-on activities to improve critical thinking and perceptual abilities of the learners. Students become learners as they are provided with access to information. They establish a novel relationship with knowledge when they create or assimilate information at their own pace.

Blended learning is increasingly becoming prominent nowadays in tertiary education because of colleges' and universities' increasing needs for classrooms and teachers. It provides a dynamic, flexible, and interactive environment for teaching - learning process by taking advantage of the 21st Century technology which our digital natives' learners are adept into (Garrison, D. & Vaughan, N., 2008). It also addresses some of the concerns on individualized learning and learning style of the students.

Students today learn differently, and teachers and schools must adapt to cope with this technology-driven society. More flexible learning environment is needed to make learning personalize and improve students' engagement and motivation. Hence, this study was conducted to compare the performance of the students who are exposed in traditional face-to-face classroom instruction and blended-learning strategy.

**Objectives of the Study**

This study was conducted to determine and compare the performance of BSE II students in educational technology using blended learning strategy and face-to-face instruction. Specifically, the study aims to:

1. describe the performance of the BSE II students in educational technology using face-to-face instruction and blended learning strategy;
2. determine the extent of difference of the performance of BSE II students in educational technology who are exposed in face-to-face instruction and blended learning strategy;
3. determine the challenges encountered by the students and teacher in using blended learning strategy; and
4. identify the strengths of using blended learning strategy.

**Significance of the Study**

ICT has revolutionized the way we do things especially in the field of education. It transforms students into owners of their learning. It provides educators and students the opportunities which are not possible in a face-to-face learning through the use of various technologies. Based on the 2014 report of the International Association for K-12 Online Learning (iNACOL), blended learning is one of the fastest growing areas in the educational system today. Allen and Seaman (2013) stated that students taking at least one online course increased dramatically from 570,000 to over 6.5 million students. Researchers have predicted that by 2019, 50-percent of all high school courses will be delivered in an online format. The move to blended or online courses in schools holds the potential to revolutionize education by making it more accessible and individualized (Horn & Staker, 2011). Hence, this study aims to investigate the effectiveness of blended learning approach in comparison to the traditional face-to-face instruction in teaching educational technology among teacher education students.

The result of this study may provide information regarding the performance of students who are exposed in blended learning as well as the challenges encountered by the teacher and students in the implementation of blended learning approach. This will serve as basis in crafting framework and policies for the adoption and implementation of blended learning as an alternative delivery in the 21$^{st}$ century education.

To the students, the adoption of blended learning approach will give them provision for independent/ individualized learning with a little control on time, place and pace when they are given the content via internet or other digital devices. They can establish novel relationship with knowledge when they create or assimilate information at their own pace. They may develop and master their ICT skills in accessing information via digital technology. They may also learn how to act and decide independently, think critically and present their outputs creatively. Through these, students may realize that learning is their responsibility and they should have control over the process.

To the teachers, the use of blended learning will serve as an alternative way of facilitating instruction taking advantage of the students' interests in technology. This may also trigger the creative talents of the faculty to develop computer-based lectures suited to the needs of their students. This may provide them opportunity to offer electronic access to course materials and carry out assessments as well as online interactions between faculty and students which will save time, efforts and other resources both for the students and teachers.

To the school officials, since some of the contents will be delivered through digital media, it will lessen the face-to-face contact time of the teachers and students inside the classroom. This may address the concerns on lack of classrooms and teachers as well as to save resources of the University.

**Scope and Delimitation of the Study**

This study focused on determining and comparing the performance of the BSE II students in Educational Technology using traditional face-to-face instruction and blended learning strategy. This was conducted during the first semester of the school year 2015-2016.

**Theoretical Framework**

This study was anchored on the Networked Learning and Connectivism Theory of George Siemens (2004). According to the theory, learning is a network phenomenon influenced by socialization and technology. To know something is to be organized in a certain way to exhibit patterns of connectivity. To learn is to acquire certain patterns. Instead of knowledge resides only in the mind of an individual, knowledge resides in a distributed manner across a network. Learning is a process of connecting to a specialized nodes or information sources.

In light of this study, the researcher conceptualized that when students are given alternative way of acquiring knowledge aside from what is provided in the four corners of the classroom, learning will be enhanced. Much more if the given alternative is in-line with their interest and they can work at their own pace. Instead of presenting content/information/knowledge in a linear sequential traditional manner, learners may be provided with a rich array of tools, activities and information sources to use in creating their own learning pathways. The links and connections are formed by the learners themselves. In the implementation of the blended learning strategy, the framework below was considered.

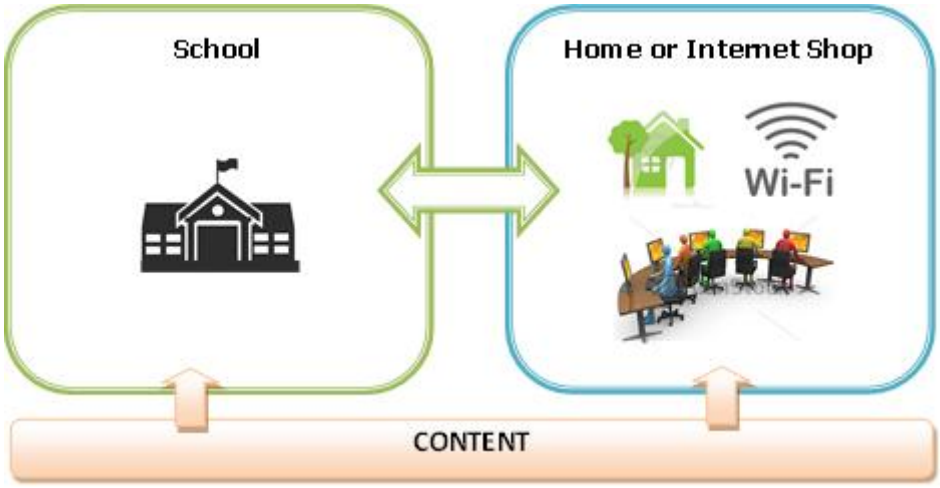


Figure 1. Paradigm of the Blended Learning Strategy implemented.

## METHODS AND PROCEDURES

### Research Design

The descriptive-comparative research design was utilized in this study. It is descriptive because it described the performance of the students who are exposed in traditional face-to-face instruction and in blended learning strategy, and the challenges encountered by the students and teacher in implementing the blended learning approach. It is comparative because it compares the performance of the students exposed in face-to-face instruction and in blended learning strategy.

### Subject of the Study

The subjects of the study were the BSE II students enrolled in Educational Technology 1 during the School Year 2015-2016.

### Data Gathering Procedure

Two sections of BSE II students were utilized in the study. One section was exposed to traditional face-to-face instruction while the other section was exposed to blended learning strategy. Students assigned for each section were randomly chosen and statistically comparable in terms of their academic performance prior to the study. They were given the same set of lessons in educational technology and were taught by the same teacher.

In the Traditional face-to-face instruction, all the contents were delivered by the teacher through lecture, discussion and interaction among the students inside the brick and mortar classroom. Lectures were delivered through power point presentation and other forms of visual materials. Learning activities (individual and collaborative) and assessments are done inside the classroom within each lesson.

In Blended learning strategy, parts of the contents were delivered through lecture-discussion in the classroom and the other parts were delivered via digital media (internet). The students were required to complete activities online prior to the face-to-face meetings to ensure that everyone shares a common knowledge base. Then during class time the content were supplemented and enriched with application and problem solving activities (Smart, K., & Cappel, J. 2006). The face-to-face time were used to learn the material at a deeper level and link the content to broader topics (Collopy, R.M.B., & Arnold, J.M., 2009). This allowed students some element of control with regards to time, location and pace on how they accessed the content and does and submits their activities.

Lectures and activities for the blended learning strategy were posted in a blog created and managed by the teacher for that purpose. Links were given to the students through email or facebook for them to access their online lectures and activities. Given the instructions and time frame, the individual students prepared their

activities and submit them to the teacher via email or facebook private message. The teacher retrieved the activities, evaluate and then do some follow up activities during their classroom interaction. The process was repeatedly done throughout the duration of the course.

Lecture and demonstration on the use of application programs in the blended learning strategy were also provided to the students prior to the implementation of the study. The facebook group was created and were used for class online interaction and communications. Other application programs were also utilized such as gmail, youtube, blogger, google docs, and yahoo messenger.

**Unit of Analysis**
The units of analysis were the BSE II students enrolled in Educational Technology I.

**Statistical Analysis**
For objective no. 1, frequency counts, percentage, and verbal description were used to describe the performance of the BSE II students.
For objective no. 2, frequency counts, percentage, and t-test were used to compare the performance of the students exposed in traditional face-to-face instruction and in blended learning strategy.
For objective no. 3, frequency counts and rank were used to describe the challenges encountered in the implementation of blended learning approach.

## RESULTS AND DISCUSSION

This chapter presents the discussion of the results of the study based on the problems identified in the statement of the problems.

### Performance of BSE II students in Educational Technology Using Face-to-face Instruction and Blended Learning Strategy

**Performance in Classroom Face-to-face Instruction**
Table 1 shows the performance of BSE II students in educational technology using the traditional face-to-face instruction. On this session, all the contents were delivered by the teacher through lecture-discussion and interaction among students inside the classroom. No contents are delivered through digital media.

**Table 1. Performance of the BSE II Students in Face-to-face Instruction**

| PERFORMANCE | QUIZZES | | ACTIVITY | | TERM TEST | | FINAL GRADE | |
|---|---|---|---|---|---|---|---|---|
| | F | % | F | % | F | % | F | % |
| Excellent (1.0 – 1.10) | 0 | 0 | 17 | 43 | 0 | 0 | 0 | 0 |
| Superior 1.11 – 1.50) | 5 | 13 | 12 | 30 | 0 | 0 | 1 | 2 |
| Very Good (1.51 – 2.00) | 20 | 50 | 8 | 20 | 0 | 0 | 33 | 83 |
| Good (2.01 – 2.50) | 10 | 25 | 1 | 2 | 26 | 65 | 5 | 13 |
| Passing (2.51 – 3.00) | 5 | 13 | 2 | 5 | 10 | 25 | 1 | 2 |
| Conditional Failure (3.01 – 4.00) | 0 | 0 | 0 | 0 | 4 | 10 | 0 | 0 |
| Failure (4.01 – 5.00) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **40** | **100** | **40** | **100** | **40** | **100** | **40** | **100** |

In terms of students' performance in their quizzes, five or 13% are superior, 20 or 50% are *very good*, 10 or25% are *good*, and five or 13% are *passing*. While in terms of their activities, 17 or 43% are *excellent*, 12 or 30% are *superior*, eight or 20% are *very good*, one or 2% is *good*, and two or 5% are *passing*.

With regards to the students' performance in their term tests, majority (26) or 65% are *good*, 10 or 25% are *passing*, while 4 or 10% are *conditional failure*. While in terms of their final grades, one or 2% is *excellent*, 33 or

83% which is majority of the students obtained a *very good* performance, 5 or 13% got a *good* performance, and one or 2% registered a *passing* performance. No one among the students got a conditional and failing grade.

**Performance in Blended Learning Strategy**

Table 2 shows the performance of BSE II students in educational technology using the blended learning strategy. On this session, one half of the contents were delivered through technology-enriched classroom instruction and the other halves were delivered through digital media.

In terms of students' performance in their quizzes, one or 2% is excellent, majority (42) or 64% are *very good*, 14 or 21% are *good*, six or 9% are *passing*, and three or 4% are *conditional failure*. While in terms of their activities, nine or 14% are *excellent*, majority (42) or 64% are *superior*, eight or 12% are *very good*, four or 6% are *good*, and three or 4% are *passing*.

With regards to the students' performance in their term tests (mid-term and final tests), five or 8% are *good*, majority (43) or 65% are *passing*, while 18 or 27% are *conditional failure*. While in terms of their final grades, 47 or 71% which is majority of the students obtained a *very good* performance, 15 or 23% got a *good* performance, and four or 6% registered a *passing* performance. No one among the students got a conditional and failing grade.

**Table 2. Performance of the BSE II Students in Blended Learning Strategy.**

| PERFORMANCE | QUIZZES | | ACTIVITY | | TERM TEST | | FINAL GRADE | |
|---|---|---|---|---|---|---|---|---|
| | F | % | F | % | F | % | F | % |
| Excellent (1.0 – 1.10) | 0 | 0 | 9 | 14 | 0 | 0 | 0 | 0 |
| Superior 1.11 – 1.50) | 1 | 2 | 42 | 64 | 0 | 0 | 0 | 0 |
| Very Good (1.51 – 2.00) | 42 | 64 | 8 | 12 | 0 | 0 | 47 | 71 |
| Good (2.01 – 2.50) | 14 | 21 | 4 | 6 | 5 | 8 | 15 | 23 |
| Passing (2.51 – 3.00) | 6 | 9 | 3 | 4 | 43 | 65 | 4 | 6 |
| Conditional Failure (3.01 – 4.00) | 3 | 4 | 0 | 0 | 18 | 27 | 0 | 0 |
| Failure (4.01 – 5.00) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **66** | **100** | **66** | **100** | **66** | **100** | **66** | **100** |

The result was congruent to the findings of Kenney, J. & Newcombe, E. (2011). Their study showed that in terms of unit test, the blended section had a slightly higher average score (47.46 out of 60) than the large, non - blended section (44.34) and the small, non-blended section (47.40). Moreover, iNACOL (2014), on their report shared five areas where over 50% of the teachers responding reported student academic ability were either better or much better in their classrooms that used blended learning models. Teachers reported the development of higher level thinking skills, improvement of homework and test scores and higher levels of student perseverance. At the University of Central Florida, researchers found the blended model having learning outcomes comparable to, and in some cases, better than face-to-face while lowering attrition rates in comparison with the fully online students (Dziuban et.al, 2004)

Whether through face-to-face or blended delivery, many studies show no significant differences in student learning outcomes (Napier, N.P., & Smith, S. (2009), Garrison, D.R., & Vaughan, N.D., (2008), Albrecht, B., (2006)). These results were promising and revealed that students can be responsible for their own learning through online. The impact on students' learning did not suffer using a blended learning approach, but it was comparable with face-to-face and slightly better in some aspects.

**Differences in the Performance of the BSE II Students in Educational Technology who are Exposed in Face-to-face Instruction and Blended Learning Strategy**

Table 3 shows the percentage comparison of the performance of BSE II students who are exposed in blended learning and face-to-face instruction.

**Table 3. Percentage Comparison of the Performance of BSE II Students using Blended Learning and Face-to-face Instruction.**

| PERFORMANCE | QUIZZES | | ACTIVITY | | TERM TEST | | FINAL GRADE | |
|---|---|---|---|---|---|---|---|---|
| | BL | F2F | BL | F2F | BL | F2F | BL | F2F |
| Excellent (1.0 – 1.10) | 0 | 0 | 14 | 43 | 0 | 0 | 0 | 0 |
| Superior 1.11 – 1.50) | 2 | 13 | 64 | 30 | 0 | 0 | 0 | 2 |
| Very Good (1.51 – 2.00) | 64 | 50 | 12 | 20 | 0 | 0 | 71 | 83 |
| Good (2.01 – 2.50) | 21 | 25 | 6 | 2 | 8 | 65 | 23 | 13 |
| Passing (2.51 – 3.00) | 9 | 13 | 4 | 5 | 65 | 25 | 6 | 2 |
| Conditional Failure (3.01 – 4.00) | 4 | 0 | 0 | 0 | 27 | 10 | 0 | 0 |
| Failure (4.01 – 5.00) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

*BL – Blended Learning*
*F2F – Face-to-face Instruction*

Result shows that in terms of quizzes, majority (64%) of the students who are exposed in blended learning are *very good* while only 50% for the students who are exposed in face-to-face instruction. However, higher percentage (13%) from the face-to-face instruction was registered for the *superior* performance compared to the 2% from the blended learning strategy.

As to the students' performance in their activities, result shows that majority (64%) of the students who are exposed in blended learning are *superior* while only 30% from the students who are exposed in face-to-face instruction. However, higher percentage (43%) from the face-to-face instruction was registered for the *excellent* performance compared to the 14% from the blended learning strategy.

With regard to the students' performance in the term tests, majority of the students under the blended learning are *passing*, while majority of the students from face-to-face instruction are *good*. In terms of the overall performance in the final grade, both strategies registered majority students in the *very good* performance.

Table 4 shows the differences in the performance of BSE II students in educational technology using blended learning and traditional face-to-face instruction.

**Table 4. Difference in Performance of BSE II Students using Blended Learning and Face-to-face Instruction.**

| PERFORMANCE INDICATOR | MEAN OF GRADES | | t-computed | t-critical | Probability | Remarks |
|---|---|---|---|---|---|---|
| | BLENDED LEARNING | FACE-TO-FACE | | | | |
| Quizzes | 2.080 | 2.015 | 0.634 | 1.995 | 0.527 | NS |
| Activity | 1.423 | 1.425 | -0.017 | 1.997 | 0.986 | NS |
| Term Test | 2.867 | 2.482 | 6.843 | 1.986 | 9.49E-10 | HS |
| Final Grade | 1.898 | 1.787 | 1.989 | 2.005 | 0.052 | NS |

*NS – Not Significant*
*HS – Highly Significant*

Results reveal that no significant differences existed on the performance of students exposed in blended learning and students exposed in pure face-to-face classroom instruction in terms of their performance in quizzes,

activity, and final grade. This was the result of the comparison made using t-test where the computed t-values were compared to the t-critical. This goes to show that performance of students exposed to the two strategies are statistically comparable as to the three above-mentioned performance indicators.

However, result further shows that highly significant difference existed in terms of students' performance in the term tests in favor to those who are exposed in face-to-face classroom instruction. This can be attributed to the fact that more time for lecture-discussion and teacher-student interaction was provided to the students who were exposed in face-to-face instruction.

**Challenges Encountered by the Students and Teacher in Blended Learning Strategy**

**Challenges Encountered by the Students**

Table 5 shows the different challenges encountered by the subject students in the implementation of the blended learning strategy.

Result shows that the most pressing challenge majority of the students experienced were the "lack of budget for computer rental especially for those who do not have personal computer/laptop", and it was followed by "lack of access to computers in the school". These problems emerged because there are no available computers in the University dedicated to be utilized by the students for free to do their blended learning activities. Hence, majority of them went to the internet shops to do their activities which required them to spend extra money for the computer and internet rentals. According to Dmitry Matukhin and Elena Zhitkova (2015), for effective delivering the academic courses by means of blended learning, it is necessary to develop methodological support which consists of teaching materials and computer support, designed on the basis of modern information and communication technologies. Rossett (2003) declares that information support of educational activities of the universities in the field of blended learning is largely dependent on the type of the university system, educational process organization, the level of computerization as well as information and communication training technology.

**Table 5. Challenges Encountered by the Students in Blended Learning Strategy.**

| CHALLENGES | RANK |
|---|---|
| Difficulty in sending activities especially in areas with weak or limited internet signal | 3 |
| Lack of budget for computer rental especially for those who have no personal computer/laptop | 1 |
| Students lack of access to computer in the school | 2 |
| No internet connection available in the area | 4 |
| Power interruption during the preparation and submission of online activities | 5 |
| Lack of knowledge and skills in using computer and internet | 6 |

The other challenges were the "difficulty in sending activities especially in barangays with weak or limited internet signal" and "no internet connection available in the area". These problems were experienced by the students who reside in barangays/areas where there is no internet signal or weak signal is available. This shows that until the present time, internet connectivity is still a problem in our society.

The other challenges encountered by the students were "Power interruptions" and "Lack of knowledge and skills in using computer and internet". Despite the demonstration activity conducted on the use of application programs and internet prior to the blended learning activities, there were still students who encountered problems on the lack of necessary (ICT) skills in doing their activities. This seems to be unexpected of young people today, who are real "digital natives", "generation Z", etc., not imagining their life without smart electronic devices and gadgets (Nazarenko, 2015).

**Challenges Encountered by the Teacher**

Table 6 shows the different challenges encountered by the subject teacher in the implementation of the blended learning strategy.

The major challenge the teacher encountered was the "Lack of training and specific framework to implement blended learning approach". Developing a course to work in a blended format is not easy. It needs technological and pedagogical knowledge combined with mastery of the contents to effectively integrate online with face-to-face instruction. It can be best understood when there is a chance to attend formal training and interact with practitioners or qualified trainers.

Another challenge the teacher encountered was the extra time allotment devoted in the preparation of online activities as well as in the retrieval of student activities. It requires time more than what was expected especially in checking and evaluating student outputs and in giving feedbacks to the students. The "slow internet connection in the school and at home" was added problem. This is needed in the posting and retrieval of online activities. If the internet connection is slow, it consumes time in addition to the time devoted in the preparation of online activities.

Also, there was a challenge on getting the students on board with the individual online activity especially those who have low motivation. Since some of the activities were online, students have to do their activities on their own with minimal supervision from the teacher. There is a need to develop a framework on how to encourage and motivate students to do their activities. According to Nazarenko (2015), it is necessary to know what particularly attracts youngsters to technologies (findings of complex multidisciplinary investigation of the problem) and make use of those particular characteristics (like keeping a reasonable balance of textual and visual learning materials).

Another challenge the teacher encountered was the "copying of activities among students". The teacher should be vigilant in assessing the student's activity to determine whether it is authentic or just copied from others. The teacher should come up with mechanisms to identify copied activities.

**Table 6. Challenges Encountered by the Teacher in Blended Learning Strategy.**

| CHALLENGES | RANK |
|---|---|
| Time consuming on the preparation of materials, posting and retrieval of online activities | 2 |
| Slow internet connection in the school and at home | 3 |
| Copying of works among students | 5 |
| Lack of framework to encourage learners who have low motivation for the online activity | 4 |
| Lack of formal training and specific framework to implement blended learning approach | 1 |

**Strengths of the Blended Learning Strategy as observed by the Teacher**

Blended learning strategy as applied in the classroom has strengths and weaknesses as compared to other strategies.

The greatest strength of the blended learning approach is the ability to personalize the instruction and address the individual needs of each student in a more effective manner. Using curricula specifically designed for online instruction (rich content, interactive media, and state-of-the-art instructional tools), online teachers lead interactive sessions and encourage class participation and discussion (www.connectionslearning.com).

This instruction can be customized for each student to encourage acceleration in students who are ahead or to provide remediation for students who are behind. Online instruction can be customized to each student's skill level and can be adjusted because of the flexibility of the online format and the sophistication of performance tracking tools (Blended Learning Primer).

The following are the observed strengths in the implementation of blended learning approach:

***Lessons can be accessible, anytime and anywhere.*** Since some of the lessons are delivered online, they can be accessed by the students in the school, at home, in the internet shops or anywhere they want at their own convenience. They can be accessed anytime and students can do their assigned activities and submit it within the period specified by the teacher. They are given a little control on time, place and pace in their learning.

***Variety of activities can be given to the students using ICT.*** Blended learning provides opportunity for the teacher to integrate ICT in the lesson. The teacher can present the lesson in various ways taking advantage of the 21st century tools for education. Moreover, students can be given varied activities where they can utilize the various resources and array of tools available in the web. This may provide opportunity for the students to express their creativity and use their learning style in doing their activities. This further develops the multiple intelligences of the students.

***It saves space and other resources of the school.*** The use of blended learning approach reduced the contact time of the teacher and students inside the classroom. With this, schools may save space which can be utilized by other classes. This may lessen the need for additional classrooms which is one of the perennial problems of any higher education institution. When the contact time inside the classroom is minimized, then, the other resources may also be reduced such as electric energy consumption derived from lighting and ventilation facilities,

teaching aids such as chalk, board marker, meta cards and other visual materials, and even waste materials produced by the students may also be minimized.

***Supplementary materials can be easily provided to the students.*** Since some parts of the lessons are delivered online, supplementary reading materials can be easily provided to the students by providing links to the different websites and other online resources. Electronic materials can be uploaded in the web or they can be published through webpages or blogs which can be accessed by the students freely.

***Classroom interactions are improved.*** Students who are exposed in blended learning are observed to be more interactive in classroom discussions. Werth et.al (2013) reported that students in the blended learning are perceived to be more motivated to participate in the classroom. This may be due to the advance activities provided to them and the readily available materials online which make their understanding of the lesson more comprehensive. Student engagement positively changes when blended learning is utilized (iNACOL 2014).

***It develops and improves the digital literacy of the students.*** ICT literacy is necessary in blended learning. Students can access their lessons using digital media, hence, they need to develop and enhance their skills in using technology. Because of the need to use ICT tools to do their activities, students continuously explore and unconsciously deepening their knowledge on the use of ICT resources.

***Students' progress is easily and accurately monitored.*** Monitoring of student's outputs in face-to-face is tiresome especially in big classes. The teacher needs to wait for the students to submit their outputs while the students tend to rush just to finish within the period. The result may be a half-baked, inferior in quality or just for compliance output. In blended learning, online activities can be easily monitored. With just few clicks, the information can be easily gathered such as "*who did not submit yet*", "*who did not submit in time*", "*what activities are they lacking*", etc. The teacher can also give immediate feedbacks or comments regarding the students' outputs. Since the students are given the leeway to do their activities at their own pace and time, it is expected that they would have superior outputs.

***Flexibility in time, pace and place.*** The advantage of blended learning both for teacher and students is the flexibility in time, pace and place. Learning does not only take place inside the classroom but it can happen anywhere and anytime as long as there is internet connection. Classes may happen even the teacher and students do not meet due to inevitable circumstances such as inclement weather conditions. Lessons can be continued even the teacher is out of the school because of other academic related activities. It can minimize the disruption of classes among students.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

The following conclusions were drawn based from the results of the study:

1. The use of blended learning is viewed by the students as very effective in teaching educational technology. Students who are exposed in blended learning strategy and face-to-face instruction both perform superior and excellently in their activities and very good in their quizzes and final grades.
2. Students who are exposed in blended learning and face-to-face instruction have comparable performance in quizzes, activity, and final grade. However, students who are exposed in face-to-face instruction perform better in their term tests.
3. The most pressing challenge in the implementation of blended learning strategy as experienced by the students is the lack of available computers and internet connection to be utilized by the students for their online activities. While on the part of the teacher, the most pressing challenge is the slow internet connection which is time consuming in the posting of online lectures and activities, and in the retrieval and checking of students' online activities.
4. Blended learning provides alternative way for teachers to deliver their lessons which saves time, space, and resources of the school. It makes lessons accessible, anytime and anywhere allowing students to work on their own pace.

### Recommendations

Based on the results and conclusions of the study, the following are hereby recommended:

1. For effective implementation of blended learning strategy, the university may provide dedicated computer laboratory with internet connections or free wifi access for the students for their blended learning activities.
2. The use of mobile phones and mobile applications in the delivery of the lessons is highly encouraged to address the issue on lack of access to computers and internet since almost all students have mobile phones.

3. The teacher who utilizes blended learning approach should device mechanisms to prevent and distinguish copying of works among students.
4. The integration of motivational activities as part of the students' online activities is highly encouraged to motivate the individual learners in doing their activities.
5. The University may organize and implement training programs for teachers who may want to implement blended learning. The training may focus on designing a course for blended learning and integrating online activities with face-to-face instruction.
6. The 50% lecture – discussion in the classroom and 50% online learning activity is highly suggested for blended learning strategy.

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# Conversations, Debates and Affiliation Networks on Twitter

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**ABSTRACT**
The question addressed is whether, in connection with education, Twitter can be considered both a communication centre and an affiliation space, where virtual communities with shared interests are formed. The 6654 tweets containing the *#education* or *#educación* hashtag sent on specific days in 2014, 2015 and 2016 defined the sample. The design was a combination of the quantitative and the qualitative. The results indicated that, when tweeters not directly related with education show interest in the topic of education, they do so exclusively during a limited time period; that is to say, no permanent interpersonal links were observed amongst such tweeters. Therefore, the conclusion was that the *#educación* and *#education* hashtags make it easier to share information and to make primarily non-activist comments related with education; furthermore the hashtags enable the creation of a virtual community of shared interests but do not lead to the establishment of a permanent community. In addition, the characteristics defining the Twitter network (speed and immediacy) were observed to promote monologues more than dialogues and to encourage information sharing more than any real intention to interact or conduct in-depth discussion. These points must be taken especially into account in education.

## INTRODUCTION

Twitter has been proved a valuable space for making public opinion about recent events known (Madge, Meek & Tristram, 2009; Marwick & Boyd, 2011; Woodly, 2008). Social networks' influence on citizens has even been thought to be able to outweigh that of conventional media (Bennett & Segerberg, 2012). In fact, studying Twitter communication processes and discussions through analysis of the hashtags used in messages has become a widespread practice accepted by most researchers (Bruns & Stieglitz, 2012; Veltri, 2013). As Zappavigna (2011) asserts, hashtag analysis reveals what people are talking about at a given time, and in addition using the linguistic code of the hashtag makes it easier for Twitter users to form communities that share interests. In short, Twitter may be regarded as an important source of knowledge about public opinion on a given topic. However, it is difficult to ascertain just how much microblogging reinforces true processes of communication and social affiliation and whether, on the contrary, microblogging encourages individualistic action devoid of social commitment and interest in others.

## REVIEW OF THE LITERATURE

### Communication Centre: Communication versus Information

The foundation of this research is the difference between the concepts of "communication" and "information" according to Kaplún (1998:64), who defines communication as "that process whereby an individual enters into mental cooperation with another until they both reach a common awareness" and information as "any one-way transmission of messages from a transmitter to a receiver". Kaplún (1998) insists that communication cannot be confined to an active transmitter (speaking) and a passive receiver (listening); instead, it is fundamental for both to interact and share their own experiences. As Noguera, Martínez-Polo and Grandío (2011:139) assert, "the socialising power of the media […]" has helped make the receiver a creator and transmitter of messages, and therefore it has boosted the increase in social actors who make their opinions heard.

Twitter was created to facilitate communication amongst Twitter users and their followers. As we all know, this interaction process takes place through the posting of messages or tweets (García-Avilés, 2015). Microblogging has been considered a conversation or communication centre (Boyd, Golder, & Lotan, 2010; Del Fresno, 2014; Honeycutt & Herring, 2009; Larsson & Moe, 2012); heavy participation and great liveliness have been registered on the web through messages of no more than 140 characters. Analysts have looked at the tool's linguistic potential on the basis of a given hashtag (Zappavigna, 2011) and even the coherence of Twitter conversations and the functions of the @ symbol when used in the body of messages (Honeycutt & Herring, 2009).

In this context, some research points to a lack of interaction amongst users and considers Twitter a space for information spreading more than a space for conversation or interaction (Faktor, 2013; Lovejoy, Waters, &

Saxton, 2012; Waters & Jamal, 2011), an environment where users do not argue their opinions (Calvo, 2016), where the monologues outnumber the dialogues and where true communication processes do not take place (Lovejoy et al., 2012; Veltri, 2013; Waters & Jamal, 2011).

The Twitter communication process has been described as communication that is the result of "following" other network users and/or "being followed" by others, where no reciprocal relationship between the followed user and the follower is necessary (Kwak, Lee, Park, & Moon, 2010:6). Analysis of the communication process has produced different ways of classifying messages or tweets, which researchers label according to the linguistic codes used in the body of the message.

Kwak et al. (2010:6) provide the following tweet classification system:

- "Singleton": Single (or direct) tweet sent by a user. Characterised by the absence of @.
- "Reply": Response to a tweet sent previously by another user. These tweets include @ with the user ID of the original message's author.
- "Retweet" (or RT): A message resending an original tweet to other users. A retweet may include fresh comments. Retweets include @ plus the user ID of the original tweet's author.
- "@userid": @ plus a particular user's ID, indicating the intention to quote and communicate with that particular user.
- "Hashtag" (#) before the keyword and/or indicating a specific topic: This code is highly useful for locating information, compiling tweets and/or locating conversations.

Another classification is that provided by Bruns and Stieglitz (2013), who point to the existence of two main types of tweets:

- "@mentions" (messages with @ in their content), which may be of two types: *genuine @replies* (messages that contain "@userid" but are not retweets) and retweets (or RTs) (tweets in this format: "RT @userid [original message]").
- "Retweets", which may be divided into "unedited retweets" (tweets starting with "RT @userid") and "edited retweets" (tweets not starting with "RT @userid", although the code does appear somewhere in the text).

Other forms of codes include "via @userid" (which indicates where the post comes from) and the option of indicating that you "Like" tweets.

The functions of @ in messages is another of the aspects examined. The use of @ as an indicator of communication intention has been highlighted, as has the use of @ to show "addressivity" (the fact that a message is addressed to a particular person) (Honeycutt & Herring, 2009; Java, Song, Finn, & Tseng, 2006; Larsson & Moe, 2012). Bruns and Stieglitz (2013) assert that "@userid" in tweets entails no communicative intention when it is the result of retweeting, in which case more-detailed analysis of the tweets is necessary.
Honeycutt and Herring (2009:4) differentiate amongst the following functions of @ in tweets:

- "Addressivity": When @ informs a user that this message is addressed to him or her.
- "Reference": When the message talks about a person but is not addressed to that person. Example: I don't like what @pepe is doing.
- "Emoticon": When @ is used as part of an emoticon. Example: @ _ @.
- "e-mail": When @ forms part of an e-mail address.
- As a stand-in for the English preposition "at".
- "Other": A grab bag of uses that do not fall into the categories above.

Tweets have been classified in different ways according to their content as well.

Java et al. (2006) establish the following taxonomy of user intentions in microblogging:

- "Daily chatter": Tweets commenting on tweeters' daily life, talking about their routine or what they are doing.
- "Conversations": Tweets including the @ symbol followed by the user ID in replies.
- "Sharing information" or URLs. Tweets containing a URL.
- "Reporting news": News or comments on current events, publication of reports.
- "Unknown": Tweets that cannot be classified into the categories above.

Martis and Alfaro (2012) discern the following types of messages: news sent by a formal, objective institution, usually with a URL; news accompanied by a personal opinion; advertising or personal promotion; general opinion expressed individually; an event or information giving the author's location; chat or conversation;

question; and personal message. Naaman, Boase and Lai (2010) classify tweets into information sharing, self-promotion, opinion and/or complaints, statements and thoughts, personal anecdotes and others' anecdotes. Lastly, Sriram (2010) proposes news (neutral, personal and commentated), opinions, deals, events and private messages.

**Affiliation Network: Virtual Community of Shared Interests**

Affiliation amongst Twitter users who share interests has been studied by many authors, from the perspective of homophilia (love amongst equals) (Kwak et al., 2010), finding that interaction amongst similar persons happens more quickly if the persons are different (Weng, Lim, Jiang, & He, 2010), and from the Twitter user standpoint, finding that users who follow each other share interests (McPherson, Smith-Lovin & Cook, 2001). There are also a great many studies highlighting Twitter's role in the formation of social movements (Boix, 2009; Castells, 2012/2013; Shirky, 2009; Torrego & Gutiérrez, 2016) and citizen engagement in affairs of social interest (Bennett & Segerberg, 2012).

Studies based on social network analysis start with the concept of the social circle (Kadushin, 2013), which is defined as an informal network formed on the basis of shared interests, whose members do not necessarily have direct relationships with one another, but instead tend to have an indirect connection through, for example, friends of acquaintances. In short, the social circle is defined as diverse communities of like-minded people and/or people with shared interests without any formal organisation (without rules, borders and/or established leadership) (Kadushin, 2013:184).

Zappavigna (2011) looks at the interaction patterns and linguistic complexity of Twitter users. Zappavigna starts by assuming that the main function of using the hashtag as a linguistic code is to facilitate affiliation and the creation of communities that share interests. The author asserts that users form communities when they search for and share messages using a hashtag as a linguistic code. The author concludes that use of the various tweeting codes (RT, @ and #) modifies interaction and affiliation patterns and that looking for messages on Twitter by searching for hashtags facilitates the creation of non-permanent communities with shared interests; in other words, that a tweeter's affiliation with the community is determined by how the topics of interest evolve over time.

The research reported in this paper evaluates Twitter's potential as a communication tool, starting with the tweeter intention classification created by Java et al. (2006), including and redefining some aspects according to the proposals of Sriram (2010), Naaman et al. (2010) and Martis and Alfaro (2012). The first points examined are the value of the @ code as a conversation indicator (Java et al., 2006; Larsson & Moe, 2012), the addressivity function and other functions indicated by Honeycutt & Herring (2009), taking account of the codes singled out by Kwak et al. (2010). Moreover, microblogging is considered an affiliation centre that facilitates the creation of non-permanent virtual communities according to the evolution of topics of interest, as Zappavigna (2011) indicates. This paper begins with the interest generated by the *#educación* and *#education* hashtags as important clues for ascertaining what the community interested in education-related topics is talking about during given time periods.

## METHOD

### Objectives

The general objective is to find whether Twitter can be regarded as a) a communication centre and b) a space of affiliation where virtual communities with shared interests are formed in connection with education.

In short, questions in this research are as follow:

1. Can Twitter be considered, as far as the educational environment is concerned, a Communication Centre and/or a space for affiliation where virtual communities with shared interests are formed?
2. Which are the users' intentions when dicussing Education topics on Twitter? Which is Twitter's main communication style - monologue or dialogue?
3. Which are the main communication systems (retweets and direct tweets or quotation using @) and dissemination processes taking place on Twitter?
4. Which are the specific characteristics of the virtual community related to participation in conversations about #educación and #education on Twitter?
5. What are the profiles of those Twitter users regularly posting about education like? Are those profiles related to the Education sphere?

**Participants**

Convenience sampling was used (McMillan & Schumacher, 2001/2005). Despite the drawbacks of this type of sampling technique, such as the difficulty of generalising for the whole population on the basis of the results, convenience sampling facilitates the selection of cases for in-depth study and enables a more-detailed analysis of user intentions that would not be possible otherwise (with a broader sample). The tweet extraction days were selected at random.

The *#educación* and *#education* tweets compiled on various days in 2014, 2015 and 2016 define the sample: 2014 (03 and 09 September), 2015 (13 and 15 January) and a third selection taken in early 2016 that includes data from late 2015 (17 December) and early 2016 (01 February and 23 March). The population data are given below.

**Table 1.** Preliminary Sample

| Year | Population |
|---|---|
| 2014 | 18076 |
| 2015 | 14561 |
| Late 2015 and early 2016 | 8742 |
| Total | 41379 |

The tweet selection procedure was performed in the following phases:

1. 1. Selection of messages posted in accounts in Spanish and English and grouping of tweets and retweets by topic within each year (referred to as “topic groups”).
2. 2. Grouping of messages that are the same, messages responding to the same news and sum of the frequencies in each group (including original tweets and RTs): Total tweets including RTs = 22455. Total topic groups = 1265.
3. 3. Selection of messages whose frequency is equal to or greater than 10, for each of the years, and elimination of the remaining messages, which are considered less representative: Total tweets = 6654. Total topic groups = 226.
4.

**Table 2.** Analysed Sample

| Year | By Topic Groups | By Total No. Tweets and RTs | | | | |
|---|---|---|---|---|---|---|
| | Frequency | Percentage | Frequency | | Percentage | |
| | | | Tweets | RT | Tweets | RT |
| 2014 | 104 | 46 | 3294 | 72121 | 49.50 | 71.26 |
| 2015 | 95 | 42 | 2576 | 16376 | 38.71 | 16.18 |
| 2016 | 27 | 11.9 | 784 | 12835 | 11.78 | 12.68 |
| **Total** | **226** | **100** | 6654 | 101212 | 100 | 100 |

The analysis of the aforementioned 1183 profiles on Twitter accounts from which the information was disseminated, shows that participating users have had an average of 24097.15 Tweets sent, 653,87 Follows, 1135.02 Followers and 752.75 Likes (contained in their messages). As far as these Tweeter users’ traits, it can be concluded that most of them post as individuals (53.5%) and not as part of an organization or institution while 41.2% are accounts belonging to institutions. A 4.4% of them correspond to cancelled accounts and 0.9% provides no information on their profile. Users researched show interest in a wide range of socio-political topics, related to citizenship, news dissemination, sports, religion, fashion, food and music. In some other cases, the accounts aim to promote business, sales, and telecommunication providers. Next, further details will be provided on whether users have Education-related profiles, which is a factor of special interest in this research.

Such data provide a different perspective when compared with those obtained from analyzing the profiles of the most popular users (132 top users) since the latter are mostly belonging to institutions (56,1%) such as: Apply For College; General Secretary National Union of Teachers; Psychotherapist & Certified Diabetes Educator; Communications Officer, @CoE; Secretariat of the Statistical Commission of @OIC_OCI; school-based healthcare professionals; Shasta College Online; Podemos; Mchari Institute. On a lesser amount, profiles corresponding to individuals are registered (31,8%), such as: Massachusetts teacher and technology integrator, SMARTboard trainer; Educational Tech Coach, EdTech enthusiast; Citizen and active participant in the world; Kan ku pandu dunia ini; Director of Earth FX International; an education/political activist; Cardiologist; Emmy Award writer; Kindergarten Gen Ed & Spec Ed Teacher, etc. A 9.8 % corresponds to cancelled accounts.

**Instruments**

The data collection instruments used were the *Twitter Archiving Google Spreadsheet (TAGS* v6*)* (Hawksey, 2013), Excel (to organise the data) and SPSS Statistics version 22.

The data were collected by means of the TAGS v6 (Hawksey, 2013). These data collection systems labour under certain restraints. In the first place, Twitter limits tweet retrieval to the last month's tweets, depending on the number of messages sent. In the second place, overestimation of the more-influential users could bias the data (Jain, 2015) and/or select the more-retweeted tweets instead of the original messages (Bruns & Stieglitz, 2013). In the third place, TAGS v6 only covers tweets sent in the last seven days.

Albeit temporary, the data gleaned from these collection systems are still an interesting research objective (Bruns & Stieglitz, 2013; Gerlitz & Rieder, 2013); it is interesting to collect both original messages and retweets, because retweeting frequency is considered a reflection of the information's popularity. In addition, as Bruns and Stieglitz (2012) point out, to obtain all the tweets or hashtags, one must trust the API, because it is the only tool that facilitates large-scale data collection. Researchers have no other way of confirming data quality and accuracy, and therefore this restriction is considered an inevitable one that does not invalidate the results (Bruns & Stieglitz, 2013).

The research was performed in three phases:

1. 1. Phase 1. Data extraction with the TAGS V6 tool: Searches were run for tweets in the months of September 2014, January 2015, December 2015 and February and March 2016.
2. 2. Phase 2. Sample preselection and selection: April 2016. The sample whose content was to be analysed was selected from the data found.
3. 3. Phase 3. Data analysis: September and October 2016.

**DATA ANALYSIS**

The design combined quantitative elements (a descriptive study) and qualitative elements (content analysis).

With all the different communication options available (RT, @ and original tweet), **descriptive analysis** helped learn how the communication process developed and what tweeters' intentions were. Tweet **content analysis** enabled the messages to be grouped by topics and ascertained tweeter profiles (as persons related with education or not related with education) and the characteristics of the community or affiliation group with shared interests.

In order to obtain information about the users' profiles, their account are acceded and the latest Tweets received are checked. In addition, posted information is analysed since, as a whole, it can be considered as the user's introduction letter to potential followers. Such analysis shows the participants' basic traits and their relation – if any – with the Education sphere. Those classified as directly related to the Education sphere are the ones belonging to an Education institution (school, education-focused media, universities, etc.) or professionally engaged in the Education field (teachers, professors, school principals, politicians assigned to education issues, etc.).

**Content analysis** was performed following the steps given by García-Llamas, González and Ballesteros (2001): 1. Definition of the content universe and selection of the sample; 2. Decision on the unit of analysis and establishment of the families and codes (classification system based on categorizing content according to its similarities). Lastly, the information was organised into five *families* of message types: news reports, information, quotations, personal matters or daily chatter and other.

After the superfamilies (grouping of families to facilitate the recovery of information according to pre-established criteria) and families were established, the various families were subjected to comparative analysis. Following the recommendations of Flick (2015:65), the goal was "to find the core of variance in the field". The contents published by tweeters who are teachers and/or are directly related with education and tweeters who are not teachers and have no relationship with education were compared, because it was felt that the two samples could furnish interesting data contrasts. Further contrasts were run looking at messages' activist nature and relationship with tweeter profile. Descriptive analysis was performed through the generation of contingency tables, and the messages sent by the two samples were subjected to content analysis.

**Table 3.** Relationship Between Research Objectives and Data Analysis Method

| Research questions | Method | Sample |
|---|---|---|
| *a) Communication Centre: Communication Versus Information*<br>*1.* Which are the users' intentions when dicussing Education topics on Twitter?<br>2. Which is Twitter's main communication style - monologue or dialogue? | Descriptive analysis | 6654 tweets organised into 226 topic groups. |
| 3. Which are the main communication systems (retweets and direct tweets or quotation using @) and dissemination processes taking place on Twitter?<br>*b) Affiliation Network: Virtual Community with Common Interests*<br>4. Which are the specific characteristics of the virtual community related to participation in conversations about #educación and #education on Twitter?<br>5. What are the profiles of those Twitter users regularly posting about education like? Are those profiles related to the Education sphere? | Content analysis<br>Descriptive analysis (contingency tables) | 6654 tweets organised into 226 topic groups.<br>1183 profiles of tweeters responsible for sending the most popular tweets and 137 top tweeters. |

**RESULTS**

The results of these analyses are presented according to the research objectives: Twitter as a conversation centre and Twitter as an affiliation space and community of shared interests.

**Communication Centre: Communication Versus Information**

The following were utilised to analyse the communication process that takes place on Twitter:

1. 1. Classifications of tweets by the codes employed: Kwak et al. (2010) on retweeting and direct tweets or quotations (using @); Bruns and Stieglitz (2013), who differentiate between *genuine @replies* (tweets that contain the user's @userid but are not the result of a retweet) and RT @ (tweets in the "RT *@username* [original message]" format).
2. 2. The functions of @ according to Honeycutt and Herring's classification (2009), the contributions of Java et al. (2006) and Larsson and Moe (2012): *addressivity* (@ addresses a message to another person and has the function of telling a user that this message is addressed to him or her), reference, emoticon, e-mail, a stand-in for "at".

Classifying according to Kwak et al. (2010), it was found that 21.1% were singletons (no @), whilst the majority, 77.9%, used the code "*@user id*", either as the result of retweeting or as a direct message addressed to some person (*genuine @reply*).

Subsequent analysis showed that only 14.6% of these messages were messages with a *genuine @reply*, and that 63.3% were the result of a retweet (*RT @userid*). Within these groups, 4% of the messages were observed to use *RT @userid* and *genuine @reply* together in the same message. In addition, in another 4% of the messages, the @ referred to the message's origin (*via @userid*). The other categories established by Honeycutt and Herring (2009) were not found.

**Table 4.** Descriptive Analysis of Message Types

| | **Frequency** | **Percentage** | **Valid Percentage** |
|---|---|---|---|
| No @ | 50 | 22.1 | 22.1 |
| *@Retweet* | 143 | 63.3 | 63.3 |
| *Genuine @reply* | 33 | 14.6 | 14.6 |
| Total | 226 | 100 | 100 |

Analysis of the *most popular tweets* revealed a certain interaction by means of the "Like" label. The message "when your alarm goes off tomorrow morning and you think to yourself: do I really need an education?", coded as "personal comment", registered 10936 "likes". The message came from Cameron Asa (@Tweet like a girl), a communications student at the University of Tennessee, who opened her account in 2012. According to El Mudo TKM (2014), her messages tend to go viral.

**Affiliation Network: Virtual Community with Interests Related with Education**

For the study of the characteristics of the virtual community, the points analysed were tweeters' profiles and relationship with education, tweet content and the activist nature or sociopolitical interest of tweets.

In order to find out the characteristics of the vitual community, information posted on the tweeters' profiles is thoroughly checked.

Tweeter profiles were categorised under the following criteria:

1. 1. Relationship with education:

- No relationship: The tweeter has no direct relationship with education although the tweeter has commented on certain topics having to do with education at some point.
- Direct relationship with education: Users are considered directly related to the Education sphere if they are professionaly focused on Education (teachers, school principals, members in Education institutions, etc.) and/or if the profile belongs to Education institutions (schools, universities, academies, etc.).

1. 2. Teaching career: The account owner is a teacher or is not. Accounts are filed under this category only in case the account owner is a teacher. All other options have been discarded.

Analysis of tweeter profiles revealed that 72.2% of the tweeters at issue had no direct relationship with education, and only 27.8% had some relationship with education. In fact, amongst the tweeters related with education, it was observed that only 7% were teachers. In contrasts, analysis of the profiles of the 132 top tweeters (the most popular tweeters in the sample) confirmed that 62.5% of that population had a direct relationship with education, but only 7.6% had a Twitter profile as a teacher.

Categories to analise the tweets' content are based on a two-stage process:

1) Reading each tweet and categorizing its content.

2) Analyzing classifications used by external experts in previous studies (Java et al., 2006; Martis y Alfaro, 2012; Naaman et al., 2010; Sriram, 2010) and checking whether they appear or not in the research sample.

Therefore, the tweets' content is classified under the following categories:

i. 1. News sharing: News or current events, reports, generally posted on formal media and accompanied by a URL.

ii. 2. Information sharing: Opinions on different topics (politics, jokes, personal matters). These tweets may originate with a news item, but they include commentary. They may be accompanied by the new item's URL.

1. 2.1.Sociopolitical and education events:
   2.1.0. Non-activist.
   2.1.1. Activist.
1. 2.2.Reports, blog entries, interviews.
2. 2.3.Promotion or self-promotion: Messages sent to introduce, publicise or promote events, institutions, courses, magazines, etc.
3. 2.4.Educational resources.

1. 3. Personal, personal comments or daily chatter: Personal information, commentaries on daily life and personal life, voicing thoughts or sharing quotations.

1. 3.1. Quotations: Sharing quotations by other authors to display agreement with the opinion, making it one's own.
2. 3.2. Personal comments.
   3.2.1. Non-activist.
   3.2.2. Activist.
1. 3.3. Congratulations.

1. 4. Unknown, unlocatable or cancelled account: Message of unknown origin, message that cannot be located or account that has been cancelled.

Content analysis indicated that most tweets were personal comments (personal information, commentaries on daily life and personal life, voicing thoughts or sharing quotations) (37%), followed in second place by tweets sharing information (34.4%).

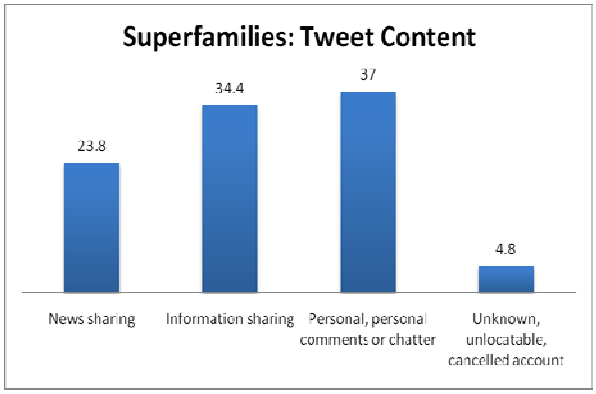


*Figure 1.* Tweet Content Superfamilies

Deeper analysis shows that, in the "Personal, personal comments or daily chatter" superfamily, most tweets were personal comments (76.2%), 53.6% were non-activist tweets and 45.2% were activist tweets. Most of these tweets (77.4%) were sent by tweeters unrelated with education. In addition, it was found that, within the "Information sharing" superfamily, the most frequently sent tweets were "promotional or self-promotional" messages of institutions and/or courses (37.2%), followed in second place by posts referring to reports, blog entries and/or interviews (30.8%). Most of the tweets in this superfamily were not activist messages (94.9%) and bore no relationship with education (69.2%), and the tweeters were generally not teachers (96.2%).

Comparison of frequencies within the analysis of families found that most of the tweets were personal comments (28.2%), followed in second place by news (23.8%). One interesting finding was the low percentage of tweets related with sociopolitical events related with education (1.8%).

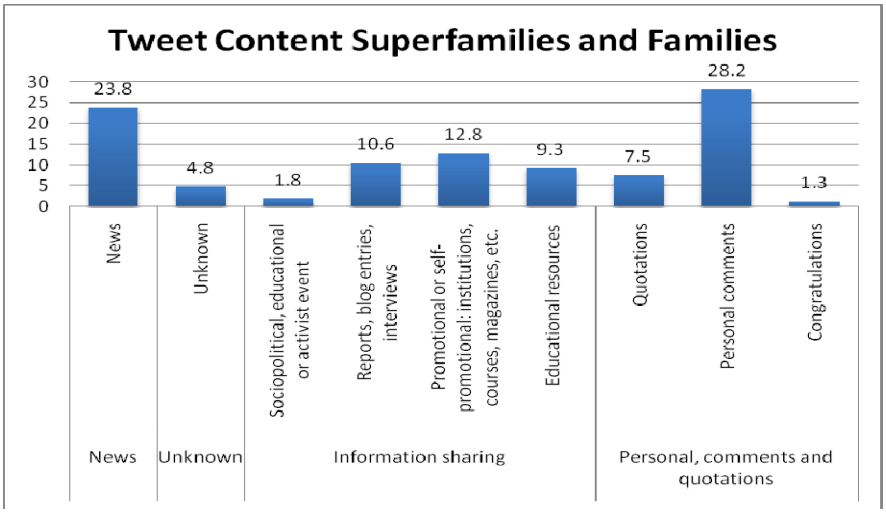


*Figure 2.* Tweet Content Superfamilies and Families

The activist nature of tweets was analysed as well. It was found that most tweets were not activist (81.1%) and that the activist tweets were related with sociopolitical events (18.5%) and, to a lesser degree, with personal comments and quotations (0.4%).

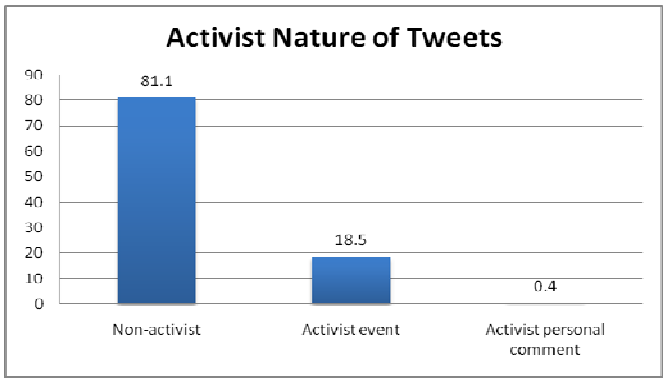


*Figure 3.* Activist Nature of Tweets

Tweeters related with education posted mostly "information sharing" tweets (38.1%), in contrast to tweeters unrelated with education, who posted mostly personal tweets (39.6%). It was found that teachers posted mostly personal tweets (50%), followed in second place by news (31.3%) and in last place information (18.8%).

**Table 5.** Cross-tabulation of Superfamilies with Relationship/Non-relationship with Education

| | | Superfamily | | | |
|---|---|---|---|---|---|
| | | **News Sharing** | **Information Sharing** | **Personal, Personal Comments or Chatter** | **Unknown, Unlocatable, Cancelled Account** |
| **Relationship with Education** | No | 23.2 | 32.9 | **39.6** | 4.3 |
| | Yes | 25.4 | **38.1** | 30.2 | 6.3 |

Furthermore, it was found that most of the activist tweets were sent from profiles not directly related with education (13%). Only 5.7% of these posts were sent by tweeters related with education. However, it was found, first, that 31.25% of Twitter entries made by teachers were activist in nature (as opposed to 18% of non-teacher posts) and, second, that 20.6% of the messages sent by tweeters related with education were also activist tweets (as opposed to 18.2% of the tweets from profiles unrelated with education).

**Table 6.** Cross-tabulation of Activist Nature of Tweets with Relationship with Education (in Percentages)

| | **Relationship with Education** | **Total** | | |
|---|---|---|---|---|
| | No | Yes | | |
| **Activist Tweet** | No | 59.03 | 22.02 | 81.05 |
| | Yes | **13.2** | **5.72** | 18.94 |
| **Total** | | 72.24 | 27.75 | 100 |

**Table 7.** Cross-tabulation of Activist Nature of Tweets with Tweeter Profile (Relationship with Education: Teaching Career) (Percentages)

| | **Teacher** | | |
|---|---|---|---|
| | **No** | **Yes** | |
| **Activist Tweet** | **No** | 81.9 | 68.75 |
| | **Yes** | 18.0 | 31.25 |

Because activist tweets are considered to be of special significance, some examples are offered.
In the first place, some examples are given from amongst the tweets classified into the **"Personal, Comments or Chatter"** category sent from profiles **related with education,** as such tweets are considered to be of special interest.

In the Spanish national environment, @xavieraldekoa criticised fundamentalism ("Contra el fundamentalismo: Educación, arma de construcción masiva. https://t.co/ilhqXpZBtz") ("Against fundamentalism: Education, weapon of mass construction. https://t.co/ilhqXpZBtz"). He posted a picture of a group of fundamentalists shying away from a book entitled, "Education". The tweet sparked a huge amount of conversation and interaction amongst participants. The second tweet of special importance was sent by @EorldeRohan, criticising the Spanish ministries of Health and Education ("RT @EorldeRohan Sanidad y Educación, los ministerios más

importantes con los ministros más incompetentes. #AnaMatoDimision #Wertdimision") ("RT @EorldeRohan Health and Education, the most important ministries with the most incompetent ministers. #AnaMatoResignation #Wertresignation").

In the international sphere, there was @louisevanrhyn, who sent a personal tweet stating concern over improving the education system in Africa ("Listen up South Africa: we can transform our education system in 10 years. If we care enough to do so"). A second tweet drew attention to the announcement that the Legislative Assembly of Victoria, in Canada, will be maintaining financing for children's education ("@bctf: Let's keep up the call for more education funding to meet kids' needs - Contact info for MLAs here: http://t.co/kvpElSHe7I"). Lastly, in the United Kingdom, in the wake of fee protests, students complained about the growing cost of living and demanded affordable housing, or else they would have to leave university ("RT @JudyFriedberg: Students are campaigning for end to rents that swallow up 95% of their maintenance loans, writes @shellyasquith […]").

Foremost amongst the messages sent by tweeters with **no direct relationship with education** were these: requests for better primary education ("RT @elnathan: Dear Jonathan I take it back. Don't fix electricity. Fix education. Starting from primary school. We are gone, but please sav"); denunciations of the cost of keeping prison inmates and the potential use of that money in education ("RT @FactsInYourFace: The money it takes to support a prison inmate every year could pay 3 years of a college education"); denunciations of education cutbacks to finance the Tea Party, a party focusing on conservative right-wing politics in the United States ("RT @FLBlueVoter305: #GOP cuts Education funding to keep #teaparty alive. #UniteBlue http://t.co/24NemftGPM"); criticism of the dearth of black academics at university ("RT @MelBala: #Nzimande on being an example: Young people must get educated. Only 30% are black academics at university. The struggle today"); general criticism of education ("RT @PassionPosts: so many years of education yet nobody ever taught us how to love ourselves & why its so important" and "RT @diostuitero: EDUCACión. https://t.co/HpvrWclkCs"); messages emphasising the positive aspects of having an education ("RT @harisbhadra: Education is the most powerful weapon which you can use to change the world"); and criticism of the education systems of certain countries, such as Venezuela ("@diana_dagostino: Para reconstruir a Vzla es imperativo educación de calidad, maestros con sueldos dignos, transporte, comedores, biblio") ("@diana_dagostino: To rebuild quality education in Vzla, decent teacher salaries, transport, dining halls, library are musts") and Singapore ("@herniepotter: my friend speaks the truth abt our education system http://t.co/ey9rdOvVBo").

The foremost tweets in the Spanish national sphere support public education and health ("RT @eva_arqtec: ¿Crees en una sanidad y educación públicas, en una justicia independiente y en una democracia participativa? #El31EcomienzaenelSur") ("RT @eva_arqtec: Do you believe in public health and education, independent justice and participatory democracy? #El31EcomienzaenelSur") and support for Susana Díaz's policy in the autonomous community of Andalusia ("RT @psoedeandalucia: Susana Díaz: En Andalucía sólo se ha recortado un 5% en educación frente al 20% del conjunto español #SURsusanadíaz") ("RT @psoedeandalucia: Susana Díaz: In Andalucia education has been cut back by just 5% as opposed to Spain's overall 20% #SURsusanadíaz").

In second place, amongst the **information-sharing tweets posted by tweeters related directly with education,** one **activist** tweet stands out, about a letter addressed to the U.S. House of Representatives asking for review a law ("RT @hamletgarcia17: In America Wanting a Quality Education should never be a crime PA bill HB2341 https://t.co/cjDooYkVdT"). Spencer (2015) describes this case in the state of Pennsylvania, where a child's parents were taken to court for "stealing of an education", the felony of theft of services and conspiracy to commit theft of services. They were accused of lying to get their daughter into a school, which could mean a fine and seven years in jail. Also shared is the manifesto of the National Union of Teachers of the United Kingdom ("RT @cyclingkev: @LabourEoin could you RT this very wide support for the NUT's Stand Up For Education manifesto? http://t.co/sukudQeMDB", 2015), which stresses the need to think and talk about education, the need for politicians to listen to parents and the need for the education community to participate in the creation of a manifesto on education improvement.

An interesting message on "information sharing" was sent from a profile **with no direct relationship with education.** Syed Talat Hussain, a Pakistani journalist and foreign political commentator, tweeted criticism of the fact that schools throughout the world forbid Muslim women to wear headscarves whilst many such schools allow crucifixes ("Hypocrisyhistory6:Muslim women r barred from education, if wearing headscarf. There is no uniform policy, and crosses").

Lastly, in messages tweeted from **profiles related with education with no activist intent,** there are promotional

and/or self-promotional tweets, such as these: the announcement of the opening of the national Ofsted organisation in the U.K. ("RT @Ofstednews: Help shape the future of education inspection - major Ofsted consultation opens 10am today #OfstedConsult"); application sharing ("#iOS #Apps - Google for Education launches Classroom iOS app to help students get more done - Six months… http://t.co/00qWnh657Z #Google"); a personal interview with Enrique Dans ("Hablando sobre educación: Carlos Guerra me hizo una pequeña entrevista hablando sobre temas […] http://t.co/tOzMlSNTAe #avanzacorporate") ("Talking about education: I gave Carlos Guerra a short interview talking about topics […] http://t.co/tOzMlSNTAe #avanzacorporate")] and information about Stamford Bridge Stadium's hosting Education Day on 23 February 2015 ("RT @ChelseaFC: Stamford Bridge is to host the @ZRFoundation Education Day next month... http://t.co/k1yNXyWksH #CFC http://t.co/aVOvnA0sZm").

## CONCLUSIONS

The *socialising power of the media* and new social networks has helped turn the receiver into a transmitter and also a creator of messages. Tweeters perform this function by sharing information that they consider especially significant (Noguera et al., 2011). All Twitter users can participate in the communication process as transmitters and receivers, a necessary condition, according to Kaplún (1998), for the process to be considered communication at all.

This research found that when users talk about education they display a tendency to share information and general personal commentaries rather than discussing or conversing with other tweeters.

Firstly, it was found that 21.1% of messages were direct tweets, posts without any interactive intent, where the tweet's author primarily gives an opinion or shares a resource but does not address the message to a particular recipient. This kind of communication on Twitter results in monologues where users send information one-way without referring to other users. In these cases there is no true process of communication; there is only a spreading of information in which one-way message transmission occurs.

Secondly, despite the fact that a high number of tweets using the @ code was found (77.9% used *@userid*), it cannot be unequivocally concluded that Twitter is a conversation centre, because only 14.6% used *genuine @replies*, which indicate an explicit intention to communicate; and therefore only in that 14.6% of cases could it be concluded that the tweeter was unequivocally addressing another person. Furthermore, 63.3% were retweets (*RT @userid*), which indicated that the tweeter was resending a message received from another tweeter. This kind of message reveals two things: interest in the retweeted content and the message's reception-transmission trajectory, rather than a true intention to communicate or addressivity. The conclusion drawn in these cases was that the intention to communicate with another user was not explicit; tweeters were simply indicating the origin of the message. In addition, only a certain amount of interaction was used by means of the "Like" tag, especially in the most popular tweets; but such tweets could not be considered significant, taking account of the entire sample studied.

The Twitter tool can promote one-way conversation and/or individualistic behaviour, through singletons entailing no intention to interact or through almost mechanical retweeting; a tweeter needs to pay no attention to other users or show any true intention to communicate and interact with third parties. The automatic message management system that microblogging presents promotes a fast process of communication that could explain the general trend (found in the sample) to retweet without including any comments. Probably the network's own traits (speed and immediacy) primarily promote the sharing of information, making it easier to know what is happening with a topic in real time, but speed and immediacy do not reinforce a true communication process, in which time is spent interacting and topics are discussed in depth. In addition, the 140-character limitation on tweets means information must be condensed; it does not allow a detailed description of what one wants to express and thus limits the communication possibilities.

As Zappavigna (2011) asserts, the different codes used when we communicate on Twitter (RT, @ and #) are modifying our patterns of interaction and affiliation. Hashtag searching has facilitated the creation of **virtual communities** interested in the topic of education at specific moments in time: communities characterised by their temporary nature, non-permanent communities. Union within each community works according to the way the topics of interest evolve over time; there is no similarity amongst the profiles of the tweeters in the community. Generically speaking, the members of the sample studied did not share common interests related with education. Most of the tweeters had no relationship with education (72.2%), and only 7% were teachers. In short, the tweeters did not share a specific interest in education; they had diverse interests, but at a given point they found certain news or information interesting and/or made comments on education. The conclusion is that the analysed sample, containing dissimilar profiles, showed interest in the current-events topic of education for a

given period, without any permanent ties uniting the members of the sample. The *#educación* and *#education* hashtags made it easier for members to spread information, providing the opportunity to create a non-permanent virtual community.

It can be concluded that the discourse related with *#education* and *#educación* has been in the hands of people who bear no direct relationship with education. This implies that the general citizenry is mostly responsible for transmitting news, spreading information and making comments about education during the time periods analysed. However, the more-popular tweeters about education had profiles related with education, although only 7.6% of these top tweeters were teachers. In addition, although the majority of the activist posts were sent by tweeters having no direct relationship with education, it was observed that tweeters related with education and teachers (when they participated in Twitter) were more likely to share activist messages or messages of sociopolitical interest than were non-teachers and/or tweeters with no direct relationship with education. This fact could point to the importance of education institutions for spreading information on Twitter and for reinforcing communication processes on social networks concerning education and topics related with sociopolitical and/or activist events. Obviously, though, citizen participation is considered fundamental to spread information through microblogging.

Tweet content analysis showed that topics of high socio-educational and political importance were handled, both nationally (in Spain) and internationally, such as: education funding and/or denunciations of cutbacks in education, citizen participation, fundamentalism and its relationship with education, improvement of the quality of education, the importance of children's education, the need to reflect, the importance of opening discussion about education and engaging the education community, restrictions on university access for racial reasons, positive and negative aspects of education, student activism and problems related with the education systems of different countries.

In short, the social network could be promoting individualistic more than collective, interactive actions. It could be turning into a space where monologues are reinforced more than dialogues. Tweeting about education cannot be held to involve a true process of communication or a genuine intention to interact with other users related with education. However, in this context, where messages and interaction-free retweets abound, posts of high sociopolitical and education significance –messages that deal with topics of social interest– were found (although less frequently). Amongst all the noise generated by citizens, participants in microblogging also generate conversations and deal with affairs of socio-educational and political interest. It is necessary to reflect on Twitter's influence on noise generation within the communication process, although, in the end, the network is just a virtual reflection of the very nature of the communication process and our society.

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# Flipped Learning for ESL Writing in a Sudanese School

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## ABSTRACT
Sudanese students seem to lack proficiency in writing English. In addition, teachers continue to use traditional, teacher-centered methods in teaching English as a second language (ESL). The flipped learning (FL) approach where video lectures are assigned as online homework before class, followed by learning activities during class, might be able to address the issue of the lack of proficiency in writing. A module for teaching English paragraph-writing using FL for Sudanese students in Secondary Year 1 was developed. The purpose of this study is to investigate the effects of this module on students' writing proficiency and their satisfaction with the module. An exploratory-implementation study was conducted with 28 student volunteers in two groups, in which only one group used the module. The analysis of data collected from tests, focus group interviews and online interactions indicated that there was improvement in the students' writing proficiency, and satisfaction, based on their engagement and interaction, with the module. In future, further studies can be done to determine if the module which used the FL approach, could be implemented on a larger scale in Sudan, and extended for other topics in ESL in other countries.

**Keywords:** Flipped; ESL writing; Satisfaction; Engagement; Interaction

## INTRODUCTION
English language proficiency is necessary for economic, educational, and political reasons (McKay, 2005). Writing in English is important not only in the classroom, but for encounters in real-life situations. In addition, writing proficiency seems to be positively related to learning (Ellis, Taylor & Drury, 2005; Manchón & Roca de Larios, 2007). Teachers are able to identify errors and diagnose the extent of students' understanding of the subject through students' writing (Krause, 2001; Maclellan, 2004).

The need to master English as a second language (ESL) is crucial for Sudan as she opens to the outside world. However, Sudanese students' proficiency in English is still below expectation and is a cause of concern (Ministry of Education (MOE), 2012). Studies report that the majority of the Sudanese ESL learners might not be competent in communicating, specifically when writing (Alwasilah, 2006; Hajana, 2006; Makki, 2005; Nur, 2012). Unfortunately, even graduates from Sudanese universities face difficulties in communicating in English (Yong, 2012).

In Sudan, Arabic is the first language, while other Sudanese dialects are used for communication. ESL is taught only from Grade 5 in the basic, or primary school. This means that English is taught after the child has attended two years of pre-school, and completed half of the eight years of basic education (Arora, 2003). The lack of ESL writing proficiency might be because learners have not had sufficient preparation (Al-Khsawneh, 2010; Makki, 2005). This problem has been noted by the government who attributed it to the lack of effective methods for teaching ESL writing skills at both the basic and secondary schools (Minister of Education, 2012).

Teaching writing to ESL learners is challenging (Adas & Bkir, 2013). Research seem to indicate that passive learning experiences and the inefficient traditional teaching practices contribute to the lack of writing skills (Mack, 2012; Philips, 2012). The ESL learner has little opportunity to communicate in English in authentic real-world situations as they only use English in school (Sarwar, 2000). Further, the passive teaching methods in

Sudanese schools provides little opportunity for students to experience authentic ESL learning experiences (Alhaj, 2005; Munhal, 2009). Makki (2005) attributes the lack of attention to ESL writing skill by both the teachers and the learners in the Sudanese context to the traditional methods of teaching writing. Hence, students lack of confidence in communicating in English in situations outside school.

In teaching ESL, a product-based approach, which relies on the practice of students' memorizing grammatical structures, vocabulary, and specific written texts for passing their examinations is employed (Cronje, 2006; Makki, 2005; Nur, 2012). While it is undeniable that grammatical and lexical knowledge is important for ESL writing proficiency, these formal lessons develop declarative knowledge rather than a practical approach for writing (Ferris, 2004; Morris & Cobb, 2003; Nassaji and Fotos, 2004). In addition, most Sudanese students are given exposure to a model of writing by the teacher, which may be taken from the textbook, and are then asked to model exactly to produce a writing composition as the final product (Makki, 2005; Alwasilah, 2006; Baffoka, 2012).

The poor performance of students in writing ESL might be attributed to the deficiencies in the current Sudanese Integrated Curriculum for ESL (Saeed, 2012). The resource for implementing the English language curriculum in schools is a series of six textbooks known as the Sudan Practical Integrated National English (SPINE), which was developed by the MOE with the support of the British Council Khartoum (Arora, 2003). These textbooks are used for teaching English at both the basic and secondary levels. However, there has been some contradictions on the suitability of these textbooks as some studies have identified the curriculum used as a reason for the low ESL writing proficiency among Sudanese students (Abdalla, 2000; Alwasilah, 2004; Cronje, 2006; Mohammed, 1999; Nur, 2012). Hence, other learning resources may be required to improve writing.

More research is required to determine models of instruction which can enhance the teaching of ESL writing (Keshta & Harb, 2013). Baffoka (2012) claimed that technology-enriched and innovative teaching practices can contribute to the improvement of ESL students' proficiency. Hence, the flipped learning (FL) model may be a solution for improving writing. There has been some studies on FL in English writing, but more studies are required to investigate the use of this model in secondary schools for improving ESL writing (Flumerfelt, & Green, 2013). Further, there does not seem to be any study on FL in Sudanese schools.

Therefore, the purpose of this study is to investigate whether an instructional module developed with the FL model could improve Sudanese students' paragraph-writing skills in ESL. The research questions are: What are the effects of FL on Secondary 1 Sudanese students' achievement in ESL paragraph-writing in a Sudanese Secondary School in Qatar? and What are the students' satisfaction with FL through their engagement and interaction ?

This study is significant to teachers in Sudanese schools to determine the effects of FL, and how it can be implemented in schools for active learning beyond using the textbooks alone. Researchers will benefit from the determining whether FL could solve the problems of ESL learning in Sudanese schools. In addition, policy makers could use these findings to plan teacher-training and the implementation of the new ESL curriculum for the improvement of instructional practices in Sudanese schools. Further, this study may help curriculum planners to consider the technology to be integrated in teaching.

## BLENDED AND FLIPPED LEARNING

Technology may be used to overcome the problem of passive teaching by providing rich and interactive learning environments. Students' are able to seek and build new knowledge from information gathered on the internet for learning at anytime and anywhere (Fu, 2013). The teacher should be a facilitator to promote active learning in order to be relevant to the current social, cultural and individual changes in learning (DeWitt, 2010). Hence, learning writing can be more process-based with student-centered approaches.

Technology can promote the quality of the teaching and learning experience, which is no longer confined to a traditional classroom (Roblyer & Doering, 2013). The learning experience is enhanced through interactions with the content, peers and the teacher, both in and out of the classroom (DeWitt, 2010; Moore, 2013).

Students should be given the opportunity to use technology to improve learning (Almusharaf & Hassan, 2012). However, while technology may add value to the students' learning experiences, new and innovative models of instruction with technology are required (Rogers, 2002). Even though technology is pervasively used among students in many activities, its use in teaching and learning in Sudanese schools is relatively low (Ali, 2010). Hence, this study is important to determine whether an instructional module using FL could be implemented (Rogers, 2002).

A blended-learning approach may be more suitable for teachers used to working in traditional classrooms but want to use digital technologies for teaching (Motteram & Sharma, 2009). Blended learning assumes the continued use of face-to-face teaching for the learning experience, but enriches it with technology (Marsh, 2012). However, suitable activities need to be designed (Motteram & Sharma, 2009).

FL is a blended-learning model (Milman, 2012). The usual classroom is flipped as students watch, listen to, interact with video lessons outside the classroom in their own time, and then use class time for engaging activities facilitated by the instructor (Love, Hodge, Grandegenett & Swift, 2013; Sams & Bergmann, 2007). Class work is done prior to class, while homework is done in the classroom (Pierce, 2013). This frees the class time and provides opportunity for active learning (Bergmann & Sams, 2012). At the same time, the learning environment can be enriched with creative learning activities that enhance students' learning and develop their skills (Keshta & Harb, 2013).

This means that there is a possibility that FL may be used to address the problem of having a passive learning experience and the use of traditional teacher-centered approach in teaching ESL in Sudanese schools. In addition, this approach may enable a process-based approach to assessment and instruction, rather than the traditional product-based approach. The teacher can then focus on the development of ESL writing skills during class time as technology and FL enables teaching to extend outside the classroom.

There still seems to be little research on the FL model of instruction (Johnson & Renner, 2012; Strayer, 2007). FL may be suitable for certain subjects such as science (Ruddick, 2012; Snowden, 2012; Torkelson, 2012) and mathematics (Clark, 2013; Schwakl, 2013; Strayer, 2007; Snowden, 2012). However, there are also some studies for English instruction (Baranovic, 2013; Snowden, 2012). In addition, most of these studies seem to be done ofr higher education (Baranovic, 2013; Pierce & Fox, 2012; Ruddick, 2012; Strayer, 2007; Zappe, Leicht, Messner, Litzinger Lee, 2009). However, research seems to suggest that FL can support students' active and meaningful learning through the building of social skills in group activities and interactions with effective use of technology (Strayer, 2007). Most of these studies show that FL improved achievement and satisfaction (Baranovic, 2013; Clark, 2013; Pierce & Fox, 2012; Ruddick, 2012; Schwakl, 2013; Torkelson, 2012; Wang, Han, & Yang, 2015). On the other hand, some studies show that students' satisfaction was lower with FL (Johnson & Renner, 2012; Strayer, 2007). Hence, there needs to be more research on the implementation of FL in secondary schools, and specifically for English writing.

Implementation of FL has been done using video lectures followed by group work, project work (Strayer, 2007), or quizzes (Zappe et al., 2009). Online assignments may be used and class-time was spent on problem solving activities (Ruddick, 2012). It is also noted that students preferred videos created by their own teacher, and to be a maximum length of 15 minutes (Torkelson, 2012). In addition, interaction with the content and should be varied with more structured and less open-ended activities (Strayer, 2007). These guidelines were taken into consideration in developing the module for this study.

**STUDENTS' SATISFACTION**

In this study, satisfaction is measured through students' engagement and interaction (Dziuban, Moskal, & Hartman, 2005) (see Figure 1). Engagement results in increased achievement, positive behaviors, and creates a social environment with interactivity among students, both in and outside the classroom (Taylor & Parsons, 2011). There are three types of engagement: social engagement, which is interest, the sense of belonging and participation in the learning environment; cognitive engagement, which refers to doing tasks on time, and responding to challenges in learning; and behavioral engagement, which refers to attendance rate, as well as willingness to learn difficult tasks (Willms, Friesen, & Milton, 2009; Reeves, 2013).

There are three types of interaction in the learning environments: teacher-learner, learner-learner, and learner-content interactions (Moore, 1989). Moore (2013) stated that the learner who expects moderate or high level of interaction in his learning environment, might be very dissatisfied if experiences no learning interactions. Interactions can be on the basis of time and location of the learners, and can be used for group interactions and collaboration in both face-to-face and online learning environments (Ellis, Gibbs & Rein, 1991). This may be helpful in understanding exchange of information and writing in groups when learners meet, both at the same or at different times and locations.

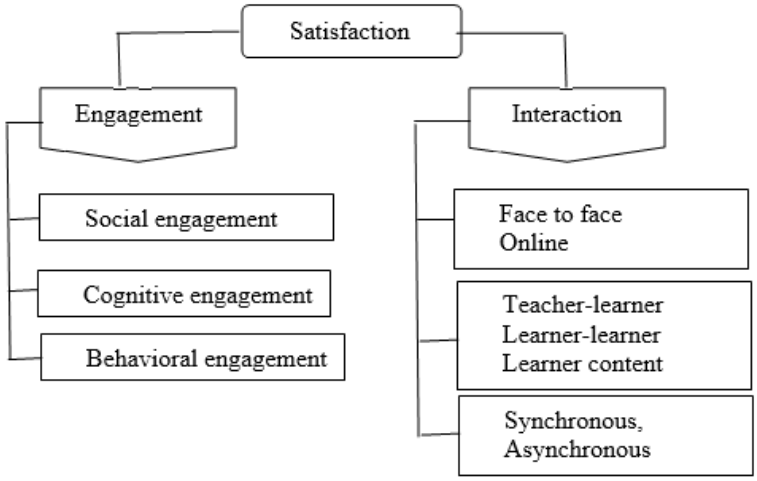


*Figure 1***.** Concept of satisfaction

## METHODOLOGY

This is an exploratory-implementation study to investigate the effects of FL in a secondary one class of Sudanese students who have just started to acquire basic ESL writing skills (DeWitt, Alias and Siraj, 2014). A module was developed for teaching paragraph-writing for ESL using the FL approach (the PW module), and implemented with a group of students. A second group of students was taught using the traditional method. Pre and post tests were used to determine students' performance in the two groups. A focus group interview was used to gather information on students' satisfaction with the PW module. In addition, student's writing and discussions on the online platform were observed and analysed.

### The context of the study

This study is conducted in a Sudanese secondary school in Qatar. This school is one of the Schools of Sudanese Community Abroad (SCA) found in Asia and Africa. SCA schools provide a link to the Sudanese education and culture for children of expatriates. The Sudanese students attending SCA schools have less difficulties integrating into the social and cultural context of the society when they return to Sudan for higher education.

Despite the different locations of these schools, the learning environment in SCA schools is similar to schools in Sudan. The curriculum used is the government-approved curriculum and the teachers are Sudanese: some hired by the school from the MOE in Sudan, while others are expatriates. The students prepare for the national basic and secondary certificates assessments after completing basic and secondary schools, similar to students in Sudan. In addition, these assessment is centralized with the examination papers prepared in Sudan.

A SCA school was selected for this study as it is believed that the teachers and students in this type of school may be more receptive to the possibility of implementing the FL**.** In this study, a SCA secondary school for girls in the State of Qatar with an enrolment of 250 Sudanese students was selected. There are two secondary one and secondary two each, and three classes of secondary three. The school uses the SPINE textbooks as a resource for teaching ESL. This school is considered a typical Sudanese school in terms of infrastructure, where children of Sudanese expatriates working in Qatar are enrolled.

### The sample

There are two secondary one classes with 30 students each. One of the classes was randomly selected for the intervention with the PW module, while in the other class, the traditional approach was used. The sample consisted of student volunteers from the two classes who had their parents' permission to participate in the study. One of the classes was randomly selected for the intervention. The 14 volunteers from each class were of mixed ESL proficiency. After the intervention, six students were identified from the intervention group for the focus group interview.

Secondary one students were selected for the study as they had the required prior knowledge and skills for writing after learning English for four years at the basic level.

**ESL Paragraph-Writing (EWP) Module using the FLM**

The instructional module developed for ESL paragraph-writing using FL (PW module) consists of four lessons for four weeks. The module was designed to provide the knowledge and skills required to write descriptive paragraphs in English.

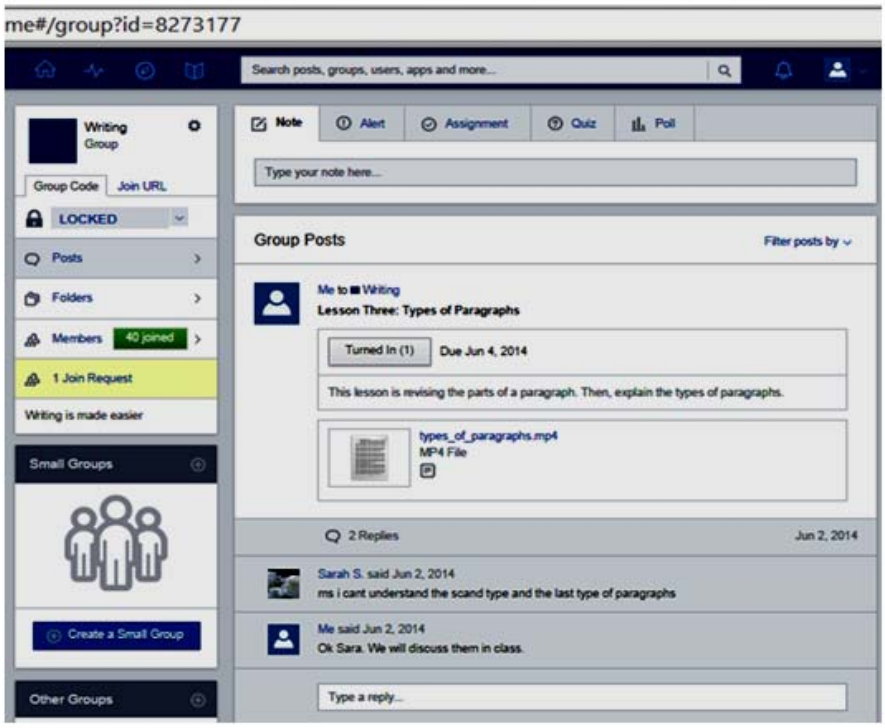


*Figure 2.* The learning management system "Edmodo"

Each lesson comprises of two modes of instruction: the online instruction, which had one instructional video per lesson, and a weekly face-to-face instruction of 40 minutes in the classroom lesson. The learning management system, "Edmodo", was used as the platform for the online learning environment (see Figure 2). Videos of 10-minute duration, accompanied by questions, were posted to encourage students to reflect upon the knowledge and skills learnt from the videos. The face-to-face instruction in class used discussions and questions, exercises and quizzes, individual and group writing tasks on worksheets and hand-outs.

**Data collection and analysis**

The instruments used for collecting data consist of a pre-test, post-test, and an interview protocol for the focus group interview. The pre-test assessed the students' ability to write a 100-word descriptive paragraph on their best friend and the post-test was a similar task for writing a descriptive paragraph on their favourite person. These tests were validated by two experienced teachers for use in the study.

Both groups of students in the two classes were given a pre-test to evaluate their paragraph-writing proficiency before the PW module was implemented. The module was implemented for four weeks, after which a post test on writing was given for both groups. The students' writing compositions were assessed by two expert teachers with more than 10 years' experience, based on a rubric. The assessment scores between the two assessors were compared and moderated to ensure inter-rater reliability was maintained (Seliger & Shohamy, 2000). The pretest and post-tests scores were analysed using t-tests to determine whether there was any significance difference in students' achievement before and after the intervention.

After the intervention, data was gathered through a focus-group interviews with 6 students, and through postings on the online forum on their experience with the PW module. Focus group interviews are useful for determining attitudes in a non-threatening environment as students would be more willing to share their feelings (Naimie, Chin, Dewitt, Akma & Mohajer, 2013). Participants were interviewed in Arabic, their first language, and the interview was audio recorded. Later, the interview was transcribed and translated into the English language. The transcript of the interview and online communications were transcribed and directed content analysis was carried out on the categories for engagement and interaction as the theory on engagement and interaction has been

determined (DeWitt et al., 2013; Dziuban et al., 2005; Ellis et al., 1991; Reeves, 2013; Willms, Friesen and Milton, 2009). The data from the transcripts were coded and categorised.

## Findings

### Effectiveness of the Module

The results of the independent-samples t-test indicate that the pre-tests scores in paragraph-writing was not significantly different between both groups, where t(19.288)=1.520, p >.145 (see Table 1). However, there was a significant difference between both groups in the post-test scores for the intervention group, where t (16.409) =2.977, p <.009. It is apparent that the post test scores for paragraph-writing in the intervention group was higher (Mean =11.14, S.D.= 4.975), compared to the non-intervention group (Mean = 6.93, S.D.= 1.817). When tested for equality of variances using Levene's test, the test was significant (p=0.001), with unequal variances for the non-intervention and the intervention group (Meier, Brudney & Bohte, 2009).

**Table 1:** Independent-samples *t*-test for pretest and post test scores between two groups

| Outcomes | Non-intervention | | Intervention | | Mean Diff. | n | 95% CI of the Difference | *p* | *t* | df | Cohen's d |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. | | | | | | | |
| Pre-test | 7.14 | 2.07 | 9.00 | 4.076 | 1.857 | 14 | .698, 4.412 | 0.145 | 1.52 | 19.288 | – |
| Post-test | 6.93 | 1.817 | 11.14 | 4.975 | 4.214 | 14 | 1.220, 7.209 | 0.009 | 2.977 | 16.409 | 1.239 |

*$p$ *0.05*

The findings also indicate that there was a significant difference in the post-test scores between both groups, where t(16.409) =2.977, p <.009. The absolute value of Cohen's d is 1.239, indicating large effect sizes. Cohen (1988) defined d as the standardised difference between two group means. The effect sizes are categorised as "small" if the d=0.2, "medium" if the d=0.5 and "large" if the d=0.8. Thus, EPW module seem to be effective in developing paragraph-writing skill of students in the intervention group.

In this study, external validity due to interaction between the students in the intervention and non-intervention group, was reduced with the use of the online platform, "Edmodo", as only the students in the intervention group were provided a password to log-in to access the materials and discussions on the online platform "Edmodo". In addition, the intervention group was informed that they were not to share or discuss their class information and activities with the other group.

The effectiveness of the module is supported with evidence from the focus group interview and the online discussion. Student A said: "This really helped to improve my English writing skill. After this experience, I realized that writing is a very important." The effectiveness was attributed to the online video lessons which enabled better understanding. Student D stated, "I found that I can understand better from the online video lesson than from reading the textbook." This might also be because of the availability of these videos. Student A noted, "The online lessons can be watched anytime and anywhere." The students gained knowledge and skills as evidenced by student C: "We are more aware about grammar, mechanics, types of paragraphs, and other aspects. We are also able to evaluate each others' writing." Student B noted, "Before my experience with the module, I paid little attention to writing in English. I only focus on completing the number of words required to finish a writing assignment." Student C said, "I got the full marks in the English mid-term exam. I attribute this to my learning experience with the PW module." Generally, the students agreed that this module was beneficial and improved their performance.

Hence, it was concluded that the students did improve in their writing and also perceived that FL was effective for learning paragraph writing in ESL.

### Students' Satisfaction

#### *Engagement*

The students were engaged socially. The students' social interactions had increased as Student C noted "the class is more active and interactive with this method." The social interactions were stimulating and engaging. Student H indicated, "I really consider it as a very exciting and interesting experience." The online video lessons prior to class time may have contributed to the increase in classroom interaction as Student C shares, "I interact more in class because I come to class with background knowledge on the new lesson." The participants felt that they were able to share what they learned from the video lesson better. Student C added "We are more cooperative and we share on the lesson." Student D concluded "I feel that we become closer than before." The researcher

also observed that the students were excited and willing to share their knowledge during class time as compared to the non-intervention group. Hence, there was social engagement with the use of the PW module.

There was cognitive engagement as students responded to the challenges in learning and completed the tasks (Willms, Friesen and Milton, 2009). Student A shared, "My teacher and I were able to detect my weaknesses in the English language. This is a result of having enough class time to work together. Thus, I work hard to overcome my problems." Students were satisfied with their performance in writing at the end of the intervention. Student D stated "I am happy because finally I can write a paragraph in English with minimum mistakes" and Student B, "I am sure now that I can write a complete paragraph with few mistakes." Moreover, observations showed that the students were enthusiastic in responding to teachers' questions during class as they were actively thinking and cognitively engaged when using the module.

The students were behaviourally engaged as they were positive towards using the PW module. They showed more confidence in learning writing. Student B shared, "Before using the module, English was the most difficult subject in school. I don't write because I am weak in English. Now, I am completely changed. I am more confident in using and writing English, even outside school." In addition, Student G reported "Before my experience with the module, English language is very difficult to learn. Now, it's changed." Similarly, student H stated in the online forum "Learning English has becomes much easier." The students were able to take responsibility of their own learning even when the teacher was not available. In her online response, student G stated "Now writing becomes much easier than before, and we are able to assess our own work. Previously, we waited for the teacher's corrections to decide how we performed."

Finally, all participants were positive about having the online lessons as they had built their prior knowledge before class. In addition, they performed better in their learning activities during class time and seemed more confident in learning paragraph-writing.

***Interaction***

There was teacher-learner interactions. The students believed that their teacher was paying more attention to them with the use of the module. Student D stated "With the module, homework is done in class and we had the chance for the teacher to answer our questions." In the online forum Student G also wrote "It is really a great idea to come the next day to class and do the homework with the help of the teacher and the other students. So, the class time becomes enough for completing our tasks." The students were satisfied by the role played by the teacher during the lesson as compared to the traditional process of delivering lectures had been replaced with more interactive group work and discussions. Student D, said,

> "With the traditional teaching, the teachers explain the lesson in class and then assign homework for us to do at home. Unfortunately, at this point we face many difficulties in doing the homework by ourselves. Moreover, when we come the next day to seek help from the teacher, we are faced with the limited class time. The teacher won't be able to discuss the difficult points with us as she has to start a new lesson."

Hence, this indicates that there was more interaction with the teacher in the classroom as Student C says, they "and work together to complete the tasks."

There was learner-learner interactions as students interacted actively in the classroom, and online (Moore, 1989). However, the researcher observed that there were fewer online interactions as students only answered the teacher's questions directly without any further discussion. This might be due to the language barrier as students lack the communication skill. Despite this, the researcher observed that shy students in class responded to questions in the online forum. This was mentioned by student C, "The shy students in the class also participated in the online discussions."

In conclusion, there was interaction among the students both online and face to face, with more interactions occurring face to face in the classroom.

There was learner-content interaction as students were engaged with the video lessons (Moore, 1989). Students reflected their satisfaction with the videos compared to the textbook. Student D "I can understand better from the online lesson than reading the textbook. The content in the video lessons is totally different from the textbook. The textbook is in black and white, which is very boring. The videos are more interesting."

Students preferred watching the videos created by their class teacher rather than from other sources. Student B said, "One of the videos contains only music and the lesson content. I didn't like it. I like to have the video

lessons explained by our teacher with her voice." In addition, Student A noted "It may be good to watch a lesson delivered by a native speaker, however, I feel it is more suitable if we have it with our teacher's voice."

In general, the students were satisfied as they interacted with the EPW module, with the teacher, and among themselves. Student G responded "I am very satisfied with my learning experience with flipped learning." In addition, Student A suggests, "I would like to continue learning with this method. I really prefer if it can be used in all the other school subjects." Student G also wrote in the online forum "I hope that all the teachers of the other subjects implement this method of teaching."

## DISCUSSION AND CONCLUSIONS

The PW module seems to be effective in improving Sudanese students writing. This indicates that FL could have contributed to the improvement in students' achievement (Bergmann & Sams, 2012; Pierce & Fox, 2012; Ruddick, 2012). These students, as non-native speakers, improved in their writing with the use of FL (Baranovic, 2013). However, it is not known if there might be other contributory factors besides FL (Clark, 2013).

The students were satisfied with the PW module as they were engaged and were actively interacting (Dziuban, Moskal, and Hartman, 2005). Students were engaged with FL approach. Besides the social engagement which improved the sense of community among the learners, the students were cognitively and behaviourally engaged as they responded to the challenges in the leaning activities (Schwakl, 2013; Taylor & Parsons, 2011). This is consistent with other studies which indicated that FL engaged learners (Pierce & Fox, 2012; Zape et al., 2009).

Student interactions with each other, the teacher and the content had increased with FL (Moore, 1989). This finding was similar to other studies (Snowden 2012; Schwakl, 2013; Torkelson, 2012), and contradicts Strayer's (2007) findings that students are unsettled while doing the activities. This might be due to the structured presentation of content and activities before class in the PW module (Strayer, 2007). In addition, students were more engaged and interacted better when their teachers produced their videos (Torkelson, 2012).

There was more teacher-learner interactions with the FL as the teacher could give more attention to the students and attend to their learning needs (Snowden, 2012). However, some studies indicate that students were not satisfied with teachers' techniques for implementing the FL (Johnson and Renner, 2012). Hence, FL may not be suitable for every student and teacher, in every context. In addition, parents of these students may also need to be convinced that viewing online videos at home could be beneficial for learning.

Hence, further studies is required to investigate whether Sudanese learners in different contexts might find the FL beneficial for learning, and the guidelines and support that are required for teachers to effectively implement the FL approach. Finally, students seemed to prefer the FL approach. Further studies could be done to determine if teachers might use the flipped learning model in teaching other subjects (Pierce & Fox (2012).

There are several limitations in this study and its findings cannot be generalized to all Secondary one students in Sudan. The current study only focused on writing descriptive paragraphs and did not include other communicative skills which may be required for the writing process. In addition, this is an exploratory implementation study with a small sample of students, and was only conducted for a period of one month. The study also did not take into account teachers perceptions, which may be important.

Hence, further studies should be conducted in other Sudanese schools to determine if the FL would have similar results. In addition, the module could be used for teaching other components in ESL, and conducted in other countries like Malaysia, to determine if it was effective. A more rigorous study with a larger sample could be used to determine whether FL could be effective for learning ESL writing.

The PW module may be a solution for addressing the issue of a passive learning experience in a traditional teacher-centered approach in learning paragraph writing among ESL learners as it seems to be effective in improving student writing proficiency, as well as satisfaction.

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# In Search of Quality Student Teachers in a Digital Era: Reframing the Practices of Soft Skills in Teacher Education

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## ABSTRACT
The purpose of this current study was to examine and document the practices of soft skills (communication, IT, numeracy, learning how to learn, problem solving, working with others, and subject-specific competencies) among English as foreign language (EFL) student teachers at one public university teacher education program in Jambi, Indonesia. The study centred on examining the level of soft skills practised by EFL student teachers in their learning process and the level of student engagement in every statement of soft skill components. Data were collected through distributing a questionnaire to EFL student teachers. The findings of the study showed the mean score of soft skills practices in overall (3.28 of 5.00) which was at an average level. A closer examination on more specific skills, five of seven Soft skills were practied at medium level; they were numeracy, learning how to learn, IT and problem solving and subject-specific competencies. However they rated their soft skills in term of communication and working each other at high level. The findings implied that the soft skills were not well-blended and practiced in learning and teaching process at the research site.

**Keywords:** Soft skills, development, practice, university, higher education

## INTRODUCTION
There have been evolving interests in ASEAN countries at the early twentieth centuries in the field of soft skills and other skills, because of the emerging quality industry in higher education. Soft skills are defined as the personal attributes and values that ought to be acquired during university education, irrespective of the students' disciplines (Higher Education Council of Australia, 1992; Directorate General of Indonesian Higher Education, 2003.) Additionally, soft skills are skills that students need to acquire in order to become successful higher education learners and successful employers in the fields of their study and work and in other aspects of their life and therefore, are important outcome of university education (Clark 1998).

The importance of skills development and their inclusion in higher education curriculum is of on going interests that did not go away in the nineties as is evidenced by some literature on the topic. For instance, Fallows & Steven (2000) suggest that it is no longer adequate for new graduates to simply acquire knowledge of an academic subject. They suggested that broader skills including retrieval and handling of information, communication and presentation, planning and problem solving and social development and interaction were also critical for graduate employment in the 21st century. Additionally, it suggests that the development of any skill is best facilitated by giving students practices and not by simply talking about or demonstrating what to do.
In other words, for the 21st century graduates, the teaching and learning at university level now, should be more on students-centred where students build their soft skills by various activities in the classroom. Graduates need to be prepared by a range of soft skills that underpin success in communication skills, application of number,

information technology, team working, improving own learning and performance and problem solving skills. However, to our knowledge, research on the practices of soft skills among student teachers in Indonesia is understudied. The purpose of this current study was to document the practices of soft skills among English as foreign language (EFL) student teachers at one public university teacher education program in Jambi, Indonesia. The study centred on: What is the level of soft skills practised by EFL student teachers in their learning process? What is the level of student engagement in every statement of soft skill components including communication, numeracy, IT, learning how to learn, problem solving, teamwork, and subject-specific competencies?

## THE CONCEPTUAL FRAMEWORK

In our study, the following conceptual framework (adapted from Jelas et al., 2006; Hadiyanto, 2011) was used to illustrate the data resources, the research process, and the type of data collected to attain the research objective.

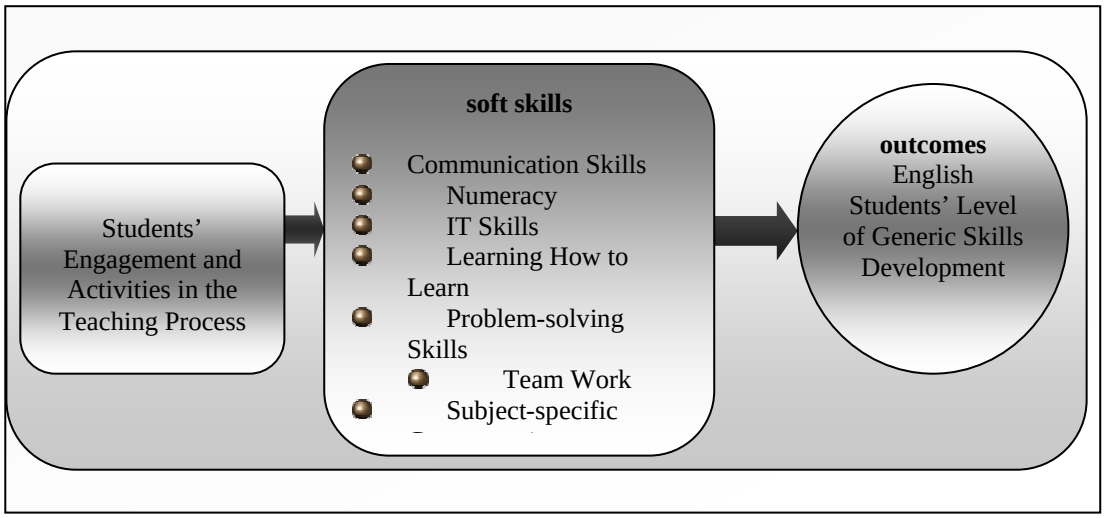


Figure 1. The conceptual framework of the study

The conceptual framework shown in Figure 1 illustrates how students' engagement and activities were generated in the classroom in relation to the development of soft skills. Soft skills are defined the set of skills or abilities essential to fulfilling the three potential outcomes of higher education, namely, the needs and requirements of employers in the marketplace, lifelong learning, and good citizenship. In this study, the soft skill set was considered to consist of seven skills: communication, numeracy, IT, learning how to learn, problem solving, Team Work, and subject-specific competencies (Jelas & Azman, 2005; Bennett et al., 2000; Cornford, 1999). The seven soft skills as displayed in the conceptual framework will be briefly elaborated in the sections below.

Students learning activities are designed with a view of encouraging students to actively participate in their process of learning. Priority is placed on lecturers' setting goals and objectives for the students' engagement and activities related to the promotion of communication, IT usage, numeracy, learning how to learn, working with others and specific subject content (Jelas & Azman 2005; Washer, 2007). A set of questionnaire is administered to acquired information of the practices of core competencies through the students' engagement and activities. Students' engagement and activities on individual of core competencies are briefly described as follow.

Communication skills continue to be essential at work so as to maintain successful job performance. The skills need to enable graduates delivering their idea as individual or as group member and comprising a diversity of backgrounds in order to come out with a good decision, solution and negotiations (Morreale, Osborn, & Pearson, 2000). In our study communication practices would be investigated by looking at students' presentation, participating in discussion, sharing idea with peer, way of integrating information from various sources, etc. Moreover, numeracy skills are not only related with number, however it includes the ability to handle information, to express ideas and opinions, to make decisions, solve problems, time management, and job priority (Jelas, et al., 2006) and (Bennet, Dunne, & Carre, 2000). In this study, we focused on numeracy activities such as time management, identifying relevant and irrelevant information, reporting tasks or assignments by using tables, charts, graphs and numbers.

Another important soft skill that we focused on is information technology skill which is one of the 'core competencies' appearing to create a powerful synergy for core competencies development. Harington and McLoughlin (1999) explained that the use of technology in teaching and learning would provide many opportunities to teachers and learners in order to develop their lifelong learning. In this study, students' IT

practices include the use of Computer, Cd Rooms, internet, WEB, Online conference, program, software, database, video and others technology by students for learning. We also looked at learning how to learn related to learning features processes, understandings and skills that can be learned and taught when one has gained mastery in learning how to learn, one can learn effectively and efficiently at any age (Bennet, Dunne, & Carre, 2000). Thus, this competence is thought to be of potential importance to the concept of lifelong learning and the self-managed learner (Smith, 1982). In this study, learning how to learn encompasses improving self-ability, performance, self-management, self-learning, identifying learning strategy, and prioritizing tasks. Another soft skill that we looked at is problem solving skills practices meaning to enable students to tackle problems systematically at the working place towards the solution and learning from this process (Qualifications and Curriculum Authority (QCA), 2002). Cook & Slife (1985) stated that the ability to solve problems would have a great impact on success of the students' "real life" endeavours. According to, Pumphrey and Slater (2002), the ability to resolve business or operational problems and to reduce downtime, and increase system efficiency is all part of the pressures now faced by employees at almost all occupational levels. This requires an individual to focus on the whole production and delivery process in order to understand the significance of a task; on the other hand, it requires independence of thought and action, and a sense of resourcefulness to pre-empt, identify or remedy problems. In our study, problem-solving skills that were investigated through students' activities for instances, problem identification in doing assignment, ways of tackle problem, looking at previous problem, PBL, case studies, self-learning.

We also looked at working with others (WWO) development focusing on helping students to learn to become valued members of a team – which is one of the most vital skills that one should have for employability (QCA, 2004). The ability to work as team member will give a great impact to produce new ideas and to find the way out in every situation of real work life. In this study, WWO development are related to students' activities in group, such as group discussion, group assignment or project, collaboration and cooperation, and inter-communications with different races. Last, we investigated subject specific competencies referring to subject content knowledge, core concepts, ideas, values, and facts, related with students' selected discipline that can be practiced and applied in the real world integrated setting (Jackson & Hancock, 2010; Hodgson & Spours, 2002; Kearns, 2001; Kelly, 2001). In this study, participants were asked to report their frequency level in completing tasks given by lecturer including discussing concepts, ideas, values and facts, and students' activities such as explain contents of knowledge, utilize knowledge in practicum and apply content of knowledge in doing assignment.

## METHOD

This study was part of our larger study on documenting the practices of soft skills among student teachers at one public university teacher education program in Jambi, Indonesia. In this study, we reported the findings of our study on English as foreign language (EFL) student teachers at one teacher education program public university, in Jambi, Indonesia. At the beginning we planned to recruit all 98 EFL student teachers of the last year in their program, however, only 54 EFL student teachers returned the informed consent form to us. This study drew upon a questionnaire to document the practices of soft skills among English as foreign language (EFL) student teachers at one public university teacher education program in Jambi, Indonesia. Participants were asked to elicit students' self-reports regarding their level of frequency in practicing soft skills. They were asked to respond to each statement about their practice of soft skills using a 5-point Likert scale (never, rarely, sometimes, often, and very often). The mean score of the respondents' level of soft skills was calculated and interpreted in three levels, as shown in Table1.

Table 1. Mean Interpretation of Soft Skills Practices

| Mean Score | Level |
|---|---|
| 1.00 – 1.80 | Very Low |
| 1.81 – 2.60 | Low |
| 2.61 – 3.40 | Medium |
| 3.41 – 4.20 | High |
| 4.21 – 5.00 | Very High |

As Table 1 shows, a mean score between 1.00 and 2.33 indicates a low level of soft skills, a mean score between 2.34 and 3.66 a medium level, and a mean score between 3.67 and 5.00 a high level of soft skills.

A reliability analysis demonstrated that all constructs of soft skills included in the study had a high Cronbach alpha coefficient (>0.7) and corrected-item correlation (>.300). The instrument was developed from theory and concept of soft skills practices at the higher education, and it had been administered at previous research (Hadiyanto, 2011).

## FINDINGS

The purpose of this current study was to examine and document the practices of soft skills (communication, IT, numeracy, learning how to learn, problem solving, working with others, and subject-specific competencies) among English as foreign language (EFL) student teachers at one public university teacher education program in Jambi, Indonesia. The study centred on examining the level of soft skills practised by EFL student teachers in their learning process and the level of student engagement in every statement of soft skill components. In the following, the practices of soft skills among EFL student teachers at one public university teacher education program in Jambi, Indonesia will be presented.

### Overall levels of students' soft skills

The findings of the study showed the mean score of soft skills practices in overall (3.28 of 5.00) which was at an average level. A closer examination of the mean score given by the EFL student teachers to each soft skill showed that the practices of communication, IT, numeracy, learning how to learn, problem solving, and Team Work were at a medium level (see Table 2). The findings implied that the soft skills were not well-blended and practiced in learning and teaching process at the research site.

As displayed in Table 3, the mean scores of all constructs remained at the medium of 3.28. This score could be interpreted that the students were still at a medium level of soft skills practices (Refer to Table 4). Every aspect of soft skills also yielded a mean score at medium level. Ironically, looking at the mean score of the aspect 'Subject Specific Competencies', the respondents, whom would be future English teachers, scored only at the medium level (mean = 3.34). Nonetheless, referring to standard competency of English teacher, to be good teachers, one of the competencies that one must have is the capability to master own subject content. This signified that participants had not acquired and practiced satisfied soft skills and had not mastered the subject specific competency yet to be good teachers.

Table 2. Overall mean and level of soft skills practices

| Soft Skills | Mean | S.td | Level |
|---|---|---|---|
| Communication Skills | 3.36 | .413 | Medium |
| Numeracy | 3.30 | .610 | Medium |
| IT Skills | 2.93 | .493 | Medium |
| Learning How to Learn | 3.32 | .461 | Medium |
| Problem-solving Skills | 3.23 | .517 | Medium |
| Team Work | 3.40 | .499 | Medium |
| Subject-specific Competencies | 3.34 | .473 | Medium |
| Overall | 3.28 | .352 | Medium |

### Communication Skills

As displayed in Table 3, the practices of communication skill in overall were at a medium level (mean score 3.36). Looking at each indicator of communication skills showed that seven of eight were practiced at a medium level (mean between 2.61 – 3.40), they were using different format, using varied vocabulary and expressions, integrating ideas or information, monitoring and reflecting, summarizing key issues, and giving feedback, while class presentation was at a high level (4.16). This finding signified that the practices communication skills were not encouraged in the process of teaching learning.

Table 3. Overall mean and level of communication skills practices

| Communication | Mean | S.td | Level |
|---|---|---|---|
| Making a class presentation | 4.16 | .504 | High |
| Using different formats for presenting information | 2.98 | .604 | Medium |
| Using varied vocabulary and expressions | 3.37 | .623 | Medium |
| Integrating ideas or information from various sources in paper writing | 3.53 | .719 | Medium |
| Monitoring and reflecting on the use of communication skills | 3.14 | .711 | Medium |
| Reflecting and evaluating on use of communication skills | 3.18 | .728 | Medium |
| Summarizing key issues from a classmate oral presentation | 3.14 | .711 | Medium |
| Giving feedback (question, comment or suggestion) | 3.40 | .901 | Medium |
| overall | **3.36** | **.413** | **Medium** |

### IT Skills Practices

The mean scores of IT skills practices were at the medium of 3.30. Furthermore, four indicators yielded means score at a medium level (between 2.61 – 3.40), they are entering and developing information, presenting information using it skills, creating new information and using software. The finding implied that participants

were not performing IT skills well in terms of the indicators in their learning activities. Hence, the students revealed the practices of IT skills in terms of looking for information from e- resources and developing the structure of a presentation at high level.

Table 4. Overall mean and level of it skills practices

| IT Skills | Mean | S.td | Level |
|---|---|---|---|
| Looking for information from e- resources and printed resources. | 3.66 | .931 | High |
| Entering and developing information in varies form | 3.11 | .724 | Medium |
| Presenting information using IT skills to suit different purposes. | 3.31 | .820 | Medium |
| Creating new information by comparing it from various sources. | 3.33 | .846 | Medium |
| Using software or application features to improve work efficiency. | 3.09 | .916 | Medium |
| Developing the structure of a presentation | 3.42 | .860 | High |
| **Overall** | 3.30 | .610 | Medium |

**Numeracy Skills Practices**

Table 5 shows that the overall mean score of numeracy was at a medium level (mean score 3.03). All indicators of numeracy skills yielded a mean score at a medium level (between 2.61 – 3.40). This finding signified that the participants in this study did not frequently practice the numeracy skills during their study at the research site. While current working places, future teachers must indulge with the numeracy skills, for instance, in managing time, making job priorities, reporting working progress, etc.

Table 5. Overall mean and level of numeracy skills practices

| Numeracy | Mean | S.td | Level |
|---|---|---|---|
| Reading and understanding tables, charts, graphs and numbers | 3.03 | .800 | Medium |
| Reading scales on measuring equipment | 2.59 | .835 | Medium |
| Using effective ways to present findings | 3.20 | .683 | Medium |
| Constructing and labeling tables, charts and graphs | 2.83 | .665 | Medium |
| Assessing the effectiveness of my work | 2.98 | .788 | Medium |
| Monitoring and reflecting on my use of numeracy | 2.72 | .737 | Medium |
| Identifying the relevant information sources and outcomes | 3.20 | .855 | Medium |

**Learning How to Learn**

Table 6 displays the practices of learning how to learn skills (LHLS). Overall, participants were at a medium level (mean score 3.32). When we looked at indicators of learning how to learn skills, it showed that seven of eight indicators were practiced at a medium level (mean between 2.61 – 3.40). The seventh indicators were setting and planning, managing time and prioritizing, working and learning independently, identifying better ways of learning, putting together knowledge, reviewing what had learned and what had not, and consulting way and performance of learning. These indicate that the EFL student teachers were not strongly prepared to be a lifelong learner.

Table 6. Overall mean and level of lhls practices

| Learning How to Learn | Mean | S.td | Level |
|---|---|---|---|
| Improving performance in the quality and way of work | 3.64 | .587 | High |
| Setting and planning realistic targets of work | 3.16 | .636 | Medium |
| Managing time and prioritizing works to meet the deadlines | 3.35 | .804 | Medium |
| Working and learning independently | 3.27 | .787 | Medium |
| Identifying better ways of learning | 3.37 | .875 | Medium |
| Putting together knowledge from different courses | 3.51 | .693 | Medium |
| Reviewing what had learned and what had not | 3.33 | .777 | Medium |
| Consulting way and performance of learning to a lecturer | 2.87 | .891 | Medium |
| Adapting learning strategy | 3.42 | .837 | Medium |
| Overall | 3.32 | .461 | Medium |

**Problem Solving Skills**

The findings in Table 7 showed that problem-solving skills in overall were practiced at the medium (3.22). Further analysis in each indicator of problem solving skills revealed that there was no indicator obtain a mean score at a high level, nevertheless all indicators were at a medium level. These findings implied that participants were not strongly promoted with the problem solving skills.

Table 7. Overall mean and level of problem solving skills

| Problems Solving Skills | Mean | S.td | Level |
|---|---|---|---|
| Identifying problems in doing assignments | 3.37 | .830 | Medium |
| Coming up with ways to tackle a problem | 3.14 | .528 | Medium |
| Using different methods to analyze the problem | 3.31 | .796 | Medium |
| Including and suggesting diverse perspectives | 3.09 | .956 | Medium |
| Exploring ways of problem solving | 3.33 | .868 | Medium |
| Getting and making efficient use of resources | 3.16 | .841 | Medium |
| Presenting an approach to solve a problem | | | |
| Overall | 3.22 | .724 | Medium |

**Team Work Skills**

Teamwork skills are one of the necessary skills in order that the prospective teachers are able to anticipate facing challenges and multi-task constraints. Obtaining an optimal teamwork will come out with a high quality of working output. However, as displayed in Table 8, it showed that participants rated their teamwork skills at a medium level (mean score 3.40). All indicators of teamwork skills yielded a mean score at a medium level (mean between 2.61 – 3.40) except for 'working with others on activities other than coursework'. In conclusion, the findings in this kills signified that participants were lack of practices of teamwork in their learning process.

Table 8. Overall mean and level of teamworks practices

| Team Work Skills | Mean | S.td | Level |
|---|---|---|---|
| Working with others on activities other than coursework | 3.41 | .864 | High |
| Having discussion in different race or ethnic | 3.11 | .861 | Medium |
| Working with others on projects | 3.53 | .692 | Medium |
| Resolving conflicts occurred in group work | 3.51 | .770 | Medium |
| Sharing constructive feedback | 3.40 | .687 | Medium |
| Seeking effective ways to keep team member motivated | 3.25 | .805 | Medium |
| Offering ideas of using best resources in completing group tasks | 3.57 | .837 | Medium |
| Overall | 3.40 | .499 | Medium |

**Subject Competencies**

The findings in Table 9 indicated that the mean scores of subject competencies were at a medium level 3.36. It was supposed to give a high to a very high mean score, due to these competencies related to their own subject discipline. Furthermore, participants perceived the practices of subject competencies in terms of 'applying subject-content knowledge', enhancing English through wacthing movies and TV news, and developing English through reading written English news at a high level. However, students perceived the practices of soft skills in terms of following statements; 'discussing and connecting content between subjects', explaining contents learned to classmates or friends, answering questions proposed by lecturer, utilizing subject-content knowledge in teaching practice, enhancing English through wacthing movies and TV news and developing English through reading written English news were at a medium level.

Table 9. Overall Mean and Level of Subject Practices

| Subject Competencies | Mean | S.td | Level |
|---|---|---|---|
| Applying subject-content knowledge | 3.42 | .601 | High |
| Discussing and connecting content between subjects | 3.12 | .952 | Medium |
| Explaining contents learned to classmates or friends. | 3.11 | .816 | Medium |
| Answering questions proposed by lecturer | 3.29 | .743 | Medium |
| Utilizing subject-content knowledge in teaching practice | 3.16 | .818 | Medium |
| Enhancing English through wacthing movies and TV news | 3.74 | .781 | High |
| Developing English through Reading written English news | 3.57 | .943 | High |
| Overall | 3.36 | .413 | Medium |

## DISCUSSION

The purpose of this current study was to examine and document the practices of soft skills (communication, IT, numeracy, learning how to learn, problem solving, working with others, and subject-specific competencies) among English as foreign language (EFL) student teachers at one public university teacher education program in Jambi, Indonesia. The study centred on examining the level of soft skills practised by EFL student teachers in their learning process and the level of student engagement in every statement of soft skill components. In general, the findings indicated that EFL student teachers were able to distinguish clearly between the seven components of the soft skill-set (communication, IT, numeracy, problem solving, learning how to learn, Team Work, and subject-specific competencies). They were able to reflect on their own level of soft skills and to

identify which of the seven skills they practised. In addition, EFL student teachers demonstrated a medium rating of soft skills; they needed to be encouraged for having the practices of communication, IT, numeracy, learning how to learn, problem solving, Team Work, subject-specific competencies, and overall soft skills of their students. They must be able to comprehend and analyse current and future work challenges with a critical mind and to use their soft skills to develop their self-quality, to succeed in their career, and to satisfy stakeholders. It is particularly important, due to the lack of soft skills practices among participants. Policymakers at faculty and department levels should encourage lecturers to implement learning activities that aim to improve students' soft skills to ensure a minimum mean score of 3.41 to 4.20, that is, the 'high level' banding of soft skills.

Previous literature has indicated that graduates should leave higher education better and stronger than as they enter it. This improvement should be attributable to curriculum. Graduates need to be equipped with soft skills that they can use to 'sell themselves' to employers. By practising these soft skills in and outside of the classroom will enable students to become more effective and independent learners during their studies. In addition, it will enhance their employment prospects following their graduation. In short, the university graduate should leave with three main attributes, namely employability, life-long learning, and good citizenship (QCA, 2000; Jelas et al., 2006; Washer, 2007; Star & Hammer, 2007).

What do we learn from our findings? Our study results shed important light on what might result in EFL student teachers rated their overall soft skills practices at the average of level of mean scores. First, there might be no guidance curriculum implementation or a blue print at university, faculty and department levels for embedding soft-skills into teaching and learning process. The second, there might be no thoughtful plans and actions in lecturers' syllabi and lesson plans to encourage their students with soft skills as faculty and university do not suggest to do so. The third, there might no standard input, process and output. There might no strong commitment of policymakers at university, faculty, and department to plan, monitor, and evaluate the quality input, process and output of the graduates. Policymakers at university, faculty and department levels should address these kinds of soft skills in order to produce quality future teachers who will have long-term commitment in teaching (Sulistiyo, et al.,2016; 2017; Mukminin, et al., 2017a; 2017b; Muazza, et al., 2016) or other areas of education that they are interested in.

Our findings should be considered in light of some limitations. Although our results may possibly extend the kind of facts on the practices of soft skills among English as foreign language (EFL) student teachers at one public university teacher education program, our small sample size may not be representative of all EFL student teachers. Future quantitative or qualitative or mixed methods research may include a larger sample of EFL student teachers from different areas.

## CONCLUSION

The purpose of this current study was to document the practices of soft skills among English as foreign language (EFL) student teachers at one public university teacher education program in Jambi, Indonesia. The study centred on: What is the level of soft skills practised by EFL student teachers in their learning process? What is the level of student engagement in every statement of soft skill components including communication, numeracy, IT, learning how to learn, problem solving, teamwork, and subject-specific competencies? The findings of the study showed the mean score of soft skills practices in overall (3.28 of 5.00) which was at an average level. A closer examination of the mean score given by the EFL student teachers to each soft skill showed that the practices of communication, IT, numeracy, learning how to learn, problem solving, and Team Work were at a medium level (see Table 2). The findings implied that the soft skills were not well-blended and practiced in learning and teaching process at the research site.

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# In-Service Secondary School Teachers' Technology Integration Needs in an ICT-Enhanced Classroom

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**ABSTRACT**
The use of information and communication technology (ICT) is becoming an essential skill for teachers to enhance teaching and learning. Teachers' training on ICT utilisation in higher education institutions in South Africa has emerged as an important issue. However, limited research has been done on a needs analysis for teachers who plan to make use of ICT in their teaching. This article reports the findings of the training needs analysis as well as the attitudes of secondary school teachers about the use of ICT for purposes of teaching in an ICT-enhanced classroom environment. A survey was administered to a group of 21 in-service teachers from a secondary school in Pretoria in Gauteng Province, South Africa. A focus group interview was also conducted with this group of teachers. The findings reveal that the majority of teachers required to learn computing skills on software installation, web design software, creating database using MS Access and electronic resources for teaching; that only a few needed to learn basic computing skills such as e-mail and Internet; and that a more important issue was that this group of teachers has a positive attitude towards using ICT in their teaching activities and wanted to learn how to integrate ICT in classroom teaching effectively and efficiently. These findings are important as they could guide teacher trainers at higher educational institutions when planning training programmes in ICT and education.

**Keywords:** attitudes, ICT-enhanced classroom, ICT training, in-service secondary school teachers, procedural functional knowledge

## INTRODUCTION

The purpose of this article is to report the findings of the training needs analysis training needs analysis as well as the attitudes of secondary school teachers who are planning to use ICT for purposes of teaching in an ICT-enhanced classroom environment. The study conducted is the initial phase of the planned intervention project that seeks to address secondary teachers' challenges about the use of ICT in an ICT-enhanced classroom in Gauteng Province of South Africa. It was deemed important to identify secondary school teachers' training needs in order to come up with an appropriate strategy for the intended intervention.

Recently, the introduction of ICT resources in secondary schools in South Africa was one of the most significant developments. There has been a large investment in ICT resources, yet it seems to have had relatively little effect on the ways that teachers make use of these resources for teaching and learning purposes (Adegbenro, Gumbo & Olugbara, 2015). It would seem that this investment is going to waste as teachers still struggle with basic computer skills, for example, MS Word, e-mailing and PowerPoint. Globally, a lack of ICT-basic knowledge and skills among teachers has been seen as a major obstacle to realising the ICT-related objectives of schools and colleges (Pelgrum & Anderson, 2001). Generally, teachers feel confident about their basic skills but less confident about addressing some technical applications. This claim is backed up by numerous challenges that exist in literature about the integration of technology in an ICT-enhanced classroom instruction (Adegbenro, et al 2015; Flanagan & Shoffner, 2011). Flanagan and Shoffner (2011) recently studied two in-service and pre-service English teachers' methods in solving computer technical problems. They discovered that teachers relied on trial-and-error methods and often avoided using ICT tools when they did not have access to technological skills and resources. Pelgrum and Anderson (2001) suggest that perhaps the most difficult challenge for teachers is lack of training and preparation for technology use in ICT-enhanced classroom instruction. Ruthven, Hennessy and Brindley (2004) report that teachers who are trained with obsolete technologies often lack in-service technological training. This seems to be the reality with secondary school teachers in Gauteng Province.

The present study forms part of a big project in which the researchers aim to train in-service teachers on how to integrate ICT in to the teaching and learning processes. In order to achieve this overarching aim, the investigation of the teachers' training needs as well as their attitudes towards using ICT tools in the classroom

became an urgent study which needed to be carry out. In terms ICT training content, Xu & Song (2006) point out that there is a need to revisit the existing pre-service teachers training curriculum to fulfil the teachers' needs on the use of ICT in the classroom. In their opinion and within their context, a new training curriculum structure was deemed necessary in order to enhance both pre- and in-service teachers' literacy in ICT. Similarly, within the South Africa context, there is need for professional development programmes which will provide appropriate training for the in-service teachers on ICT integration into their teaching and learning processes. The role of teachers in the integration of ICT into the school curriculum is obviously very important. According to Cuban (2000), every educational reform programmes should take into consideration teachers' knowledge, skills, beliefs, and attitudes towards technology in general. Other studies such as Fullan (1982, 1993) also emphasise that the alteration of mindsets, such as pedagogical assumptions, values, and beliefs, is a key factor to any educational change effort. Sáncheza, Marcosb, Gonzáleza & GuanLina (2012) state that beliefs and attitudes play an essential role in the way in which teachers make use of ICT in the classroom. This is to say that dealing effectively with ICT relates not only to teachers' knowledge of the capability, limitations, applications, and implications of ICT, but it also involves individual teacher's attitudes and perceptions regarding ICT tools. A lot of government projects on ICT schools have not been successful because teachers' beliefs, skills, and attitudes were never taken into consideration when implanting those programmes (Musiyandaka, Ranga & Kiwa, 2013).

Therefore, as part of the needs identification and analysis exercise, the forms of skills needed for secondary school teachers to develop strategies to better prepare them to use the new technological tools effectively in an ICT-enhanced classroom had to be identified. The ICT, when used as a pedagogical tool, should include the use of ICT resources in the teaching and learning process, which involves the use of software applications to solve problems and provoke learners' capabilities as well as to communicate and share their perspectives with each other. Teachers' attitudes toward the use of ICT in teaching, and difficulties in using ICT in teaching were also investigated during the preliminary stage of the study.

In light with the above identified gap, this study attempts to answer the following questions:

- *What are the secondary schools teachers' technology integration needs in an ICT-enhanced classroom environment?*
- *What are the attitudes of the secondary schools teachers towards using ICT in the classroom?*
- *What are the difficulties that the secondary schools teachers encounter when they attempt to integrate ICT into the curriculum?*

**BACKGROUND TO THE RESEARCH PROBLEM**

In order to help teachers meet the challenges of effective teaching and learning, a number of secondary schools have been fully equipped with ICT resources by different organisations, including the South African telecommunications provider, Telkom, and Microsoft (South African Institute for Distance Education – SAIDE, 2009). The Telkom Foundation and Telkom's strategic partner, Thintana, has committed over R200m to support education and training in South Africa. The Teacher Laptop Initiative (TLI), launched in 2010, is part of the government's efforts to improve teachers' e-learning in the overall educational system in South Africa. The purpose is to help the 386 600 teachers in South African schools and further education colleges to effectively integrate ICT in their pedagogical content knowledge. This effort turned out to be a major investment of over R550m per annum for the next five years, to provide permanent teachers in South Africa with laptops (Ndlovu, 2009). The primary concern for the government, when it makes such a huge investment in ICTs, is whether the investment will positively influence teachers' teaching strategies particularly in an ICT-enhanced classroom environment.

SAIDE (2009) reported in its extensive investigation and evaluation of the use of ICT resources and emerging technologies for teaching and learning in schools and colleges, that effective teaching and learning with ICT has not taken place. SAIDE (2009) discovered that despite most schools owning between 30 to 60 computers in their computer laboratories, many teachers still lack adequate knowledge of and e-skills for the use of ICT resources for teaching and learning. Their findings further revealed that although most of the teachers interviewed admitted that they were aware of the potential benefits that learners could derive from using ICT resources, the majority still did not use their ICT resources effectively. The reason for this, according to SAIDE's report, is that teachers were set in their traditional ways of teaching and that for various reasons they did not find it easy to change or adapt their teaching methods (SAIDE, 2009). The authors of this article, however, did not want to act on the basis of a claim about teachers clinging to their traditional ways. The authors rather wanted to establish teachers' own perceptions and views which could otherwise stall their use of ICT in the classroom. The timing of this study is particularly right since large amounts of funding are currently being placed in South Africa schools in order to equip all classrooms with computers as well the use of mobile computers for teaching and learning. It is

therefore imperative to determine specifically where the South African teachers stand in relation to computer technology to ensure that the integration of computers in schools is effective.

## ICT FOR EFFECTIVE TEACHING

The concept of ICT as an important development mechanism is still a fairly recent phenomenon in many developing countries. The demand for a highly skilled workforce that uses ICT tools for innovation, creativity, improved performance and societal transformation is enormous. The ability to use ICT in this manner is known as e-skills. The European e-skills forum defines e-skills and its associated competencies as the ability to develop and use ICTs within the context of a knowledge environment, which will enable the individual to successfully participate in a world in which ICT is an essential requirement for advancement in activities of government, civil society and business (Mitrovic, Sharif, Taylor & Wesso, 2012). Teachers today are expected to develop lessons that not only teach learners academic content knowledge but also equip them with 21st-century skills that will enable them to be effective and inventive thinkers, active problem-solvers and digitally literate citizens (Partnership for 21st Century Skills, 2004). In order to use ICT resources effectively in an ICT-enhanced classroom, Adegbenro, et al. (2015) concur that procedural functional pedagogical content knowledge (PrFPCK) in the context of the teachers' use of ICT for purposes of effective teaching becomes an imperative aspect to consider. Claro, Presis, Martin, Jara, Valenzuela and Nussbaum (2012), in their recent assessment of the 21st-century ICT skills in Chile defined functional knowledge and skill in an ICT-enhanced classroom as the mastery and understanding of ICT applications and the understanding of the general principles, rules and concepts of how to use computers. Functional knowledge is also referred to by other researchers as technology knowledge (Mishra & Koehler, 2006).

ICT comprises a complex set of applications and services used to produce, process, distribute and transform information (United Nations, 2005). The ICT sector consists of segments as diverse as telecommunications, television and radio broadcasting, computer hardware, software and services, print media and electronic media, including web technology such as the Internet. The term ICT has been used to encompass technological innovation and conveyance in information and communication leading to the development of information and knowledge societies with resulting changes in social interaction, economic and business practices, political engagement, education, health, leisure and entertainment (United Nations, 2005).

In an ICT-enhanced classroom, technology knowledge is much more than just knowing about technology or having the orientation to use technology, for example, having the orientation about how to use advanced search tools on the World Wide Web (WWW) but not being able to put the ability into action effectively and solve general problems without necessarily disrupting the lesson. Basjes (2002) argues that describing a step and procedure to follow with the rules without performing the action and solving basic technical problems effectively is less productive. Mishra and Koehler (2006) assert that technology knowledge includes not only computer literacy, but also productive application of technology at work and in everyday life. Niess (2006) explains functional and procedural knowledges through the bicycle scenario: knowing how to ride a bicycle can only be demonstrated by mounting and actually riding a bicycle. This author made a clear distinction between having the ability to describe a function (which is functional knowledge) and actually performing the action (effectively applying the skill in practical terms which is procedural). Teachers' lack of knowledge and skills to integrate ICT in their teaching could as well be informed by the attitudes that they have towards technology as a whole.

## TEACHERS' ATTITUDE TOWARDS THE USE OF ICT

Bandura (1977) has shown that self-efficacy has an impact on an individual's psychological state, attitude and motivation. Individual teachers with low self-efficacy believe difficult tasks are beyond their capabilities; they are also likely to lose confidence in personal abilities. Attitudes are key factors in whether teachers accept computer as a teaching tool in their teaching practices. Research has shown that achieving a meaningful use of ICT tools in the field of education can be influenced by many factors which include teachers' attitudes towards the use of technology in teaching and learning process (Lau & Sim, 2008; Chigona & Chigona, 2010). It has also been established that teachers who do not feel ready and confident to use technology are unlikely to integrate it in their pedagogy (Lau & Sim, 2008; Chigona & Chigona, 2010). Attitudes could play themselves out as factors explaining a disinterest in the use of ICT by teachers and their inadequate knowledge to evaluate the role of ICT in teaching and learning, as well as lack of pedagogical skills to use the ICTs. According to Albirini, (2006), the success of technology use in the educational settings largely depends on teachers' attitudes toward technology use. This means that teachers' attitudes towards computers play an important role in the acceptance and actual use of computers. Furthermore, the study by Sáncheza et al (2012) on teachers' attitudes towards the use of ICT in the classroom revealed that teachers' attitudes are highly positive but their actual use of ICT tools in class is rare and is subjected to innovative processes. These authors suggest that teachers need to be trained on how to integrate ICT tools into their teaching and learning processes. Prior to training on ICT integration, Donnelly

(2010) identifies teachers' beliefs and attitude towards ICT as necessary area that should be researched before commencing any training programme for teachers. It is therefore expected that the ICT training reported in this study, that teachers will get, will be implemented in such a way that it equips them with the relevant skills to be able to integrate ICT into their teaching practices. This article provides the report about an investigation of teachers' attitudes about ICT that inform their classroom practices within an ICT-enhances classroom.

## METHODOLOGY

*Sample*

Twenty-three in-service teachers from two selected secondary schools which are fully equipped with a computer system and an interactive whiteboard with an overhead data projector participated in the study. This group of in-service teachers volunteered to participate in the training programme to aim at enhancing the teachers' knowledge and skills in integrating ICT tools in teaching and learning. The training contents are organised in five modules over a period of six weeks: (1) Input and output devices/ Input skills (keyboarding and use of mouse), (2) Windows Operating System Skills, (3) Word-processing Skills, (4) A graphic productivity tool (Microsoft PowerPoint), (5) A numeric productivity tool (Microsoft Excel), (6) Using internet resources for preparing teaching materials. The average age of teachers is 36.4 years old, ranging between 24 and 65. Their years of experience range from 0 to 29 years, of which 60.86% are female while 39.13% are male.

*Data collection and analysis*

In this study, a survey was employed to collect data. A computer literacy questionnaire developed by Son, Robb and Charismiadji (2011) was adapted in this study. The survey included knowledge and e-skills in specific domains such as Microsoft word processing, spreadsheets, computer keyboarding, PowerPoint presentation, a data projector, Internet and Web technology. This is in line with the new curriculum standard and ICT White Paper Policy (Department of Education, 2004). The two parts of the questionnaire immediately after the demographical information included items that measure teachers' basic computer skills and teachers' knowledge about computer-related tools. The last part makes use of a 5-Likert scale to assess teachers' attitudes towards using ICT in the classroom (SA=strongly agree, A= Agree, UN = Uncertain, D=Disagree, SD = Strongly disagree). In terms of trustworthiness, the researchers spent time designing and deliberating on the survey. The response rate was pleasing, i.e. 100%. Data from the survey were triangulated with the focus group data. Thus, triangulation ensured rigorous, empirically grounded claims and assertions (Cobb, Confrey, diSessa, Richards & Schauble, 2003). The collected data were analysed using mixed-method approach. Descriptive statistical analyses were done for the Likert type questions (i.e. frequency analysis, measures of central tendency and dispersion) and content analysis for the focus group interviews.

## FINDINGS

The results of the study are discussed below according to the research questions. Meanwhile, the participating teachers' profiles are presented blow.

### *Teachers' profile*

Table 1 presents the participating teachers' profiles in terms of gender, age range and their accessibility to computers. Out of the 23 teachers that participated in the study, 9 (39.13%) were male, while 14 (60.87%) were female. Their ages ranged from 21 to 65. Seventeen (73.91%) of the teachers were aged between 21 and 50 while 6 (26.09%) of them were aged between 51 and 65. Turning to their accessibility to computer, almost all the teachers, i.e. 21 (91.30%), had access to computers to use in their practice.

**Table 1: Participant profile**

| Variables | Categories | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 9 | 39.13% |
| | Female | 14 | 60.87% |
| Age range | 21–50 | 17 | 73.91% |
| | 51–65 | 6 | 26.09% |
| Access to computers by teachers | Yes | 21 | 91.30% |
| | No | 2 | 8.70% |

### *Teachers' basic computer skills*

In order to determine the participating teachers' basic computer skills, 21 items in table 2 were used for this. The teachers were able to indicate their capability to use the computer by responding to the "Can you" questions listed in table 2. While most teachers indicated that they were able to do various computer-based tasks such as turning on and shutting down a computer, starting and exiting a computer program, minimising, maximising and moving windows on the desktop, about 50% of the teachers indicated that they were not able to install a software

program on their computers, record and edit sounds, create a simple database using MS Access, create a simple Web page, and use a video conference tool on the Web.

**Table 2: Teachers' basic computer skills**

| Items | Yes (%) | No (%) |
|---|---|---|
| Can you properly turn on and shut down a computer? | 22 (95.65%) | 1 (4.35%) |
| Can you start and exit a computer program? | 22 (95.65%) | 1 (4.35%) |
| Can you change monitor brightness and contrast? | 12 (52.17%) | 11 (47.83%) |
| Can you minimise, maximise and move windows on the desktop? | 18 (78.26%) | 5 (21.74%) |
| Can you perform file management, including deleting and renaming files, etc.? | 14 (60.87%) | 9 (39.13%) |
| Can you use a "search" command to locate a file? | 14 (60.87%) | 9 (39.13%) |
| Can you install a software program? | 5 (21.74%) | 18 (78.26%) |
| Can you scan disks for viruses? | 12 (52.17%) | 11 (47.83%) |
| Can you move a file from a hard drive to a USB drive? | 13 (56.52%) | 10 (43.48%) |
| Can you record and edit sounds? | 8 (34.78%) | 15 (65.22%) |
| Can you print a document using a printer? | 21 (91.30%) | 2 (8.70%) |
| Can you create a basic Word document? | 17 (73.91%) | 6 (26.09%) |
| Can you copy, cut and paste text in a document? | 14 (60.87%) | 9 (39.13%) |
| Can you change font style and size in a document? | 18 (78.26%) | 5 (21.74%) |
| Can you create a basic Excel spreadsheet? | 10 (43.48%) | 13 (56.52%) |
| Can you create a simple database using Access? | 4 (17.39%) | 19 (82.61%) |
| Can you create a simple presentation using PowerPoint? | 8 (34.78%) | 15 (65.22%) |
| Can you send and receive attachments through e-mail messages? | 17 (73.91%) | 6 (26.09%) |
| Can you search for information online using a Web search engine? | 14 (60.87%) | 9 (39.13%) |
| Can you use a video conferencing tool on the Web? | 5 (21.73%) | 18 (78.27%) |
| Can you use Blackboard Learn to support your teaching? | 4 (17.39%) | 19 (82.61%) |

***Teachers' basic knowledge about the use of computer-related tools in the classroom***

Table 3 presents findings on teachers' basic understanding of computer-related tools and how to use them for teaching and learning purposes. Looking at table 3, 17 (73.91%) teachers thought that they understood the basic functions of the computer hardware components while 6 (26.09%) of them thought that they did not understand. In terms of the basic function of the software, 15 (65.22%) teachers also thought that they did understand the basic function of the software, while the remaining 8 (34.78 %) teachers responded that they did not understand. When it comes to integrating computers into teaching and learning, only 6 (26.09%) teachers were using computers in their teaching at the moment, while the remaining 17 (73.91%) teachers were not doing so. Thirteen (56.52%) teachers used a computer connected to the Internet at school, 19 (82.61%) teachers found it easy to learn something by reading it from the computer screen, and 3 (13.04%) teachers used CD-ROMs to supplement their teaching/learning activities. It is interesting to note that 15 (65.22%) teachers were using Websites to supplement their teaching/learning activities (see table 3).

**Table 3: Teachers' basic knowledge about computer-related tools**

| Items | Yes | No |
|---|---|---|
| Do you understand the basic functions of computer hardware components? | 17 (73.91%) | 6 (26.09%) |
| Do you understand the basic function of computer software? | 15 (65.22%) | 8 (34.78%) |
| Do you use a computer for teaching purposes? | 6 (26.09%) | 17 (73.91%) |
| Do you use a computer connected to the Internet at school? | 13 (56.52%) | 10 (43.48) |
| Do you find it easy to learn something by reading it from a computer screen? | 19 (82.61%) | 4 (17.39%) |
| Do you use video clips, CD-ROMs to supplement your learning/teaching? | 3 (13.04%) | 20 (86.96%) |
| Do you use Websites to supplement your learning/teaching? | 15 (65.22%) | 8 (34.78%) |
| Do you use an overhead data projector for your teaching? | 6 (26.09%) | 17 (73.91%) |
| Do you use an interactive whiteboard for your teaching? | 3 (13.04%) | 20 (86.96%) |

***Teachers' attitudes towards using computers for teaching and learning purposes***

Eight-item variables from the adapted questionnaire were used to assess the teachers' attitude towards using computers in their classrooms. Teachers used a 5-point rating scale of strongly agree (SA) to strongly disagree

(SD) to answer the questions shown in table 2 *(SA=strongly agree, A= Agree, UN = Uncertain, D=Disagree, SD = Strongly disagree).* The higher the variable's value, the more positive teachers felt about using computers for teaching and learning purposes.

Overall, it was observed that teachers had positive attitudes towards using computers in their classrooms. Looking at the teachers' responses to the first and the third statements in table 4, it shows that all the teachers who participated in this study enjoyed using computers in their classrooms and were willing to learn more about how to integrate computers in the teaching and learning processes. Table 4 shows that only 3 teachers (13.04%) expressed uncertainty about their willingness to learn more about computers and how to use computers as pedagogical tools in the classroom. Item 2 reveals that 18 teachers (78.26%) felt comfortable about using a computer in their classrooms, 4 (17.39%) were uncertain about the statement, while 1 teacher (4.35%) disagreed with the statement. To the statement, "I think that computers are difficult to use", having 82.60% of the teachers disagreeing and strongly disagreeing with the statement means that the teachers believed that computers are not too difficult for them to use in the classroom. Only 2 teachers (8.70%) thought that computers are difficult tools to use in the classroom. On the other hand, 2 (8.70%) teachers were uncertain about the statement. Furthermore, the statement, "I feel threatened when others talk about computers", with 78.26% of the teachers disagreeing and strongly disagreeing with the statement, suggests that this group of teachers felt comfortable to discuss computers among themselves. Moreover, table 4 reveals that all the teachers (100%) agreed and strongly agreed that it is important for them to learn how to use computers and they would like to use computers in their classrooms. In conclusion, all the teachers (100%) agreed that using computers for teaching and learning will have a positive impact on their teaching strategies and enhance their learners' learning processes.

Furthermore, during the initial focus group interview with the teachers about their major motivations and attitude towards using computers for teaching and learning processes, two male and one female in-service teachers with 21 and 25 years teaching experience respectively commented as follows:

Teacher A: Yes….. *ICT are just here and they are essential for learning. You cannot fall behind. You have to embrace it and learn how to use it in your classroom.*

Teacher B on the other expressed her feelings regarding the components of attitude: cognitive, emotional and behavioural.

Teacher B: Using *ICT in the classroom makes the motivation towards learning bigger than in the convention settings. For me it is the main motivation, not for being part of the curriculum. The motivation towards learning is bigger. Both for children and even for me as their teacher, I learn new things every day.*

**Table 4: Teachers' attitudes towards the use of computers in the classroom**

| Attitude items | SA | A | UN | D | SD |
|---|---|---|---|---|---|
| I enjoy using computers. | 17 (73.91%) | 6 (26.09%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| I feel comfortable using computers. | 13 (56.52%) | 5 (21.74%) | 4 (17.39%) | 1 (4.35%) | 0 (0.0%) |
| I am willing to learn more about computers. | 19 (82.61%) | 1 (4.35%) | 3 (13.04%) | 0 (0.0%) | 0 (0.0%) |
| I think that computers are difficult to use. | 1 (4.35%) | 1 (4.35%) | 2 (8.70%) | 8 (34.78%) | 11 (47.82%) |
| I feel threatened when others talk about computers. | 1 (4.35%) | 1 (4.35%) | 3 (13.04%) | 8 (34.78%) | 10 (43.48%) |
| I believe that it is important for me to learn how to use computers. | 21 (91.3%) | 2 (8.7%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| I would like to use computers in the classroom. | 21 (91.3%) | 2 (8.7%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| I think that my teaching can be improved by using computers. | 21 (91.3%) | 2 (8.7%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| I believe ICT enhances learners' understanding | 21 (91.3%) | 2 (8.7%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |

The teachers' comments concur with Lau and Sim (2008), Chigona and Chigona (2010), who report that teachers who do not feel confident to use technology are unlikely to integrate it in their pedagogy.

***Difficulties in the implementation of ICT in the classroom***

When teachers were asked about the difficulties they encountered when they attempt to implement ICT into their classroom practices, most of them felt that practical implementation was difficult, mainly had inadequate knowledge and lacked skills to use ICT in their pedagogical practices. This finding is evident in Teacher C's comments during the focus group interview below.

**Teacher C:** *Despite the fact that l really like to teach with ICT resources with adequate knowledge in the use of ICTs because we are in the computer age, I always feel incompetent and inept in the use of ICTs. I believe, l do not have adequate knowledge to use the equipment. My hands are so stiff on the keyboards and l finds it difficult to move my fingers flexibly on the keyboards. I like to have sufficient training that will enable my fingers to be flexible on the keyboards*

This finding is in agreement with Albirini (2006) who opines that teachers' attitude towards technology is considered the major predictor of the use of technologies in educational settings. Therefore, it is expected that the planned training intervention for the teachers by our research group will be helpful in changing all the teachers' negative beliefs and attitudes in the use of ICT resources as pedagogical tools in their practices.

## DISCUSSION OF FINDINGS

This study reports the findings of the training needs analysis and attitudes of secondary school teachers about their use of ICT tools for the purposes of teaching in an ICT-enhanced classroom environment. Looking at the teachers' responses to their basic computer skills, the "Can you" questions enabled us to investigate what the teachers can do with ICT tools at the moment. A total of 95.65% of the teachers can turn on and shut down a computer properly and they can maximise, minimise and move windows on the desktop. On the other hand, the teachers seem to have little or no knowledge of how to use databases, video-conference and learning management tools like Blackboard in their teaching practices. This means that for the successful implementation of the intervention programme, teachers' actual competence should be carefully considered in the design and implementation of ICT integration training programmes. These results are consistent with the previous findings (Ruthven, et al. 2004; Sáncheza, et al. 2012).

As shown in table 3 on the teachers' use of computer-related tools, more than half (73.91%) of the teachers had very diverse experiences with computer applications. There were also individual differences in the level of computer literacy; some teachers were very comfortable with using computers for teaching while others expressed their feelings about choosing appropriate software, videos and CD-ROMS for their teaching. Knowing these differences in the teachers' ability to use ICT tools brings about a need for a different approach to teacher training for a group of teachers with a different background. This will allow teachers to improve their personal level of computer literacy and competency and gain various experiences contextually relevant to their teaching practices.

The results show that all the teachers who participated in this study had a positive attitude towards using computers in their classrooms. Also, teachers' responses during the focus group interview showed that they are willing and ready to integrate ICT tools in the teaching and learning processes. This situation can be explained by the fact that 73.91% of the teachers are below the age of 51. We expect that younger teachers will be open to the use of ICT and might have experienced ICT during their education. This result is in agreement with the previous study by Sáncheza, et al. (2012), who emphasise that in order to integrate technology in the classroom practices effectively, teachers' attitudes towards technology should be positive and they should be trained in using modern technologies in the field of education. However, teachers mentioned some of the factors inhibiting them from using ICT in the classroom during the focus group interview. These factors include insufficient ICT tools, teachers' lack of computer confidence in teaching and lack of professional teacher development programmes on ICT integration in the classroom. Based on these findings, it can be said that this group of teachers' positive attitudes are very promising as it suggests their willingness to be developed further in the ICT areas where they are still lacking. Even though positive attitudes do not always mean high competency, this study would enable the authors to take the teachers' comfort, confidence and competency into consideration during the planned teachers' training programmes on how to integrate ICT tools into the classroom practices.

In this study, the training needs analysis of a group of teachers in Gauteng Province of South Africa have been presented. The outcome of the needs analysis investigation shows that for learners to benefit from the implementation of learner-centred instruction in an ICT-enhanced classroom, it is essential that teachers receive training *in situ* to fully integrate technology in their teaching practice. The teachers who participated in this study represent South Africa's teachers who are interested in computer technology and can share their experiences and challenges with the research group, i.e. authors of this article. In order to respond to these teachers' contextual

demand for improving their computer literacy and competency, more provision of computer facilities should be made and more teacher training programmes should be developed. This research group is picking up on this challenge through a series of planned training programmes for the teachers on how to integrate ICT tools into their teaching practice.

## CONCLUSION AND RECOMMENDATION

In conclusion, it is noteworthy that teachers would benefit from future training and structured support that not only demonstrate how to more effectively incorporate ICT tools in their curriculum but that work to shift their mindset to more student-centred philosophies in order to leverage the potentials of computers in teaching and learning processes. As one of the first studies to investigate the training needs analysis of teachers in using ICT tools in South Africa, the current study provides novel insights and a starting point for more empirical research on the impact of ICT tools on the conceptual understanding of learners in various learning areas. In order to achieve the overarching aim of this project, teachers need to be well trained on how to incorporate the technology in innovative and creative ways for fostering learning while integrating computers into the curriculum.

The authors' future research will investigate the specific interventions that can be used in helping to increase teachers' attitudes and the perceived usefulness of computers in the classroom. Moreover, longitudinal studies may be designed to determine the effect of using computers for teaching and learning purposes. The authors intend embarking on the second phase of the project on ICT integration through a series of classroom implementation and observations ICT usage in the classroom.

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# Interactive Courseware for Supporting Learners Competency in Practical Skills

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## ABSTRACT
This study is carried out to develop an interactive multimedia learning aid that increases students' competency in practicing electrical motor installation. Students of Public Vocational High School in Langkat, Indonesia involve in this study. The Research and Development (R&D) methodology by Borg and Gall (1998) is adapted in this study, in which the steps include understanding the problem, gathering information, design and development, validation, product improvement, product testing, product revision, installation, design improvement, and product distribution. In terms of pedagogy, ASSURE learning model (that consists of Analyze, State Objective, Select Methods, Utilize, Requirement, and Evaluate) is incorporated in the product. When data were tested, the results prove that generally, respondents believe that the developed learning aid is highly qualified to be used. More ever, all parties highly believe that the developed learning aid is able to increase the students' competency in electrical motor installation.

## INTRODUCTION
Education is a process that people go through for continuous improvement. Also, education is important to assist people to expand their potentials. In Indonesia, every individual is guaranteed with similar right to receive similar education in improving the quality of life. The 1945 Constitution of the Republic of Indonesia Section 31 Sentence (1) states that each citizen is eligible to get access to education. Further, Sentence (3) urges that the government designs and maintains a national education system that upgrades faith and god-fearing as well as moral in up-lifting the life of the nation.

In terms of the advantages of media, Asyar (2011) believes that besides teachers' creativity, instructional considerations is also one of the determining factors. In most cases, teachers have not optimized learning media appropriately, in which they use the aids without considering the efficiency and effectiveness aspects (Churcill, 2011; Zulaiha & Mutalib, 2015a). The use of media is very much related to the quality of teaching and learning. Beyond that, the teaching and learning could contribute to the meaningful learning experience; facilitate interactions between students and teachers and among students regardless of locations, which enriches learning experience (Aziz & Mutalib, 2016; Norshahila, Fatimah, & A'fza, 2014). It is believed to be an agent that twists passive learning environments (Hoon, Chong, Ngah, & Kee, 2009; Chinn, 2012; Aziz, Mutalib, & Sarifi, 2014). In an active environment, students dynamically discuss and search for learning resources, while teachers facilitate the learning process.

The availability of various learning media and technology assists learners to flexibly achieve their learning outcomes (Hanim & Fatimah, 2011; Aziz & Mutalib, 2016). The development of interactive media is very important in overcoming the drawbacks in the available conventional learning aids. When learning media is self-developed by respective teachers, they feel more confident with the contents (Aziz, Eshak, & Mutalib, 2011). Besides, it increases their credibility and professionalism (Schittek, Mattheos, Lyon, & Attström, 2001; Aziz, Hazwani, Shiela, & Mutalib, 2010). On top of that, it is better for the students' knowledge acquisition.

In Indonesia, vocational high school is one educational stream that significantly develops human capital in technical aspects, as outlined by the curriculum development unit. Indonesian government regulation no. 19 The year 2005 on national education standards article 26 point (3) states that vocational education aims at increasing intelligence, knowledge, personality, and moral as well as skills to be independent. Further, it also provides opportunities for students to further extend their studies in their respective technical intelligence.

Although the government is aware of the importance of skill development among learners, realizing it is a puzzle. Records (details are confidential) prove that the achievement by learners in vocational high school is continuously low. Generally, learners score below the average. This is a mismatch because something important is not well-achieved. At the same time, efforts in establishing and running a vocational high school are huge. This study believes that the establishment of the vocational high school is not a wrong decision, but the teaching and learning practice needs to be revisited. It is the symptom that alerts this study. Accordingly, a close observation was arranged.

This study went to the vocational high school and spent tens days to understand the scenario. It was focused on understanding the teaching and learning practice, and learners behavior while learning. After tens days observing, this study gathers a significant answer to the symptom. It This study found that teachers use conservative techniques and materials like boards, books, chalks in their classroom. The classroom is very teacher centered, leaving learners passively listen to the explanation. Books show static pictures with a wordy explanation. With such limitations, books are not able to demonstrate a process. It contradicts with the philosophy of skill development, which requires learners to digest processes. When that happens, learners do not focus on their learning. Hence, this study noticed that most of them do not focus on the learning contents. Further, to better understand the scenario, this study interviewed the teachers and learners.

Altogether, this study interviewed five teachers and tens learners, one at a time, separately. Based on the interviews, teachers are not happy to use textbooks in teaching the skill-based subject, particularly the electrical motor. They feel very difficult to impart knowledge into learners because the textbooks are not able to visualize the process. As a result, learners are not happy and are not engaged in the learning process. It is commonly seen that learners do something else during the class sessions, like playing games and chatting with peers. They believe that the delivery should be altered to suit the current scenario. While learners are exposed to technologies, their learning experience should also acknowledge that. Otherwise, it creates a conflict that leads to learning gap. When learners were asked about the experience, they also agree with their teachers. Although one learner does not really concern about the delivery technique and materials, the other four learners really concern about it. For them, they prefer something that could visualize processes for them. It is highly appropriate because they learn about processes in an electrical motor. Furthermore, most of them are very exposed to technologies at home.

Based on the observation and interviews, this study asked them whether they prefer if an appropriate interactive learning material (courseware) is available for them in their learning activity. The teachers responded positively. For them, courseware could help a lot. For learners, they really expect for the courseware. They believe, courseware could enable them to learn on their own. While teachers as human are tired of repeating for them, courseware can repeat as many times as they want. Also, the combination of various media could enrich the knowledge delivery.

Based on the findings from the observation and interviews, this study discovers the gap in skill development among learners in vocational high school, particularly in the electrical motor subject. While the contents in the subject are mostly skill-based, the delivery should support its needs. Hence, the current conservative teaching delivery and materials should be transformed into something more appropriate for current development. Thus, this study proposes to use interactive learning material in supports for skill development in Vocational High School.

Based on the gap as discussed in the previous paragraph, this study aims at accomplishing the following objectives: (1) to design and develop an interactive learning material for an electrical motor subject, and (2) to test the interactive learning material through expert and users.

## LITERATURE REVIEW

### Learning Models

Learning is an activity carried out by a person to obtain certain knowledge and skills to increase his or her competencies, which commonly involves a teacher and a learner (Pribadi, 2009). Learning is also viewed as an elaboration process in discovering means of certain tasks. Basically, the learning process is carried out to increase certain abilities or competencies. That makes Sadiman, Rahardjo, Haryono, and Rahardjito (2009) formulates that learning is a lifelong complex process. When learning has taken place, it effects in behavioral changes, which could be observed in cognitive and psychomotor, as well as those related to value and attitude.

A learning model is a conceptual framework that visualizes a comprehensive inter-connected concept and outlines systematic procedures in organizing learning experience in achieving learning goals, and that it guides designers and teachers in their teaching practice (Pribadi, 2009; Trianto, 2010). Before that, Joyce, Weil, and Calhoun (2009) stated that a teaching model is a description of a learning environment, including teachers' behavior. Generally, models guide practitioners in various stages, ranging from planning lessons and curriculums to designing instructional materials, including multimedia programs. That is the reason Supriatna and Mulyadi (2009) convincedly expressed that models are highly advantageous, because of their variations.Among the advantages can be seen in the openness for selecting the most appropriate learning design to meet learners' characteristics and the context. Besides, existing models could be adapted into meeting current phenomenon to meet the necessities.

There are various learning designs, in which some are very popular. One of the popular ones is called ASSURE model (Smaldino, 2008; Smaldino, Russell, Heinich, & Molenda, 2005). The names combine the keyword of each step in the model: Analyze - State Objective - Select Methods - Utilize - Require - Evaluate (ASSURE). ASSURE is a model that formulates activities for learning to teach, which is also known as a class-oriented model. The model consists of six steps (Figure 1):

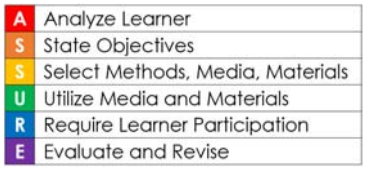


**Figure 1:** Steps in ASSURE learning model

**Interactive Multimedia**

According to Asyhar (2011), learning media refers to everything that could transfer information from a sender to a receiver in a planned manner, in a conducive environment that makes learning process effective and efficient. Additionally, Musfiqon (2012) defines it as physical or non-physical tools purposely used as mediators between teachers and learners in ensuring learning contents are well-understood. They have to be designed to ensure learners are happy with the learning contents so that they learn further. In this era, learning contents need to incorporate various media. Mayer (2009) defines multimedia as a combination of text and pictures. Meanwhile, Ariani and Haryanto (2010) and Pilli and Aksu (2013) further clarify that multimedia is used in learning and teaching to deliver information (knowledge, psychomotor, and attitude) and stimulate thinking, feeling, attention and willingness so that learning happens and well-guided.

Interactive learning material with various media has been developed for various types of users. For Ariani and Haryanto (2010), interactive multimedia should be equipped with learner control mechanism, so that they could entertain their needs, rather than the tool controls them. It agrees with Schittek, Mattheos, Lyon, and Attström (2001) when they developed their courseware project. Sidhu and Manzura (2011) solved problems faced by dyslexic learners. Meanwhile, Fatimah, Shahrina, and Syafiza (2013) developed solutions for slow learners in their learning practice. Also, works to solve problems faced by slow learners have been carried out by Zulaiha and Mutalib (2015b) and Fatimah, Shahrina, and Syafiza (2013). Visually-impaired people has been handled by Aziz, Mutalib, and Sarif (2015b). Besides, interaction styles for use in a big crowd have been researched by Al-Aidaroos, Mutalib, and Zulkifl (2013).

**Learning Tool**

Prastowo (2011) states that learning tools are materials designed systematically either written or non-written that enables learners to learn. It could be anything, as long as it supports learning either in the classroom or out (Sofiani & Ahmadi, 2010). It continuously dynamically develops to meet the demands of the society and inline with technology advancement (Ahmadi, Amri, & Elisah, 2011). It has to be critically designed for purposes like it (1) meets the needs of the curriculum by considering the necessities of the teachers, learners, and context, (2) assists learners in learning through alternative materials besides textbooks, and (3) assesses teachers in their teaching practice. The tools have various types, including: (1) visual materials including printed and non-printed, as well as real objects, (2) audio materials, (3) audio-visual materials, and (4) interactive multimedia including Computer Assisted Instruction (CAI), Web-based Learning (WBL), and collaborative learning.

In the early of the 21st century, Bactiar (2009) found that learners were very enthusiastic with his computer-based learning materials. Eventually, the use of computer-based learning materials optimizes his learners' interest and knowledge acquisition. Since then, the use of computers in teaching and learning were extensively studied and practice. Various learning tools have been developed, including for disabled people. Learning

contents for visually-impaired people have been developed by Aziz, Eshak, and Mutalib (2011) by incorporating Multiple Intelligence theory, in which it was extended with SECI model by Aziz, Hazwani, and Mutalib (2011). Later, Aziz, Mutalib, Sarif, and Jaafar (2013) extended the study to determine the potential of learning content for a creative environment.

Meanwhile, Adelina (2009) found that incorporation of learning model in her planning for teaching leads to an increase in the quality of delivery. Besides, her learners experience the learning activities very positively. The incorporation of the learning model has to be considered while designing the scheme of work. At the same time, Aziz, Hazwani, and Mutalib (2009) found similarly.

Not only that, Mursid (2010) discovered that (1) practical-oriented competency learning is highly potential in improving cognitive, psychomotor, and affective skills, (2) method and teaching model should meet the learning needs, (3) work-based learning could highly increase learners' performance, and (4) work-based learning should be critically designed to ensure effectiveness and efficiency, and to optimize learners' interest in meeting the demand in the industry.

## METHODOLOGY

To ensure the problem could be solved and objectives are achieved, this study has gone through a common methodology consisting of three phases; the understanding problem, design and development, and testing (illustrated in Figure 2). In understanding the real problem, this study first determined the symptom. As a response to the symptom, this study observed the context of study very closely, and then interviewed the subject of study to gather first-hand data. This eventually clarifies the real problem being solved, as explained in detail in the problem statement. Regarding design and development, Sukmadinata (2006) believes that Research and Development Methodology (Borg & Gall, 1983) (with steps visualized in Figure 3) is a very potential research method and strategy for improving practice.

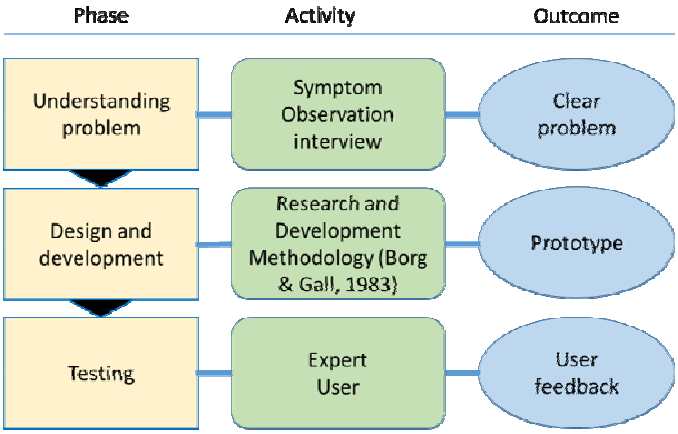


**Figure 2:** Research methodology

### Design and Development Phase

Figure 3 visualizes the steps in Research and Development Methodology by Borg and Gall (1983). It is seen that there are ten steps in the methodology, which are quite similar to the methodology adopted by Aziz, Hazwani, and Mutalib (2009). Each step is elaborated in the following paragraphs.

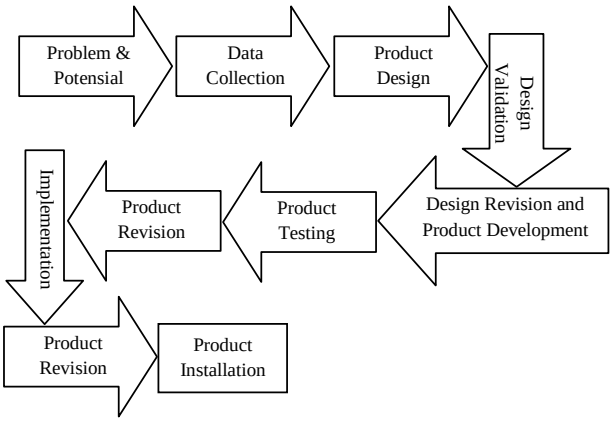


**Figure 3:** Design and development steps (Borg & Gall, 1983)

**Problem and potential**

Needs analysis comprises two levels; performance analysis and needs analysis. Performance analysis was carried out to determine the performance problem being faced. Also, it is important to identify the solution to the problem, such as either learning program and management need certain revision and coordination. Meanwhile, needs analysis determines the abilities and competencies learners need to equip themselves with in improving their learning performance.

Regarding that, this study focuses on the competencies in practical aspects. For the need analysis, direct observation and interview were carried out (as explained in the problem statement), in which teachers were observed and interviewed in their natural setting in their schools. From the observation and interviews, the following facts and understandings were obtained.

- Learning contents were delivered through oral explanation, where learners just listen. They were allowed to ask questions when necessary.Through the interview, this study found that the learning is focused on theory, not involving practical.
- Learners expect some alternative media that could complement the existing practice so that it is easier for them to understand the learning content, specifically the installation of an electrical motor. In addition to that, they prefer some visual representation that supports practical training rather than merely theoretical explanation.
- According to the learners, the content on the installation of the electrical motor is important because it is the basic for other advanced courses.
- The school is located in a town, which is surrounded with internet cafe and computer rental store. Other than that, some learners have their own laptop.

As the problem has been clarified in the previous phase, this step was focused on analyzing on the potentials of the solution. Hence, in terms of potential, this study decides the following:

- The medium of distribution – DVD – since anything on the network might be distracted by the communication medium.
- Language – Indonesian language – because it will benefit students more than any other languages.
- Content – follow the standard by the ministry – this study focuses only on the design.

**Data collection**

The users involved in this study through seven times workshop in each school from April to November 2015, in designing, developing, and testing process. Data were gathered from the real users through a workshop. In the workshop, learners demonstrated their tasks. A few samples of interactive applications, with different interaction styles and degrees of difficulty, were made available in the workshop. This study observed their activities to understand their strengths and weaknesses.

In the end, it was found that most of the learners are quite slow in using computers. Their ability in interacting with advanced interaction styles is quite low. Hence, they must be provided with a simple interaction style. The instruction has to be carefully designed.

**Product Design**

Having the data gathered, this study started designing the low-fidelity prototypes of the interactive learning material. Those paper-based design artifacts convey the concept and navigation styles. As this is the first design step, a few options were made available for users to select. For the purpose of gathering user feedback upon the low-fidelity prototypes, a workshop was conducted, housing the same participants during the data gathering step. In the workshop, participants (the users of the interactive learning material) were briefed on the purpose of the activity. Basically, the goal was to identify the most appropriate concept and navigation styles for the learning material. This benefits this study significantly because the workshop outcome crystalized requirements for the learning material. Eventually, the most appropriate concept for the learning material was obtained.

**Design Validation**

The gathered requirements that make the most appropriate concept obtained in the product design step was translated into a newly-formulated design. Then, the design was validated to ensure it meets common guidelines. For that, ten experts were involved. They are interaction design and instructional experts, who associate the proposed design with the users. It is more than sufficient for this study because the experts were able to come out with saturated data. This technique is adapted from Aziz, Mutalib, and Sarif (2015a). Based on their reviews, some recommendations for improvement were addressed. Basically, the proposed design was a bit complicated for the users.

**Design Revision and Product Development**
Based on the recommendations in the validation step, appropriate modifications were made. It included structure, layout, and navigation style. Eventually, the design shown in Figure 4 was finalized. It is seen that every sub-topic contains some indicators, certain purposes, the contents, pictures, and tests. The buttons are always available to allow users click t any time.

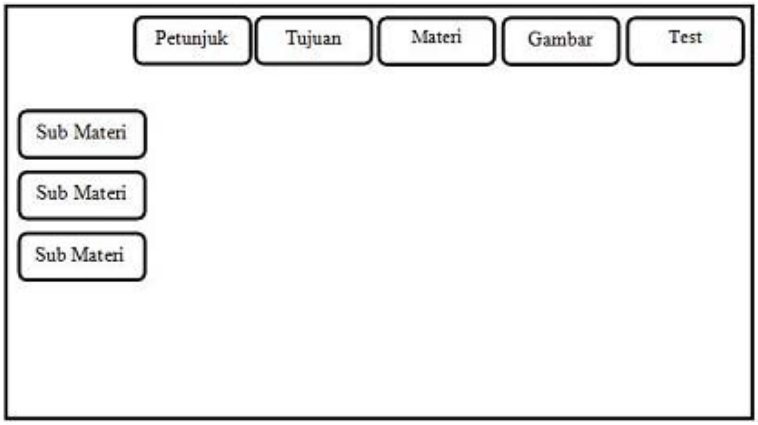


**Figure 4:** The design concept of the interactive learning material

Having the modified design ready, it was transferred into a working prototype, which closely functions as the final product. All functions were made working, leaving some contents unfilled. With that, users could interact to experience the actual product. Accordingly, they could express their perception while experiencing the learning material.

**Product Testing**
Once again, a workshop was conducted to let the users experience the learning material. It was carried out in their school, in a natural setting. In the workshop, every learner was provided with the learning material, and this study lets them use it as they like. To ensure they explore the learning material, they were provided with a list of tasks that they have to do. A sheet for them to locate their feedback was also provided, which really assists this study. On top of that, this study closely observed their interaction with the learning material. They were also interviewed to understand the symptoms observed in their interaction.

In the end, it was found that the prototype was easy for them. Very few mistakes were made in navigating the prototype. They learn about the prototype quickly and remembered the steps clearly after learning it.
When interviewed, they explain that the prototype is useful for them because they could access their intended contents efficiently. They were not afraid of making an error or recovering from errors because the interaction style has been made very straight-forward.

However, overall, they provided some suggestions to improve the prototype, which mostly is on the detailed physical design like the use of colors, visual representation, and terminologies.

**Product Revision**
The prototype was then revised based on the suggestions gathered in the testing step. The revision involved editing the colors, clarity of visual representation, and use of terminologies. When the terminologies, especially in the instructions, were rephrased, the instructions were clearer to the learners.

**Implementation**
Having the prototype fully revised, all contents were completed, making the product fully functioning, it was installed for implementation. It was intended to determine the product works well in its actual setting. It is very important because the finished product contains various graphics, videos, and animations. They are heavy, hence examining their smoothness is necessary. Figures 5 and 6 showcase snapshots of the interactive learning material.

Figure 7 shows the main page. It states the title very clearly. It makes use of attractive colors and meaningful buttons. While the page loads, the background music plays to stimulate learners' mood.


**Figure 5:** The main page

Further, Figure 8 shows the sub-topics in the learning material. They are divided into separated pages and provided with appropriate links to each sub-topic.


**Figure 6:** The sub-topics

**Product Revision**

In the actual setting, the interactive learning material may still contain errors, that distract the experience of learning. However, as it runs on CD, there was no distraction in terms of loading time or anything related to the network. As a result, this study discovered a very minimal error for actual implementation.

**Product Installation**

Eventually, the interactive learning material was installed in its actual setting. It was done very carefully, comprehensively, for all users' utilization.

**Testing phase**

The testing phase was focused on determining learners' practical competency in installing electrical motor among students of Vocational High School in Langkat District. Altogether, five content experts and five instructional experts involved. User test was carried out in two cycles, the sample as user randomly selected from 963 population by using the formula Slovin (1960) obtained a sample of 283 students in which involved in the user test 1 and user test 2. For experts, they were asked on aspects related to their expertise, either content or instructional aspect. An appropriate questionnaire with the scale format of a typical five-level Likert item, are strongly disagree=1, disagree=2, neither agree nor disagree=3, agree=4, and strongly agree=5 were used to gather data, adapted from (Aziz & Mutalib, 2016).

For the purpose of data analysis, the descriptive statistic method used by Sriadhi (2014) was adapted. The analysis was stressed to analyze the effectiveness of the interactive learning material towards learning the installation of the electric motor. The following steps were followed through in ensuring the analysis meets its objective.

- The gathered questionnaires were examined to ensure the answers were complete, then they were sorted according to respondent codes.

- The answers were coded into the quantitative measure, based on the predefined scores.
- Data were tabulated.
- Transformed into interval scores as outlined in Table 1.

**Table 1**: Assessment criteria interval

| No | Interval Score | Interpretation | |
|---|---|---|---|
| 1 | 0.00 - 2.49 | Very Bad | Not Qualified |
| 2 | 2.50 - 3.32 | Bad | Less Qualified |
| 3 | 3.33 - 4.16 | Good | Qualified |
| 4 | 4.17 - 5.00 | Very Good | Excellence |

(Sriadhi, 2014)

## FINDINGS AND DISCUSSIONS

### Validation by instructional experts

The application was examined by five experts in instructional multimedia. They were asked to evaluate the instructions, the interaction in the courseware, and the display. It was carried out using a scale between 1 and 5, in which 1 means very low and 5 means very high. The outcome of the validation is detailed in Table 2.

**Table 2**: Validation by instructional experts

| | N | Mean | Std. Deviation | Agree (%) | Strongly Agree (%) |
|---|---|---|---|---|---|
| Instructions | 8 | 4.75 | 0.46 | 25.0 | 75.0 |
| Courseware Interactions | 8 | 4.63 | 0.52 | 37.5 | 62.5 |
| Display | 8 | 4.88 | 0.35 | 12.5 | 87.5 |

In Table 2, it is seen that the experts are happy with all three aspects. In detail, the lowest mean score is 4.63 with 62.5% strongly agree, for the courseware instructions. The highest mean score is 4.88 with 87.5% strongly agree for the display. This means that the experts believe that the courseware could provide a positive learning experience to the learners. Hence, they believe that the courseware is ready for use.

### Validation by Content Experts

Five content experts were involved in validating the contents from two key aspects; the instructions and real learning contents. In the end, the outcome as seen in Table 3 has been obtained.

**Table 3**: Validation by content experts

| Aspects | N | Mean | Std. Deviation | Agree (%) | Strongly Agree (%) |
|---|---|---|---|---|---|
| Instructions | 8 | 4.75 | 0.45 | 25.00 | 75.00 |
| Real Content | 8 | 4.63 | 0.52 | 37.50 | 62.50 |

With reference to the outcome in Table 3, it is seen that the content experts score very high for both instructions and the real content aspects. The mean scores are 4.63 with 62.5% strongly agree and 4.75 with 75% strongly agree respectively. This shows that the content experts believe that the application is ready for use.

### User test

User test was carried out after the expert evaluation was carried out. It was aimed at determining whether the application meets the needs of the users. The application was distributed in a CD to learners. The test was carried out in two stages, (stage 1 and stage 2) involving 283 students. Data were gathered through a questionnaire, which focuses on three aspects; the instructions, the quality of the media used in the application, and the real content. Table 4 details the results of the user test, both descriptive statistics and inferential statistical of paired samples t-test.

**Table 4**. Descriptive Statistics of user test stage 1 and stage 2, and t-test for Equality of Means

| Aspects | N | Mean | | Std. Deviation | | Agree (%) | | Strongly Agree (%) | | Paired Samples t-Test | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Stage 1 | Stage 2 | Stage 1 | Stage 2 | Stage 1 | Stage 2 | Stage 1 | Stage 2 | t | Sig. |
| Quality of Media | 283 | 4.11 | 4.33 | 0.69 | 0.64 | 51.90 | 48.80 | 29.70 | 42.00 | -5.81 | 0.00 |
| Real Content | 283 | 4.16 | 4.32 | 0.66 | 0.68 | 60.40 | 45.60 | 28.60 | 43.50 | -6.78 | 0.00 |
| Instructions | 283 | 4.34 | 4.46 | 0.62 | 0.66 | 50.20 | 36.00 | 42.00 | 54.80 | -5.16 | 0.00 |

In stage 1, the participants experienced the application themselves in their own convenience, because the application was distributed to them in a CD. Referring to the results shown in Table 4, it is seen that the lowest mean score is 4.11 and the highest mean score is 4.34 with interpretation are good or qualified. This means that the learners find the application is helpful in their learning activity. There are 51.90% and 29.70% of the participants agree and strongly agree with the quality of media, and there are 60.40% and 28.60% of the participants agree and strongly agree to the real content. Additionally, 50.20% and 42.00% of the participants agree and strongly agree with the instructions. However, they provided some comments for improving the application. Accordingly, some revisions were made to the application. The revision was focused on the interface aspects. Based on the recommendations, the colour was redesigned, to establish a contrast between foreground and background, pictures were enlarged, titles were made bold, and much more, without any content change.

After revision, stage 2 was carried out involving the same 283 learners again, testing the similar aspects (instruction, the quality of the media, and the real content). It was designed like so to prevent any bias. The results of the test are shown in Table 4. Referring to the table, it is seen that the lowest mean score is 4.33 and the highest mean score is 4.46 with the interpretation is very good or excellence. This means that the learners find the application is very potential in assisting them in their learning. Not only the content but also the interface is highly accepted by the learners. Specifically, 48.80% of the learners agree and 42.00% strongly agree with the quality of media. Meanwhile, 45.60% of the learners agree and 43.50% strongly agree with the real content, and 36.00% of the learners agree and 54.80% strongly agree with the instructions. Their comments were considered for improvement. Accordingly, the application was revised to entertain the learners' needs. The revision based on recommendations in user test stage 2 was addressed by focusing on the user interface. Similarly, with the revision after the user test stage 1, the modifications were made on colours, figures, layout, and typefaces. This is to ensure readability, visibility, and information retrieval.

Table 4 also shows the results of a paired samples t-test that was conducted to compare stage 1 and stage 2 for quality of media, real content, and instructions. For the three aspects, there is a significant difference between mean scores for quality of media in stage 1 (Mean=4.11, Std. Deviation=0.69) and in stage 2 (Mean=4.33, Std. Deviation=0.64) with $t = -3.88$, $p = 0.00$. Similarly, there is a significant difference between mean scores for real content in stage 1 (Mean=4.16, Std. Deviation=0.66) and in stage 2 (Mean=4.32, Std. Deviation=0.68) with $t = -2.82$ and $p = 0.04$. Also, there is a significant difference in mean scores for instructions between stage 1 (Mean=4.34, Std. Deviation=0.62) and stage 2 (Mean=4.46, Std. Deviation=0.66) with $t = -2.11$ and $p = 0.00$. These results explain that the application has improved significantly after the test in stage 1.

**DISCUSSION**

The results of user tests explain that the developed interactive learning media is ready for utilization especially for the installation of electrical motor course. As a courseware, it requires minimal technology, because it runs on any computer with CD or DVD ROM. For learners, this is not difficult.

From experts' views, Tables 2 and 3 exhibit that the developed interactive learning media is highly qualified for implementation in school. They believe that the interactive learning media is able to support the learning experience. With various media elements, the learning activity will be interesting, and it supports the content acquisition. Earlier, Navarro, Aguilar, Marchena, Ruiz, Menacho, and Luit (2012) and Nusir, Izzat, Al-Kabi, and Sharadgah (2013) found similar results.

Specifically, Table 4 exhibits an increase in the mean score of quality of media, real content, and instructions from tests in stage 1 to the tests in stage 2 (from 4.11, in stage 1 to 4.33, in stage 2; from 4.16, in stage 1 to 4.32, in stage 2; from 4.34, in stage 1 to 4.46, in stage 2). The differences are statistically significant with the results of t-test for Equality of Means is Sig. < 0.05. Majority of students evaluation on quality of media, real content, and instructions towards better outcomes. This improvement that shows when the interactive learning material is applaid in learning, students' learning outcomes and their retention can be improved.

Similarly, learners also believe that the developed learning material, with user control and various media elements, is able to intensify content acquisition and support positive learning experience. Such feedbacks were gathered after the developed learning material has been revised step-by-step. The revisions were made on the interface, not on the content because the contents in the interactive learning media are taken from the standardized syllabus. In terms of the interface, the revisions involve colours, graphics, animation, typeface, fonts, and layout.

Obviously, the findings in this study are consistent with findings in previous works, especially those handling

technical courses like mathematics (Huang, Liu, & Chang, 2012; Huang, Liang, Su, & Chen, 2012; Kurvinen, Lindén, Rajala, Kaila, Laakso, & Salakoski, 2012; Witte, Haelermans, & Rogge, 2014; Syah, Hamzaid, Murphy, & Lim, 2015). Not only that, it also supports the findings by Aryati, Hawaniah, Nazirahi, and AbuSafia (2014) who studied the needs of early childhood learning.

## CONCLUSION

This study attempts to provide an alternative to learning from textbooks. In the beginning of the study, learners requested for a computer-based learning material, that allows them to learn actively, and show them some practical aspects on top of theoretical explanation. Accordingly, this study designs an interactive learning media, which incorporates various media elements in teaching the installation of an electrical motor. Research and DevelopmentMethodology drive this study, which involves a number of evaluations before the application is made available for distribution.

Through the testing sessions, which involved experts and users, the results show that the developed interactive learning material is highly qualified for utilization in schools officially.

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# Learning and Teaching with Web 2.0 Applications in Saudi K-12 Schools

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**ABSTRACT**
This study aims to understand teachers' perspectives of the use of Web 2.0 applications in learning and teaching and to explore the barriers to their use. The sample of this study involved teachers from primary, middle, and secondary schools in the Kharj region. The total sample consisted of 352 teachers. A quantitative survey instrument was utilised. Analyses of the resulting data were performed using both descriptive and inferential statistics. The findings of this study indicate that most of the participant teachers are familiar with Web 2.0 applications. However, their uses in education seem to be rarely mentioned. As they reported, the top barriers preventing them from the effective use of Web 2.0 applications in education are related to school level barriers, such as the large number of students in the classroom, the lack access to the Internet in schools, and the lack of a clear plan for the use of Web 2.0 in education. The findings also show that there is a significant difference in teacher responses about Web 2.0 applications in education in accordance with gender, educational levels, and teaching subjects. Finally, recommendations for teachers, educators and educational decision and policy-makers are provided. Recommendations for further research are also offered.

**Keywords:** Web 2.0 applications, teachers, technology, education, K-12 schools, Saudi Arabia

## INTRODUCTION

The use of Information and Communication Technology (ICT) in education has been believed to improve learning and teaching environments (Bransford, Brown & Cocking, 2000; Grabe & Grabe, 2007; Lefebvre, Deaudelin & Loiselle, 2006; Romeo, 2006). The Internet is continually growing and moving from searching tools of information to creating content and collaborating among users. Web 2.0 tools are expected to assist teachers and students to create an effective learning and teaching environment and facilitate blended learning (Majid, 2014). Web 2.0 applications are being implemented at all levels of education with the intention of enhancing learning and teaching (Anastasiades & Kotsiadis, 2013). Web 2.0 tools have impacted a variety of life skills including promoting sharing, collaboration, interaction, socialisation, creativity, autonomy and communication, teamwork, and inventive thinking (Karkoulia, 2016; Kontogeorgi, 2014).

There is evidence that the majority of teachers have a positive attitude towards the integration of Web 2.0 tools into teaching (Karkoulia, 2016; Majid, 2014). However, teachers' uses of Web 2.0 tools in learning and teaching environments still need to be investigated and measured.
Saudi Arabia has expended effort, money and time, to provide new technologies to schools. However, most educators and decision makers concern about whether or not teachers use new technologies in their teaching effectively (Bingimlas, 2010). Many Saudi researchers have been interested in studying the importance of using new technology in education. Several Saudi studies discussed the use of Web 2.0 in high education (i.e. Alhazani 2013; Algumaizy & Alghimlas, 2016; Maatouk 2013). However, rare studies have focused on the use of Web 2.0 in the Saudi middle schools. This study aims to understand Saudi teachers' perspectives of the use of Web 2.0 applications in learning and teaching and to explore the barriers to their use.

## WHAT IS WEB 2.0?

The term Web 2.0 was founded by O'Reilly (2005) referring to a new generation of World Wide Web tools that enable users to create and share their own content. Web 2.0 applications can be described as technologies that facilitate online collaboration and interaction with users. This depends on the behaviour of users who need to be more active and collaborative, generative, interactive (Anastasiades & Kotsiadis, 2013). According to Redecker, Ala-Mutka, Bacigalupo, Ferrari and Punie (2009), Web 2.0, sometimes called "*social computing*", refers to "the range of digital applications that enable interaction, collaboration and sharing between users" (p.19). From their experiences, teachers who participated in a study conducted by Kiyici (2010) defined some popular Web 2.0 applications. For instance, they defined forums as tools used to share and discuss, and blogs as the technologies

used to create personal web sites and share information and experiences. They defined the concept of a wiki as an application used like encyclopaedia and dictionary sites.

**WEB 2.0 IN EDUCATION**

The idea of using Web 2.0 applications may be based on several learning theories. Dumitrescu (2015) argued that, with the use of Web 2.0, learning and teaching approaches seemed to be based on the theories of connectivism of cognition and instruction. However, they cannot discard other learning theories such as traditional-behaviourist, cognitivist, and constructionist, on which technologies may rely to a lesser extent than connectivism. Farkas (2012) argued that when teachers use Web 2.0 in the classroom learning environment, they need to understand social constructivist and connectivism pedagogy.

Web 2.0 applications have the potential benefit to establish effective teaching and learning environments. For example, Rogers-Estable (2014) suggested that Web 2.0 tools offer opportunities for learning, whilst creating connection and interaction between teachers and students inside and outside of the classroom. These tools help students to create groups for sharing, collaborating, and growing together. Aman et al. (2016) also found that Web 2.0 has contributed to sharing knowledge as it can help students in content sharing, collaboration, and communication. Similarly, Wheeler (2010) found that the use of Web 2.0 helps students who are geographically separated to interact, communicate, and share the learning content of the courses. An et al. (2009) concluded that Web 2.0 applications have allowed users to share content online and to connect with other users who have similar interests. Students using Web 2.0 tools can create, produce, edit, and evaluate knowledge (Richardson, 2009). This can help teachers to create effective student-centred learning environments. According to An et al. (2009), the use of Web 2.0 applications in teaching include building a sense of community and increasing interaction and communication among teachers, students, and other people.

Moreover, Web 2.0 applications can increase students' motivations (Becta, 2008; Karkoulia, 2016). A recent study conducted by Majid (2014) indicated that the perceptions of students towards the use of Web 2.0 applications were positive. Dumitrescu (2015) found that the integration of Web 2.0 into classroom learning helps teachers to expand and diversify teaching and learning approaches, and thus increases student motivation and engagement.

Furthermore, the use of Web 2.0 applications in learning and teaching environments provide valuable pedagogical tools. For instance, Newland and Byles (2014) argued that the use of Web 2.0 applications can create a different pedagogical approach through collaborative learning and the social creation of knowledge. Learning and teaching with Web 2.0 requires new teaching and learning skills. The new learning approach, called “learning 2.0” by Redecker et al., (2009) requires teachers who can act as guides, coaches, facilitators, and moderators, who provide a supportive, collaborative and interactive learning environment. In a similar view, Farkas (2012) called the new learning as "Pedagogy 2.0", which can be described as a learning ecology that unlocks the benefits of participatory technologies (p. 11). Such an environment allows for the creation of a learning community among students who can contribute to and discuss collaborative thinking and understanding of the topic. Recent studies have emphasised the significant need to adjust traditional methods of education to suit the new technological era and students' mindsets, needs, and expectations (Dumitrescu, 2015; Wilson, 2015). In other words, the new teaching and learning methods that use new technologies, especially Web 2.0, should be student-centred methods that encourage student autonomy, interactivity, collaboration, creativity, and critical thinking.

The use of Web 2.0 applications can also help to develop high level skills when they are used with pedagogical conditions. For example, Anastasiades and Kotsidis (2013) suggest that the use of Web 2.0 in education can develop critical thinking skills, meta-cognitive abilities, and problem-solving skills.

There are hundreds of Web 2.0 applications offering opportunities for creative interaction and the number continues to increase (Karkoulia, 2016). The literature suggests that the top Web 2.0 tools used in education include blogs, wikis, social networking sites such as Facebook and Twitter, video sharing (YouTube), podcasts, and discussion forums (Ahmed, Almuniem & Almabhouh, 2016; Brcta, 2008; Rogers-Estable, 2014). According to Kiyici (2010), teachers can define most of the Web 2.0 applications such as forums, wikis, blogs and social websites, but they have difficulty in defining Really Simple Syndication (RSS) and bookmarking applications. These Web 2.0 applications seem to be very popular and appear to be part of the daily lives of many students. Therefore, these are applications on which this study will focus.

## EXAMPLES OF WEB 2.0 APPLICATIONS IN EDUCATION

There are several studies examining specific Web 2.0 applications regarding their use in education. For example, Churchill (2011) argues that blogs seem to be student-centred learning tools; a blog-based environment allows students to access course material, to post reflections on learning tasks, to comment on each other's contributions, and to participate on a regular basis throughout the semester. He concluded that blogs have the potential to support learning and teaching activities. The potential pedagogical use of blogs includes online diaries, discussion fora, or communicative channels; they can encourage students to discuss what they have already learned in the classroom (Anastasiades & Kotsiadis, 2013).

Twitter is a popular micro blogging application that allows users to send and receive brief text, images, and video online. Bicen and Cavus (2012) assert that Twitter can be used as a professional and social networking tool because people can share their interests via Twitter. They found that the most commonly shared items on Twitter are quotes, photos, videos, music, news, IT news, and magazine news.

Grosseck and Holotescu (2008) suggest several advantages of Twitter as an educational tool, such as building a classroom community, collaborating across schools and countries, assessing opinions, encouraging education and sharing best practices, getting helpful information, and making quick announcements. Twitter was proved to be used as an instructional tool (Yakin & Tinmaz, 2013). It can enhance students' interaction with their teachers; it can help communication among students and can enable access to information related to lesson materials (Rinaldo, Tapp & Laverie, 2011). In another study, Kassens-Noor (2012) explored the learning and teaching practices of Twitter as an active, informal, outside-of-class learning tool through a comparative experiment in a higher education classroom setting. The study found that Twitter offers advantages for learning and teaching environments rather than traditional teaching environments. He concluded that Twitter could bring advantages to the e-learning community in higher education. However, Grosseck and Holotescu (2008) argued some negative points of Twitter, such as it being a time-consuming task, not supporting rich learning for students, (sometimes) no social/educational value, Twitter’s privacy issues, and Twitter’s spam problems.

Facebook is the most popular social network that allows students to communicate, interact, and share with others (Anastasiades & Kotsiadis, 2013). Students appear to be motivated to use Facebook. For example, Roblyer, McDaniel, Webb, Herman and Witty's (2010) findings indicate that students were using Facebook more than faculty members, but members were using traditional technologies such as email much more than the students. They also reported that students were significantly more open to using Facebook and similar technologies to support classroom work.

Another example of Web 2.0 in education is discussion boards (forums). Aljeraisy, Mohammad, Fayyoumi and Alrashideh (2015) conclude that discussion boards have a positive impact on students' grades and students' satisfaction with the learning environment. They assert that online forums can encourage students' activity, collaboration, reflection, motivation and social constructivist attributes of learning when they are well designed. However, they may have negative impacts, including their time-consuming nature, and being discouraging when there are too many long posts.

YouTube has been proved to improve learning and teaching approaches. Wilson (2015) argued that teachers' use of YouTube in their teaching practices has valuable learning resource as it can increase student engagement and reduce classroom management issues. In his study, Jaffar (2012) found that there was an awareness about using YouTube in education because it can be an effective tool to enhance anatomy learning if the videos are scrutinised, diversified, and are aimed towards course objectives.

Wikis were introduced more than twenty years ago. Although they do not appear to be used in all schools in the world, many researchers suggest that wikis can facilitate communication, collaboration, and the sharing of knowledge (Parker & Chao, 2007; Reinhold, 2006). According to Parker and Chao (2007), the most commonly listed learning paradigms that can be supported by wiki applications are "the cooperative/collaborative learning paradigm and the constructivist paradigm" (p.58). In their study, Chen, Jang and Chen (2015) found that the use of wikis in education assisted science teachers to generate imaginative teaching strategies and to design more understandable science teaching content. Similarly, a recent study conducted by Fuchs (2015) showed that teachers used wikis as discussion tools, designing tasks and writing collaboratively. Another recent study (Lau, Lui, & Chu, 2016) concluded that a well-planned wiki-based learning experience supported young students to develop their Internet searching skills, their collaborative problem solving competencies, and their critical inquiry abilities.

WhatsApp is one of many applications that provide cross-platform communication, such as Skype, Viber, Facebook Messenger, Google Hangouts, Kik, and WeChat. Susanti and Tarmuji (2016) utilised the features of the WhatsApp application, such as share audio, video, picture, links, document, create groups, and text, and explained several techniques of writing activities to help students in developing their English writing skills using WhatsApp. The techniques are brainstorming, group drafting, quick writing, peer feedback, information gathering, preparing exercises and checklist. Several researchers have studied the impact of WhatsApp on education. For example, Sayan (2016) found that the use of WhatsApp has a positive effect on students' achievement and performance by preparing them for their final exams. He stated that "using WhatsApp application, offers external activity around student-centered learning for the exam preparation in order to raise their achievement" (p. 88). However, Yeboah and Ewur (2014) explored the impact of WhatsApp messenger on the tertiary students' performance and found that most students (76%) indicated that WhatsApp had a negative effect on their performance. This is because WhatsApp is time consuming, it weakens students' language grammatical skills, and it may lead to losses of concentration during lectures.

In general, the integration of Web 2.0 applications into learning and teaching environments has many advantages but it may not be an easy way of teaching. It requires new thinking around the concept of pedagogy as the process needs a high level of support from both pedagogical teams and technical specialists (Newland & Byles, 2014). The following discusses the literature about the possible barriers to the use of Web 2.0 in education.

## BARRIERS TO THE USE OF WEB 2.0 IN EDUCATION

There are several barriers to the use of Web 2.0 in teaching and learning. Many studies have attempted to categorise the barriers to the use of these technologies. Ertmer (1999) grouped the barriers into two categories: first-order barriers extrinsic to teachers (i.e. access, time, support, resources, training) and second-order barriers intrinsic to teachers (i.e. attitudes, beliefs, practices, resistance). Similarly, Rogers-Estable (2014) stated that some of the barriers to the use of ICT in education are extrinsic, such as time, training, and support. Others are intrinsic, such as beliefs, motivation, and confidence. However, Becta (2004) grouped the barriers according to whether they relate to the individual (teacher-level barriers), such as lack of time, lack of confidence, and resistance to change, or to the institution (school-level barriers), such as lack of effective training and lack of access to resources. Likewise, Bingimlas (2009) classified barriers into two groups including teacher-level barriers such as confidence, competence, and resistance to change, and school-level barriers such as time, support, and accessibility.

Several studies have found that these barriers are preventing teachers from using Web 2.0 in education. For example, An et al. (2009) conclude that there are three main barriers to teaching with Web 2.0: uneasiness with openness, technical problems, and time. Similarly, Karkoulia (2016) suggests that the main barriers to the use of web 2.0 in teaching include a lack of training and a lack of technological equipment.

Some other barriers to the use of Web 2.0 in education were found to be related to privacy issues and the reliability of information. For example, Amin, Hasnan, Besar & Almunawar (2016) concluded that teachers did not prefer to use Web 2.0 in their teaching due to privacy issues and outdated and unreliable information on websites. A lack of awareness of legal and copyright issues when using external resources (Becta, 2008) were also barriers related to privacy.

To sum up, reviewing the literature showed that K-12 teachers have shown positive attitudes towards the use of Web 2.0 applications in the learning and teaching processes. Many studies have addressed the situation of using a specific Web 2.0 tool, such as Facebook, wikis, blogs, Twitter, and YouTube in education. They can be used in K-12 education effectively. However, this may require a change in the teacher's role in the classroom; teachers may face several barriers to the effective use of Web 2.0 in education such as time, privacy, confidence, and training.

## RESEARCH QUESTIONS

The main purpose of this study is to explore the extent of teachers' use of Web 2.0 applications in teaching and learning. Thus, the research questions are as follows:

1- To what extent are teachers familiar with Web 2.0 applications?
2- How often do teachers use Web 2.0 applications in education?
3- What are the barriers to the use of Web 2.0 applications in education?
4- Is there a significant difference in teachers' responses about Web 2.0 applications in education in accordance with gender, teaching subjects, educational level, and teaching experiences?

## RESEARCH METHOD

The sample of this study involved teachers from primary, middle, and secondary schools in the Kharj region. Kharj is a big city, which lies 85 kilometres south of Riyadh. The total sample in this study consisted of 352 teachers.

The population of this study included teachers, male and female in Saudi schools. More specifically, the target groups were teachers of schools in the General Directorate of Education in the Kharj Region. For the sample design, a questionnaire was designed and distributed by using an online survey through the Google Forms. This method offers a low cost for data collection, time shortcut, potential high speed return (Aljerasiy, et al., 2015). All teachers (about 8000 teachers) in the Kharj Region were invited by email to participant in this survey. The General Directorate of Education provided the researcher with teachers' emails. The total completed responses of the teacher questionnaires were 352 including 157 males and 195 females. Seven questionnaires were invalid because the teachers appeared to answer randomly or of incomplete and meaningless data.

Some demographic information about the participants has been provided in Table 1. As shown in the table, the sample of the study involved 157 males and 195 females, composed of 125 primary school teachers, 77 middle school teachers and 156 secondary school teachers. Moreover, about half of them (54%) have teaching experience of more than 10 years and approximately 28% have teaching experience from five to less than 10 years.

**Table 1**: The frequencies and percentages according to demographic information.

| Variables | Answers | Frequencies | Percentages |
|---|---|---|---|
| Gender | Male | 157 | 44.6% |
| | Female | 195 | 55.4% |
| | Total | 352 | 100.0% |
| Teaching experience | Less than 5 | 63 | 17.9% |
| | 5-10 | 99 | 28.1% |
| | More than 10 | 190 | 54.0% |
| | Total | 352 | 100.0% |
| educational level | Primary | 125 | 35.5% |
| | Middle | 77 | 21.9% |
| | Secondary | 150 | 42.6% |
| | Total | 352 | 100.0% |
| Teaching subject | Islamic studies | 89 | 25.3% |
| | Arabic Language | 66 | 18.8% |
| | Sciences | 65 | 18.5% |
| | English Language | 12 | 3.4% |
| | Mathematics | 26 | 7.4% |
| | Social studies | 22 | 6.3% |
| | Computer | 22 | 6.3% |
| | Other | 50 | 14.2% |
| | Total | 352 | 100.0% |

In this study, a quantitative survey instrument was utilised. It was self-administered because participants were allowed to complete it at their own chosen place and at any time that was convenient for them (c.f. Robson, 2002). The survey was developed by the researcher to gather demographic information and descriptive data regarding teachers' views about Web 2.0 applications in education. The basis for the survey items was derived from the review of the literature and the objectives of this study. The survey had two parts. The first part was designed to collect demographic information such as participants' gender, school grades (whether primary, middle or high), teachers' subjects and their teaching experience. This was useful for understanding participants' backgrounds and helped in testing different variables. The second part included 35 items and was divided into three sections: 1) understanding teachers' knowledge of Web 2.0, 2) exploring their use of Web 2.0 tools in the teaching and learning processes, and 3) determining the main barriers to employing Web 2.0 in education at Saudi K-12 schools. In the first two sections, measurement scales for the items were 5-point Likert scales and, in the third section, they were 4-point Likert scales.

## MEASURES

The survey was piloted to increase its validity (Roberts, 1999). This allowed for some suggestions to occur that helped to address any misinterpretation or ambiguity. The survey was also given to a panel of expert university faculty members from within the Saudi context in the field of educational technology and pedagogy. They provided feedback and suggestions to help in revising any ambiguous or unclear text.

The reliability coefficient was examined by using Cronbach's Alpha (Cronbach, 1951), which is generally used to measure the reliability of a set of items in a survey. Cronbach's Alpha was examined for the main three sections as shown in Table 2.

**Table 2:** The reliability coefficients Cronbach's alpha

| Sections | Items | Coefficients Cronbach's alpha |
|---|---|---|
| Teachers knowledge of Web 2.0 | 10 | 0.866 |
| Teachers use of Web 2.0 in education | 10 | 0.888 |
| Barriers to the use of Web 2.0 in education | 15 | 0.840 |
| Total (n=352) | 35 | 0.859 |

The analysis showed that the reliability coefficients of Cronbach's Alpha for the three sections ranged from .840 for the barriers section to .888 for the usage section. A value of Cronbach's Alpha that indicates an acceptable level of reliability has generally been .7 or higher (Field, 2009).

## DATA ANALYSIS METHOD

Analyses of the resulting data were performed using both descriptive and inferential statistics. Descriptive measures, including percentages, mean, and standard deviations were calculated to answer the first three research questions, including teachers' knowledge of Web 2.0, teachers' use of Web 2.0 in education, and barriers to the use of Web 2.0 in education. The interpretation of the mean scores was based on the length of the cells as shown in Table 3.

**Table 3:** Interpretation of mean scores

| Sections | Mean scores | interpretation |
|---|---|---|
| Teachers knowledge of Web 2.0 | 1.00 – 1.79 | Not at all familiar |
| | 1.80 – 2.59 | Slightiy familiar |
| | 2.60 – 3.39 | Somewhat familiar |
| | 3.40 – 4.19 | Moderately familiar |
| | 4.20 – 5.00 | Extremely familiar |
| Teachers use of Web 2.0 in education | 1.00 – 1.79 | Never |
| | 1.80 – 2.59 | Rarely |
| | 2.60 – 3.39 | Sometimes |
| | 3.40 – 4.19 | Often |
| | 4.20 – 5.00 | Always |
| Barriers to the use of Web 2.0 in education | 1.00 – 1.74 | Does not limits |
| | 1.75 – 2.49 | Slightly limits |
| | 2.50 – 3.24 | Somewhat limits |
| | 3.25 – 4.00 | Greatly limits |

Inferential statistics were used, including independent samples *t*-tests, to see the significant differences between the mean of the responses of the study sample according to gender. One Way ANOVA was used to see the significant differences between the mean of the responses within the study sample according to teaching experiences, educational levels, and teaching subjects. Fisher's LSD (Least Significant Difference) test was used to see any significant differences in each of the two groups. This technique was used to compute the smallest significant difference between the two means (Abdi & Williams, 2010). All these statistics were performed using the Statistical Package for Social Sciences (SPSS) and were symbolised by the short code (IBM-SPSS statistics, 23).

## RESULTS

The main purpose of this study is to investigate Saudi K-12 teachers' understanding of Web 2.0. In particular, this study aims to answer four main questions about teachers' familiarity with Web 2.0 applications, teachers'

use of Web 2.0 applications in education, barriers to the use of Web 2.0 applications in education, and the differences in teachers' responses about Web 2.0 applications in accordance with gender, teaching subjects, educational level, and teaching experiences. Therefore, this section is divided into four main headings according to these questions.

**FIRST QUESTION ABOUT TEACHERS' KNOWLEDGE OF WEB 2.0 APPLICATIONS**

Descriptive measures, including the mean and standard deviation, were calculated to answer the first question: To what extent are teachers familiar with Web 2.0 applications? The study has also included the percentage of the participants who rated the items either *extremely familiar* or *moderately familiar* in one column and *slightly familiar* or *not at all familiar* in another column. This gives an even clearer measure of the way that the participants rated corresponding items. As shown in Table 4, there are ten items that are related to the participants' perspective about teachers' familiarity with Web 2.0 applications.

**Table 4:** Descriptive statistics of the participants' perspective about their familarity with Web 2.0 applications

| Items | Familiar (%)** | Slightly familiar (%)* | Mean | SD | Ranking | Interpretation |
|---|---|---|---|---|---|---|
| Instant messaging (WhatsApp, Kik, Tango) | 86.9% | 4.5% | 4.49 | 0.93 | 1 | Extremely familiar |
| Social Networks (Twitter, Snapchat, Facebook) | 82.4% | 4.6% | 4.39 | 1.01 | 2 | Extremely familiar |
| Video sharing (YouTube) | 68.7% | 19.4% | 3.93 | 1.45 | 3 | Moderately familiar |
| Google applications (Google Doc) | 65.1% | 23.3% | 3.73 | 1.48 | 4 | Moderately familiar |
| Photo sharing (Flicker, Instagram) | 63.0% | 24.4% | 3.71 | 1.50 | 5 | Moderately familiar |
| Video chatting (Skype) | 51.7% | 38.7% | 3.24 | 1.71 | 6 | Somewhat familiar |
| Wiki (Wikipedia) | 27.6% | 55.4% | 2.50 | 1.59 | 7 | Slightly familiar |
| Blogs (Blogger, WordPress) | 26.4% | 59.4% | 2.33 | 1.57 | 8 | Slightly familiar |
| Really Simple Syndication (RSS) (Google reader) | 24.8% | 63.4% | 2.30 | 1.57 | 9 | Slightly familiar |
| Learning Management System (Moodle, Blackboard) | 25.0% | 66.4% | 2.21 | 1.57 | 10 | Slightly familiar |
| **Overall mean** (n=352) | | | **3.28** | **0.98** | - | Somewhat familiar |

** Percentage of the participants who indicated either *Extremely familiar* or *Moderately familiar* for the items
* Percentage of the participants who indicated either *Slightly familiar* or *Not at all familiar* for the items

The above table shows that most of the participant teachers reported themselves as being somewhat familiar with Web 2.0 applications. For example, approximately 87% of them were extremely familiar with instant messaging such as WhatsApp, Kik, and Tango. More than three quarters of the participants were also extremely familiar with social networks such as Twitter, Snapchat, and Facebook. However, more than half of the participant teachers reported themselves as being unfamiliar with wikis, blogs, RSS and Learning Management Systems (LMSs) (e.g. Moodle, Blackboard).

**SECOND QUESTION ABOUT TEACHERS' USE OF WEB 2.0 APPLICATIONS IN EDUCATION**

The second question is about how often Saudi teachers use Web 2.0 applications in education. Descriptive statistics, including percentages, the mean, and standard deviation were calculated to explore this question. As explained previously, the percentage of the participants who rated the items either *often* or *always* was put in one column and *never* or *rarely* in another column.

**Table 5:** Descriptive Statistics of the participants' perspective about their use of Web 2.0 applications in education

| Items | Often (%)** | Rarely (%)* | Mean | SD | Ranking | Interpretation |
|---|---|---|---|---|---|---|
| Instant messaging (WhatsApp, Kik, Tango) | 42.0% | 40.7% | 2.98 | 1.61 | 1 | Sometimes |
| Video sharing (YouTube) | 38.6% | 39.2% | 2.95 | 1.49 | 2 | Sometimes |
| Social Networks (Twitter, Snapchat, Facebook) | 38.6% | 48.0% | 2.81 | 1.61 | 3 | Sometimes |
| Google applications (Google Doc) | 27.2% | 54.3% | 2.53 | 1.49 | 4 | Rarely |
| Photo sharing (Flicker, Instagram) | 21.6% | 61.3% | 2.26 | 1.45 | 5 | Rarely |
| Blogs (Blogger, WordPress) | 12.3% | 77.6% | 1.74 | 1.23 | 6 | Never |
| Really Simple Syndication (RSS) (Google reader) | 11.9% | 78.4% | 1.69 | 1.28 | 7 | Never |
| Wiki (Wikipedia) | 10.8% | 80.7% | 1.65 | 1.15 | 8 | Never |
| Learning Management System (Moodle, Blackboard) | 10.2% | 82.1% | 1.61 | 1.19 | 9 | Never |
| Video chatting (Skype) | 9.7% | 82.1% | 1.59 | 1.15 | 10 | Never |
| Overall mean (n=352) | | | 2.18 | 0.97 | - | Rarely |

** Percentage of the participants who indicated either often or always for the items.
* Percentage of the participants who indicated either never or rarely for the items

Table 5 shows that the participant teachers rarely used Web 2.0 applications in their teaching and learning processes. Generally, less than half of them reported using Web 2.0 applications in education. For instance, although some of the participant teachers (about 40%) used instant messages and video sharing services such as YouTube in their teaching, only approximately 10% of them used wikis (e.g. Wikipedia), an LMS (e.g. Moodle, Blackboard), or video chat (e.g. Skype).

**THIRD QUESTION ABOUT BARRIERS TO THE USE OF WEB 2.0 APPLICATIONS IN EDUCATION**

The third research question concerns the barriers to the use of Web 2.0 applications in education. In this question, the mean and standard deviation were calculated. The percentage of the participants who rated the items was presented in two columns, comparing the *greatly limits* and *somewhat limits* in one column and *slightly limits* and *does not limits* in another column. See Table 6.

**Table 6:** Descriptive statistics of the participants' perspectives about barriers to the use of Web 2.0 applications in education

| Statements | limited (%)** | Not limited (%)* | Mean | SD | Ranking | Interpretation |
|---|---|---|---|---|---|---|
| The large number of students in the classroom | 75.9% | 24.2% | 3.20 | 1.11 | 1 | Somewhat limits |
| No Internet in my school | 69.9% | 30.2% | 3.02 | 1.17 | 2 | Somewhat limits |
| The lack of a clear plan for the use of Web 2.0 applications in education | 69.6% | 30.4% | 2.96 | 1.06 | 3 | Somewhat limits |
| Preventing students from using the smart phones in the school by school administrators | 60.5% | 39.5% | 2.80 | 1.27 | 4 | Somewhat limits |
| The weakness of the impact of the use of Web 2.0 applications in education | 59.4% | 40.6% | 2.76 | 1.10 | 5 | Somewhat limits |
| A lack of basic skills in the use | 59.1% | 40.9% | 2.75 | 1.10 | 6 | Somewhat |

| | | | | | | |
|---|---|---|---|---|---|---|
| of Web 2.0 applications in education | | | | | | limits |
| The weakness of the incentives that lead me to use Web 2.0 applications in education | 59.4% | 40.7% | 2.75 | 1.15 | 7 | Somewhat limits |
| The weakness of teachers' encouragement by school administrators | 57.9% | 42.1% | 2.68 | 1.16 | 8 | Somewhat limits |
| Preparation for using Web 2.0 in education consumes my time and effort outside the official working time | 55.1% | 44.9% | 2.60 | 1.03 | 9 | Somewhat limits |
| The large amount of content that I teach | 54.8% | 45.2% | 2.57 | 1.16 | 10 | Somewhat limits |
| I do not know how to use Web 2.0 applications | 50.8% | 49.1% | 2.48 | 1.13 | 11 | Slightly limits |
| I believe that Web 2.0 applications are related to personal issues. | 41.2% | 58.8% | 2.31 | 1.10 | 12 | Slightly limits |
| a negative attitude of my school administrators towards using Web 2.0 applications in education | 41.8% | 58.2% | 2.28 | 1.19 | 13 | Slightly limits |
| I believe that there are other teaching approaches better than using the web 2.0 | 32.1% | 67.9% | 2.18 | 0.99 | 14 | Slightly limits |
| The use of Web 2.0 applications is not suitable in my area | 35.6% | 64.5% | 2.15 | 1.10 | 15 | Slightly limits |
| Overall mean (n=352) | | | 2.63 | 0.63 | - | Somewhat limits |

** Percentage of the participants who indicated Greatly limits or Somewhat limits for the items.
* Percentage of the participants who indicated either Slightly limits or Does not limits for the items

Table 6 shows the participant teachers ratings regarding the barriers to their use of Web 2.0 applications in teaching and learning. The top three barriers were reportedly the large number of students in the classroom, no access to the Internet at their school, and the lack of a clear plan for the use of Web 2.0 applications in education. On the other hand, other barriers were reported most often as barriers only slightly limiting or not limiting their use. These barriers included the negative attitudes of the school administrators towards using Web 2.0 applications in education, teachers' beliefs that there are other teaching approaches that are better than using Web 2.0, and that the use of Web 2.0 applications is not suitable in their area.

**FOURTH QUESTION ABOUT THE VARIABLE DIFFERENCES**

The fourth research question is about whether or not there is a significant difference in teacher responses about Web 2.0 applications in education in accordance with gender, teaching experiences, educational levels, and teaching subjects. Here is the answer to this question.

***Gender differences***

To examine the differences between male and female participant teachers about Web 2.0 applications in education, the mean scores, standard deviations, Independent Samples *t*-test and the Cohen's *d* effect size were conducted as shown in Table 8. The standardised mean difference statistic, referred to as *d* (Cohen, 1988), is a scale-free measure of the separation between two group means. Both the Cohen (*d*) and Pearson correlation (*r*) are measures of effect size. However, *d* may be favoured because the group sizes are discrepant and, in this case, *r* can be quite biased compared to *d* (Field, 2009).

**Table 7:** Descriptive statistics and *t*-tests for the differences between male and female teachers for Web 2.0 applications in education in accordance with gender

| Sections | Male (n= 157) | | Female (n= 195) | | t-value | P | Effect size (Cohen's *d*) |
|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | | |
| Teachers knowledge of Web 2.0 | 3.25 | 0.97 | 3.31 | 0.99 | -.651 | 0.515 | -0.06 |
| Teachers use of Web 2.0 in education | 1.94 | 0.99 | 2.37 | 0.92 | -4.17** | 0.000 | -0.45 |
| Barriers to the use of Web 2.0 in education | 2.72 | 0.59 | 2.56 | 0.65 | 2.30* | 0.022 | -0.26 |

** Statistically significant at level <0.01
* Statistically significant at level <0.05

The *t*-test results shown in Table 8 reveal that there are statistically significant differences between the male and female participant teachers in their views about the use of Web 2.0 applications; *t*-values reached -4.17 with p-values of <0.01 in favour to female teachers. There are also statistically significant differences between the male and female participant teachers in their views about the barriers to the use of Web 2.0 applications in education, where *t*-values reached -2.30, with corresponding *p*-values of <0.05 in favour to male teachers. However, the differences are not large, as the effect sizes are 0.45 and 0.26, which are medium-sized effects (Cohen, 1988). Cohen labelled an effect size large if *d* equal 0.80 or above and small if *d* equal 0.20.

***Teaching experiences differences***

To examine the significant differences between the teachers' views about Web 2.0 applications in education according to their teaching experience, One Way ANOVA was performed as shown in Table 8. Moreover, the effect size for One-Way ANOVA was calculated using between and within group variances.

**Table 8:** Descriptive statistics and One Way ANOVA for the three sections in teacher responses about Web 2.0 applications in education in accordance with teaching experiences

| Sections | Sources of variation | Sum of Squares | Df | Mean Square | F | *P*-Value (Sig.) | *Effect size* |
|---|---|---|---|---|---|---|---|
| Teachers knowledge of Web 2.0 | Between Groups | 5.541 | 2 | 2.771 | 2.904 | 0.056 | 0.2390 |
| | Within Groups | 332.930 | 349 | 0.954 | | | |
| | Total | 338.471 | 351 | | | | |
| Teachers use of Web 2.0 in education | Between Groups | 0.261 | 2 | 0.131 | 0.138 | 0.872 | 0.0281 |
| | Within Groups | 331.317 | 349 | 0.949 | | | |
| | Total | 331.578 | 351 | | | | |
| Barriers to the use of Web 2.0 in education | Between Groups | 0.96 | 2 | 0.048 | 0.122 | 0.885 | 0.0837 |
| | Within Groups | 137.121 | 349 | 0.393 | | | |
| | Total | 137.217 | 351 | | | | |

The findings from the above table indicate that there are no statistically significant differences among the participant teachers, where the *p*-value is larger than 0.05 in relation to the three sections according to their teaching experience with small effect sizes.

***Educational level differences***

One Way ANOVA was used to determine the significance differences between the mean of the responses according to educational levels as shown in Table 10.

**Table 9:** Descriptive statistics and One Way ANOVA for the three sections in teacher responses about Web 2.0 applications in education in accordance with educational levels.

| Sections | Sources of variation | Sum of Squares | Df | Mean Square | F | *P*-Value (Sig.) | *Effect size* |
|---|---|---|---|---|---|---|---|
| Teachers knowledge of Web 2.0 | Between Groups | 4.860 | 2 | 2.430 | 2.542 | .080 | 0.1207 |
| | Within Groups | 333.611 | 349 | .956 | | | |
| | Total | 338.471 | 351 | | | | |
| Teachers use of Web 2.0 in education | Between Groups | 5.570 | 2 | 2.785 | 2.981 | .052 | 0.1307 |
| | Within Groups | 326.009 | 349 | .934 | | | |
| | Total | 331.579 | 351 | | | | |
| Barriers to the use of Web 2.0 in education | Between Groups | 4.096 | 2 | 2.048 | 5.370* | .005 | 0.1754 |
| | Within Groups | 133.121 | 349 | .381 | | | |
| | Total | 137.217 | 351 | | | | |

* Statistically significant at level <0.05

The One-Way ANOVA results reveal that there are no statistically significant differences between responding teachers' ratings in relation to educational levels in teachers' knowledge of Web 2.0 applications and teachers' use of Web 2.0 applications in education, as *p*-values reached greater than 0.05. However, the findings indicate that there are significant differences in the barriers to the use of Web 2.0 applications in the education section according to the educational levels variable at level p-values of<0.05. To determine which pairs of the group means differed, post hoc comparisons using Fisher's LSD test were utilised, as shown in Table 10.

**Table 10:** Fisher's LSD post hoc results of standardized test scores by educational level

| Sections | Stages | Mean | Primary | Middle | Secoundary |
|---|---|---|---|---|---|
| Barriers to the use of Web 2.0 in education | Primary Schools | 2.78 | - | | |
| | Middle Schools | 2.59 | * | - | |
| | Secondary Schools | 2.55 | * | * | - |

* Statistically significant at level <0.05

There are statistically significant differences in the section of barriers to the use of Web 2.0 in education between primary schools (Mean=2.78) and both middle schools (Mean = 2.59) and secondary schools (Mean = 2.55), in favour to primary schools at level p-values of <0.05. Similarly, the results indicate that there are statistically significant differences at the same level (p-value <0.05) between middle schools and secondary schools in favour to middle schools.

***Teaching subject differences***

To determine the significant differences between the teachers' views about Web 2.0 applications in education according to their teaching subjects, One Way ANOVA was performed as shown in Table 11.

**Table 11:** Descriptive statistics and One Way ANOVA for the three sections in teacher responses about Web 2.0 applications in education in accordance with teaching subjects

| Sections | Sources of variation | Sum of Squares | Df | Mean Square | F | *P*-Value (Sig.) | *Effect size* |
|---|---|---|---|---|---|---|---|
| Teachers knowledge of Web 2.0 | Between Groups | 62.346 | 7 | 8.907 | 11.096** | 0.000 | 0.4752 |
| | Within Groups | 276.125 | 344 | 0.803 | | | |
| | Total | 338.471 | 351 | | | | |
| Teachers use of Web | Between | 14.521 | 7 | 2.074 | 2.251* | 0.030 | 0.2140 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.0 in education | Groups | | | | | | |
| | Within Groups | 317.058 | 344 | 0.922 | | | |
| | Total | 331.579 | 351 | | | | |
| Barriers to the use of Web 2.0 in education | Between Groups | 6.230 | 7 | 0.890 | 2.337* | 0.024 | 0.2181 |
| | Within Groups | 130.987 | 344 | 0.381 | | | |
| | Total | 137.217 | 351 | | | | |

** Statistically significant at level <0.01
* Statistically significant at level <0.05

The results indicate that there are statistically significant differences between responding teachers' ratings in relation to their teaching subjects in all sections about Web 2.0 applications in education, as p-values reached <0.05 and <0.01. The effect size was calculated and shown as large. In this case, post hoc comparisons using Fisher's LSD test were calculated to determine which pairs of the group means differed, as shown in Table 12.

**Table 12:** Fisher's LSD post hoc results of standardized test scores by teaching subjects

| Sections | Subjects | Mean | Islamic studies | Arabic Language | Sciences | English Language | Mathematics | Social studies | Computer | Other |
|---|---|---|---|---|---|---|---|---|---|---|
| Teachers knowledge of Web 2.0 | Islamic studies | 3.07 | - | | | | | | | |
| | Arabic Language | 2.91 | | - | | | | | | |
| | Sciences | 3.66 | ** | ** | - | | | | | |
| | English Language | 3.35 | | | | - | | | | |
| | Mathematics | 3.14 | | | ** | | - | | | |
| | Social studies | 2.91 | | | ** | | | - | | |
| | Computer | 4.56 | ** | ** | ** | ** | ** | ** | - | |
| | Other | 3.34 | | * | | | | | ** | - |
| Teachers use of Web 2.0 in education | Islamic studies | 2.05 | - | | | | | | | |
| | Arabic Language | 2.05 | | - | | | | | | |
| | Sciences | 2.39 | * | * | - | | | | | |
| | English Language | 2.13 | | | | - | | | | |
| | Mathematics | 1.72 | | | * | | - | | | |
| | Social studies | 2.35 | | | | | * | - | | |
| | Computer | 2.43 | | | | | * | | - | |
| | Other | 2.36 | | | | | ** | | | - |
| Barriers to the use of Web 2.0 in education | Islamic studies | 2.75 | - | | | | | | | |
| | Arabic Language | 2.74 | | - | | | | | | |
| | Sciences | 2.57 | | | - | | | | | |
| | English Language | 2.63 | | | | - | | | | |
| | Mathematics | 2.70 | | | | | - | | | |
| | Social studies | 2.44 | * | * | | | | - | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Computer | 2.28 | ** | ** | * | - | |
| Other | 2.56 | | | | | - |

** Statistically significant at level <0.01
* Statistically significant at level <0.05

There are statistically significant differences in all sections of Web 2.0 applications in education among all pairwise comparisons as shown in Table 13. The notable result is that the subject of computers (M = 4.56) scored significantly higher on the standardised test than in other teaching subjects in regard to the section of teachers' knowledge of Web 2.0 (p-vale <0.01). Similarly, in the same section, there are statistically significant differences, with p-value <0.01, between the subject of science (M = 3.66) and other subjects in favour of the science subject. Moreover, there are other statistically significant differences between some subjects in the section of teachers' use of Web 2.0 applications in education, such as mathematics and social studies in favour of the social studies subject, and between science and the Arabic language in favour of the science subject. In regard to the third section, namely barriers to the use of Web 2.0 applications in education, some of the differences and significance appeared among a few subjects, such as computers and Islamic studies, and between social studies and the Arabic language, as shown in Table 12.

The above results will be discussed in the next section.

## DISCUSSION

This study aims to give an understanding of teachers' knowledge and use of Web 2.0 in education. The results of this study indicate that most of the participant teachers have been familiar with most of the Web 2.0 applications reported in this study. For instance, instant messaging (WhatsApp, Kik, Tango), social networks (Twitter, Snapchat, Facebook), video sharing (YouTube), and Google applications (Google Docs) were familiar to most of the teachers. However, it should be noted in the current findings that some of the Web 2.0 applications, such as LMS and RSS, were not reported as being well known to the participant teachers. This result is supported by another finding (Kiyici, 2010), which indicated that the teachers had the skills to define fora, wikis, blogs and social networks, but they were not able to define RSS or bookmarking applications.

Moreover, the results of this study indicate that they reportedly used these technologies *rarely*. Although few teachers (approximately 40%) reported using instant messaging, video sharing, and social networks, most of them (about 80%) described themselves as not using wikis, LMS or video chatting. This seems to be consistent with several studies which suggest that some teachers still preferred using traditional technologies such as email (Roblyer et al., 2010; Karkoulia, 2016). In comparison with another study (Pritechett, et. al., 2013), blogs, social networks and cloud computing were reported as being used rarely.

The inconsistency between their familiarity and their usage of Web 2.0 was caused by several barriers. Most of the top barriers did not relate to the teachers' confidence or their competence. The participant teachers reported that large numbers of students in the classroom, the lack access to the Internet, and the lack of a clear plan for utilising Web 2.0 in teaching and learning were obstacles to the use of Web 2.0 applications in their teaching. The interesting thing in this result is that all these barriers are related to the school level barriers (Bingimlas, 2009). In contrast with other studies, some other factors were reported to be preventing teachers from using Web 2.0 in the classroom, including training, technical support, time (Karkoulia, 2016; An et. al., 2009), awareness, accessibility (Becta, 2008), and motivation and confidence (Rogers-Estable, 2014). On the other hand, the participant teachers reported that the barriers that related to their beliefs were not limited to their use of Web 2.0 applications in education (see Table 5).

The interesting aspect in this study is that, although there were no differences between female and male teachers in regard to their knowledge of Web 2.0, the participant female teachers seemed to use Web 2.0 applications in education more than the male teachers. This could mean that female teachers utilise the new technologies in their teaching more often. This result is inconsistent with a study conducted by Kiyici (2012), which indicates that teachers' experiences with the use of Web 2.0 tools did not differ notably by gender. It should be taken into account that Saudi society appears to be strict towards females in regard to social media for instance. However, the results of this study indicate that the female teachers utilise what they already know about Web 2.0 applications in their teaching.

Another interesting finding is that the teachers of computing reported themselves as being very familiar with Web 2.0 applications, more so than the teachers of other subjects, because of the nature of their subject; they have been well prepared in using such technologies. Such results are consistent with Bingimlas' (2010) results that computer teachers could know more about new technologies than other teachers. On the other hand, the

computer subject teachers reportedly were not different from other subject teachers regarding their use of Web 2.0 applications in the classroom. This could be because of the barriers mentioned earlier in this section. The practical implication in this study is that the utilisation of Web 2.0 applications in learning and teaching environments requires new thinking about the concept of teaching and learning, which is called "pedagogy 2.0" in the literature (McLoughlin & Lee, 2009). This means that students need to be responsible for their own learning; they should be encouraged to communicate, participate, and create knowledge, and discuss ideas and solve problems collaboratively (McLoughlin, 2013). Changes in participatory technologies require a corresponding shift in the way of teaching and learning in the classroom (Farkas, 2012). Digital tools and social network applications need educators to pay attention to student participation and communities for learning, and help students in the production of their knowledge.

## CONCLUSION

In conclusion, this study attempts to explore the participant teachers' views about learning and teaching with Web 2.0 applications in K-12 Saudi schools. It indicates that most of the participant teachers are familiar with Web 2.0 applications. However, their uses in education seem to be rarely mentioned. As they reported, the top barriers preventing them from the effective use of Web 2.0 applications in education are related to school level barriers (Bingimlas, 2009), such as the large number of students in the classroom, the lack access to the Internet in schools, and the lack of a clear plan for the use of Web 2.0 applications in education. Due to these barriers, when formulating the policy of an education system, educators and educational decision and policy-makers should take into account the environments of teaching and learning, such as the number of students in the classroom and the Internet with the use of Web 2.0 applications in education. Furthermore, it is recommended that teachers should be encouraged and supported by a clear plan for utilising Web 2.0 applications in education successfully. The focus, however, should not only be on Web 2.0 technologies as a tool, but also as an effective learning approach (c.f. Bransford et al., 2000). Thus, rethinking about pedagogical approaches and moving to pedagogy 2.0 may improve learning and teaching.

The findings of this study can provide guidance to educators, curriculum developers and decision makers who embark on using Web 2.0 in education, particularly in regard to designing instructional material, teacher professional development programs and learning environments. This study should contribute to more effective use of Web 2.0 in schools in the future. This study recommends that teachers should relinquish at least some of their authority in traditional teaching methods, and gain some familiarity with the potential utilisation of Web 2.0 applications.

Further research can be conducted to address the question of how Web 2.0 applications can be employed in and out of school environments to improve the process of learning and teaching. Finally, it would be worth investigating practical research with designing instructional Web 2.0 tools in various areas.

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# Numerical-Technological Skills and Work Experience in the Perceived Usefulness in an Accounting Virtual Learning Environment

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## ABSTRACT
The purpose of this study was to analyse the perceived usefulness of a set of Information and Communication Technologies (ICT) applied in a virtual learning environment (VLE) in a distance education model. We analysed whether the numerical and technological preferences of the students could explain the perceived usefulness related to the ICT applied to teaching. We also tested whether the work experience of the students can modify the perceived usefulness. Diverse ICT were applied to the teaching of accounting in undergraduate courses, in a distance education model in the European Higher Education Area (EHEA). The research had an experimentation phase to implement the ICT teaching tools, one of data collection and another for the data analysis. The perceived usefulness of the ICT was measured through a questionnaire with evaluation using a Likert scale. The evaluations given by the students allowed modelling each ICT according to the variables of numerical and technological skills, including work experience as a dichotomous variable. The results of this research suggest that the perceived usefulness of the ICT is, in part, explained by numerical and technological skills. Furthermore, there are indications that work experience can diminish the perceived usefulness for a set of teaching ICT.

**Keywords:** EHEA, ICT, Numerical and technological preferences, Virtual Learning Environment (VLE), Accounting Teaching, Distance Teaching, Distance Education Model.

## INTRODUCTION
The educational innovation applied to the teaching has been studied in recent decades at the theoretical and empirical level (Salinas, 2004). The university academic world has joined the educational technological development to achieve greater efficiency in the learning processes (Salmon, 2005). This supposes the assumption of a new model based on self-learning and on the student's involvement (Arvaja et al. 2007). Models that involve students lead to self-learning and to better levels of knowledge (Magin, 2001; Bushell, 2006). It can be said that the ICT in education have been the catalyser of this process. Traditional teaching-learning model has been leaved in order to another based on different teaching resources in a virtual environment (Smith, 2012; Arquero-Montaño & Romero-Frías, 2013).

In 1996 Wilson anticipated that virtual learning environments (VLE) are environments based on computers with relatively open systems that allow interaction and meeting with other participants. It does not deal with individual computerised learning environments, but instead it is framed as learning within a group. Currently these environments are not conceived as a website of education, virtual technology or a virtual campus, but rather it is a symbiosis of all these elements, in which the student is the principal actor in the learning process (Dillenbourg, Schneider, & Synteta, P., 2002). At present the virtual environment is a usual part of the teaching-learning process (Pituch & Lee, 2006) and it combines tools, resources, contents, educational assistance and discussions, in a space without time or space limitations, but the acceptance by student is a critical factor for its success (Martins & Kellermanns, 2004).

Learning environment in which the technology is applied can improve the students' performance (Wetzel et al. 1994; Maki et al. 2000). Prior studies have shown that the use of VLE combined with face to face education has a positive effect on academic performance **(**Stonebraker & Hazeltine, 2004; Lim & Morris, 2009). Furthermore, it has been shown that the students' performance in VLE is higher than that of their colleagues in traditional

environments (Chou & Liu, 2005). In these environments there is a function of educational production that links the educational methodology, the material resources and the individual characteristics of the students with the training achievements reached by them (Gandía & Montagud, 2011). The question is, what is it that makes a VLE successful?

In the framework of research on the acceptance of educative technologies, the perceived usefulness has been established as an important factor for the success of the VLE, analysing, therefore, the technological support (Selim, 2003). This analysis is based on the study of the perceptions of the students and their measurement (Ma & Liu, 2004; Schepers & Wetzels, 2006). Other factors of the success of the environment are the social characteristics of the students, which can affect the perceived usefulness of the learning (Sun & Zhang, 2006). In distance education, the social characteristics are more marked than in the face to face education and the teaching is usually carried out in virtual environments (García, 2012; Gooley & Lockwood, 2012), through visual tools (Leton et al., 2009; 2011) combined with ICT (O'Malley & McCraw, 1999).

A typical characteristic of the students in a distance education model is that they are employed. This has been studied in the area of management qualities and skills (Simpson, 2013). It is well known that the students who combine studies with other obligations drop out of their studies earlier due to the disconnection of the training process (Yorke & Longden, 2008). This makes the use of ICT in distance education models be especially useful (Paniagua et al., 2014). In this regard, the VLE can eliminate the geographical barriers in the learning process (Hackbarth 1996; Massy & Zemsky, 1995), promoting interest, creativity and motivation of the students (Amar, 2006). This process is mediated by the professor, who has to give it cohesion (Huertas & Pantoja, 2016).

Specifically, in accounting learning, VLE results in a better academic performance (Montagud & Gandía, 2014) and the students perceive a high usefulness in the improvement of comprehension (López Pérez, Pérez López & Rodriguez Ariza, 2013). Also in distance education models a relationship has been found between the performance and the perceived usefulness of the ICT in accounting (Herrador-Alcaide & Hernández-Solís, 2016). The activities of a VLE in distance education are assessed as useful by the students as it permits linking objectives with contents (Del Campo & Esteban, 2011). In the relationship between the success of a VLE and the perceived usefulness by the student, some personal and social variables that could affect the perceived usefulness of the learning are not considered. In this respect, the numerical and technological skills are analysed in this paper.

Diverse factors have been studied that can affect the university performance in accounting (Koh & Koh, 1999; Crawford, Dale & Toney-McLin, 2003; Clinton & Kohlmeyer, 2005; Byrne & Flood, 2008). In the area of higher education in accounting, it is considered that the lack of numerical skills can subsequently affect other disciplines such as finance and management (Burgess, 2007; Curland & Lyn Fawcett, 2001), which can condition the success of the learning (Nelson & Dopson, 2001). The financial skills are studied as essential skills for life (Bernheim et al., 2001; Hoff, 1999). They are considered necessary skills in any individual for their interaction in the current society and daily decision making (Gross, 2005; Lusardi & Tufano, 2009; Willis, 2008). In addition, they are skills required by employers (Cappelli et al., 1997) and financial management processes are required within higher education (Hoff, 1999). Therefore, in this research, it was analysed if the numerical skills in the framework of financial economics may affect the perceived usefulness of the ICT-accounting in a VLE.

In the area of accounting the introduction of technology based on the Internet (IT technology) is also considered necessary, since the companies require the accounting professionals have skills related to virtual environments (Arrufat et al., 2010; Moreira, 2010; Muñoz, 2003). The debate on the possible benefits associated with the introduction of IT in accounting education does not yet have conclusive results related to findings of a positive effect (Fetters et al., 1986, Abdolmohammadi et al., 1998) and others related to a negative effect (Dickens & Harper, 1986; Togo & McNamee, 1997). In studies on the effectiveness of learning in virtual environments, the capacity of the student in handling computers has been analysed (Chou & Liu, 2005) and this is attributed to the skills of the students by themselves (Piccoli et al., 2001). In learning accounting, it has been found that the skills in the handling of computers are greater in a VLE than in the traditional environment (Chen & Jones, 2007). The question that is posed in this research is whether the technological skill of the student can affect the perception of the ICT usefulness.

Another issue to consider in the research on learning in accounting in a VLE is the impact of the student's work experience. It has been analysed whether this affects the learning of accounting (Ballantine & Larres, 2004; Laffarga & Lucuix, 2012), as the learning is transferred to the work environment both in accounting (Araiza et al., 2013) and in general undergraduate studies (Lu & Lambright, 2010), and how the students are more involved in the work environment as they advance in the course (Betancourt et al., 2015). However, whether the work

experience can affect the perceived usefulness of the educational ICT, a possible association between both two has not been analysed in- prior papers.

## LITERATURE REVIEW

### Theories applied to study of VLE

The discussion on the conceptual framework to analyse perceptions on VLE is majority based on the Social Cognitive Theory (SCT). SCT has been applied to the study of information systems traditionally (Bandura, 2001). This theory is focused on the study of the interaction among human behaviour, personal factors and the social network, mainly by analysing new styles of behaviour in social networks (Bandura, 2001). Currently, in the framework of this theory, the relationship between personal cognition and computer use-internet behaviour (Compeau & Higgins, 1995; Hsu & Chiu, 2004 ) has being analysed (mainly self-efficacy and outcome expectations), specially for considering virtual communities as a social network which combines information and knowledge in a virtual area focused on common objectives, tools and interaction roles. Furthermore, SCT has been applied to analyse the undergraduate students' participation in communities of online games and the applicability of SCT in virtual communities (Lin, 2010).

Nevertheless, the SCT has been focused on the analysis of the influence components on the individual's behaviour in social networks, being necessary to introduce the Social Capital Theory (SCpT) in order to explore how social networks can affect to the Knowledge sharing in virtual communities (Chiu, Hsu &Wang, 2006). This second theory is based on the analysis of the network relationships possessed by an individual and how this relationships can influence on the interpersonal knowledge sharing (Chiu, Hsu & Wang, 2006). Thus, it has been shown the self-efficacy applied for students in web-community affects to the knowledge shared. This is known as Web-Specific Self-Efficacy. Some authors have analysed the Web-Specific Self-Efficacy and knowledge Create Self-Efficacy in the analysis of the human capabilities in the use of different functions in a VLE (Chen, Chen, & Kinshuk; 2009). Constructivism approach in the learning process carries out more responsibility for learners, not only for building their knowledge but also by being involved in the assessment activities (Rastgoo *et al.*, 2010). In accounting research the constructivism has led to an awareness that students' experience may provide a new focus in the accounting learning process (Lucas, 2000). In the context of constructivism and regarding above theories, accounting innovative experience by educational technology has been studied by analysing of the acceptance of VLE. The major problem in a VLE is the temporal and physical separation between learners and teachers so that social network ties are required for the sharing of knowledge. Thereby, different learning tools are being testing with the only goal of improving social network ties to try to assurance the success of VLE. This issue has led to the analysis on usefulness of tools applied in VLE.

### Learning Tools and Virtual Learning Environment

Different tools are usually applied to distance learning in VLE, such as video, test, chats, forum and other ICT. Role of video as an educational tool in accounting has been studied (Martin et al., 1995; Evans & Foster, 1997; Stanley & Edwards, 2005; Brecht & Ogilby, 2008; Holtzblatt & Tschakert, 2011), both through TV (Halabi, 2005; Jacobs et al., 2006) and through IT technologies (Brecht, 2012). Short videos have been made by using ICT (Letón et al., 2011) and currently these are supported by a web conference system. Such as in previous studies (Alcaide & Solís, 2013; Ortíz, 2013) the videos were usually made *ad hoc* because to find videos perfectly adapted to the learning's necessities is not easy (De-Juan-Vigaray & González-Gascón, 2014).

Also interaction among students and teachers has been studied and this has been focused on the analysis of different levels of knowledge and comprehension (Chi & VanLehn 1991; Collins, 1991; Piccoli, Ahmad & Ives, 2001). In the analysis of accounting education, it has been found that virtual interaction improves students' performance (Potter & Johston, 2006). This interaction in VLE is made by forums as usual virtual tutorial support. Usefulness of the virtual tutorial support resides in eliminating barriers and in shortening distances for models no based in a face-to-face teaching (Cano, 2009; Castillo, 2008; García et al., 2004).

Currently, online-test has actually been another resource used in VLE because students can see their results faster than in a traditional model. The major advantage of online test is the numerical grade obtained from them. This is useful to know about his or her level of knowledge, which is an important procedure in online education processes (Oosterhoff, 2008). Training is considered an important strategy for the maximisation of the learning opportunities (Rodríguez & Ibarra, 2011), thus, several previous studies analysed this online learning tool. These research was focused on the acceptability of this tool for students (Rudland, Schwartz, & Ali, 2011), and mainly on the students' perception on the assessment in online and computerizing support (Alsadoon, 2017; Hassanien *et al.* 2013; Petrisor *et al.*, 2016; Sorensen, 2013).

For all above, these three learning tools have been selected in this research as dependent variables, in order to analyse the statistical association between the perceived usefulness for each tool and several numerical-technological skills. Thereby, this paper extends the study of factors related to success of VLE to the analysis related to perceived usefulness in EVL, but focusing it on the usefulness of specific tools used in the knowledge sharing in VLE. Therefore, short videos, online self-test and forums are the main objectives of this paper. The purpose of this paper is establish a function of statistical association between the students' perceived usefulness for each of these tools and a set of students' numerical-technological skills.

**Usefulness and Virtual Learning Environment**

Usefulness in VLE has been studied focused on the individual acceptance of the technology and the student use of this technology in a research line of Technology Acceptance Model (TAM) and this more recently in TAM2 (Davis, Bagozzi, & Warshaw, 1989; and Venkatesh & Davis, 2000) with the goal of predicting user adoption of innovative technologies in VLE. Currently, studies on the acceptance and use of VLE are increasing more and more every day (Pituch & Lee, 2006; Sellim, 2003). Several factors have been analysed in the acceptance of VLE. One of these factors is the perceived usefulness. Perceived usefulness is determining on the based on the four-item performance expectancy scale used (Venkatesh *et al.*, 2003; Van Raaij & Schepers, 2008) but the items in this paper have been adapted to the three ICT selected as a dependent variables. Thus, these items have been adapted in order to be applied to the three constructs related to usefulness of short videos, online self-test and forums.

## OBJECTIVE AND RESEARCH QUESTIONS

The main objective of this paper is to analyse the usefulness perceived by the students related to the educational ICT in a VLE, but exploring a possible function of association by linear regression between the usefulness perceived by students and numerical and technological students' skills. The paper is conceived as an exploratory analysis. Numerical profile associated with accounting, technological profile required by employers, and work experience as a sociodemographic characteristic of the distance student have considered in this research. Specifically, this paper tries to respond to the following research questions:

1. What is the perceived usefulness related to a set of ICT applied to the teaching of accounting in a virtual environment?
2. Can the numerical and technological skills of the students explain the usefulness that they perceive on the ICT?
3. Can the existence of work experience related to accounting affects the perceived usefulness of the ICT?

In this way, the research is framed within the analysis of the acceptance of new technologies in the area of accounting education. It is not aimed at establishing a global evaluation model of acceptance of the virtual environment. It is directed to analyse the usefulness perceived by the student in relation to the ICT as an important factor for its acceptance. The novelty of the focus of this research is that this perceived usefulness is established as a dependent variable which is explained by a set of variables of numerical and technological skills, which are not being considered in another models.

## METHODOLOGY

**Sample**

Different tools have been implemented in a VLE of a second course financial accounting subject in undergraduate studies in the EHEA. The studies are framed in the UNED, which applies a distance education model. This subject supposes a teaching load of 6 ECTS. The students interact in the virtual learning environment implemented for the university. In this environment an area with online resource materials, chats, forums, online surveys, web conferences and other ICT are established mandatorily. The ICT selected for the study were the short videos, the forums and the online self-test. The sample was composed by 156 students who participated in the research from a potential research population of 391 students who were examined in the final test in February of 2016. The questionnaire was carried out in the platform developed for the university –aLF – to support the VLE by an online system, which made a response rate of 39.89 %.

**Instruments and Model**

After the application of the ICT tools to the subject, data collection was carried out on the usefulness perceived by the students. The usefulness was collected through an online questionnaire, which was prepared *ad-hoc* as in previous papers on accounting education (Boza & Toscano, 2012; Hurtado & Lara, 2015).

The measurement of the perceptions of students on the usefulness of the VLE was made by a questionnaire based on prior relevant studies, which were validated in order to ensure that the use of suitable items. In this study a list of these items were included to measure the perceptions by combining validated instrument on

functionality and interaction (Pituch and Lee, 2006, Johnston et *al.*, 2005; Kreijns, Kirschner, and Jochems, 2003), on learning satisfaction (Chiu, Hsu, and Sun, 2005; Wu and Wang, 2005), on the numerical and technological skills (Concannon et al., 2005; Gámiz-Sánchez & Gallego-Arrufat, 2016; Harnar et al., 2000; Martínez et al., 2016)

Regarding prior discussion, the questionnaire for this study consisted of two major parts. The first part was developed to collect the demographic and social characteristics of students (e.g. age, previous education, gender, work experience, and others). The second part was focused on collecting the student's perception of each variable in the model.

All items are measured by using a 5-point scale ranging ("1"="strongly disagree" to "5"="strongly agree"). Once the initial questionnaire was constructed, a personal interview process with professors in accounting, education and psychology areas was made. Thus, the validity of the questionnaire was ensured by obtaining feedback of these experts. Afterward this feedback, the questionnaire was modified according to their instructions. Subsequently, the questionnaire was piloted with a small group of students in order to test the completeness, comprehension and appropriateness of the measurement instruments. Consequently, some items were rejected and other modified for semantics reasons. This process is usually applied to the questionnaires in the educational research (Alsadoon, 2017). After this pre-test, 14 items were finally included in 4 dimensions (see figure 1). 14 items in a Likert scale 1-5. For the reliability of the questionnaire, the Cronbach's Alpha was calculated and this took a value from 0,844 for items in overall. Also Cronbach's Alpha was calculated for each dimension (See appendix 1). Minimum value for reliability in social sciences research should be 0.7 (Chen, Chen and Kinshuk, 2009). Items in this study take a good reliability and discriminant validity and therefore the model can be assured. Thus, the model is shown in the figure 1.

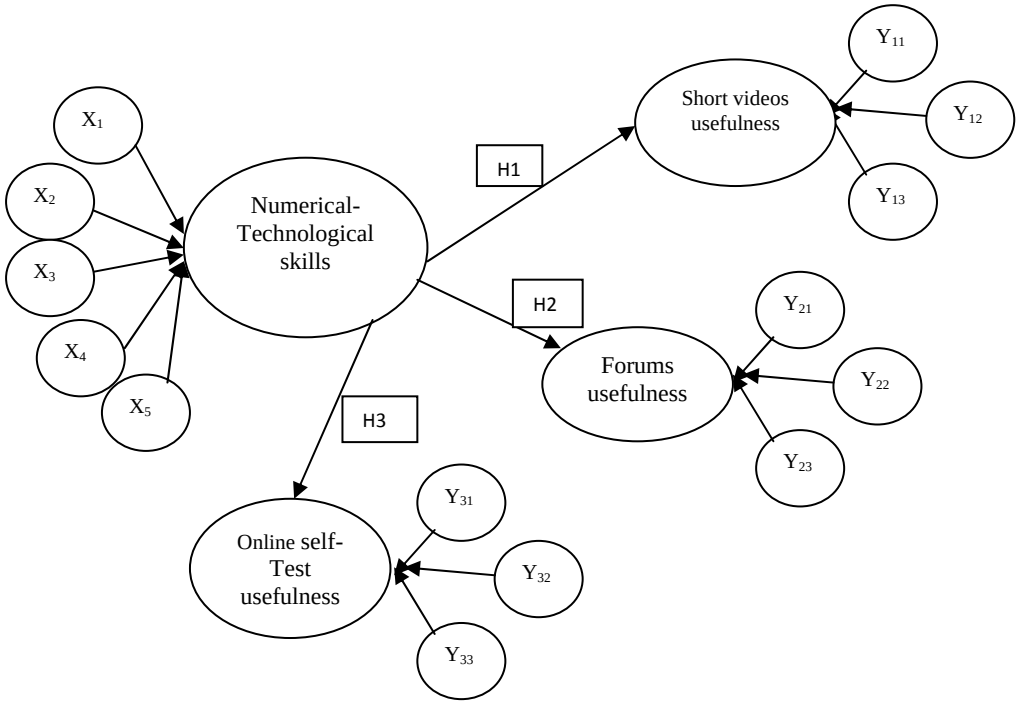


Figure 1. The Research Model for ICT Perceived Usefulness in an Accounting VLE

**Hypotheses, variables and linear regression model**

Regarding above and after the review of specific literature on usual ICT set in accounting e-learning, three instruments were selected: video, forums and online self-evaluation, in order to test the perception of the VLE. With the collected data, an analysis was conducted in various phases.

- A descriptive exploratory analysis by means of frequencies. It is aimed at summarising quantitatively the characteristics of the sample and the descriptive statistics of the variables under study. An exploratory analysis has previously used by means of the distribution of the frequencies of the usefulness perceived by the students (Polo et al., 2012; Salagre & Serrano, 2008).
- An analysis of the fit of a multiple linear regression model. It is oriented to see if the usefulness perceived by the students in relation to the ICT tools (*Yi*) can depend on the numerical and technological perceptions of the students (*Xi*).

- A fit of the model according to work experience. We analyse whether introducing work experience related with business modifies the perception of the usefulness.

Thus, three models were purposed (Figure 2).

Model 1

$H_1$: The perceived usefulness of short videos ($Y_1$) is a dependent variable from the numerical and technological skills ($X_i$)

Model 2

$H_2$: The perceived usefulness of forums ($Y_2$) is a dependent variable from the numerical and technological skills ($X_i$)

Model 3

Figure 2. Models and hypotheses

$H_3$: The perceived usefulness of forums ($Y_3$) is a dependent variable from the numerical and technological skills ($X_i$)

Usefulness perceived by students related to the three ICT studied are dependent variables and students' evaluations on the numerical and technological perception are explanatory variables (Tables 1 and 2).

Table 1. Variables and Models of ICT usefulness perceived by the students

| DEPENDENT VARIABLES (Yj) | EXPLANATORY VARIABLES (Xi) |
|---|---|
| Forums usefulness (Y1)<br>Short videos usefulness (Y2)<br>Online self-evaluation usefulness (Y3) | Numerical preferences (X1)<br>Numerical knowledge (X2)<br>Numerical capacity (X3) |
| | ICT management (X4)<br>Interaction in forums (X5) |
| MODELS OF ICT USEFULNESS | |
| *H1: Perceived usefulness of the short videos: Y1= B0 + B1 X1 + B2 X2 + B3 X3 + B4 X4 + B5 X5 + e*<br>*H2: Perceived usefulness of the Forums: Y2= B0 + B1 X1 + B2 X2 + B3 X3 + B4 X4 + B5 X5 + e*<br>*H3: Perceived usefulness of the online Self-evaluations: Y3= B0 + B1 X1 + B2 X2 + B3 X3 + B4 X4 + B5 X5 + e* | |

Questions directly linked to the explanatory variables are five (table 2).

Table 2. Questions and variables

| | |
|---|---|
| X1: Numerical preferences | Evaluate your ***preferences*** for subjects with a numerical and financial profile |
| X2: Numerical knowledge | Evaluate your numerical ***knowledge*** in financial economics. |
| X3: Numerical capacity | Evaluate your ***capacity*** in numerical and financial subjects |
| X4: ICT management | Evaluate your capacity of ***management*** of ***IT*** technologies |
| X5: Interaction in forums | Evaluate your active ***participation*** in the ***VLE*** |

For the analysis, it is assumed that there is a statistical association function between the usefulness of the educational ICT and a set of variables. Thus, this relationship could be explained by a multiple linear regression model between dependent variable (Yi) and a set of explanatory variables (Xi). This method has been used in previous studies on the analysis of online learning in accounting area (Herrador-Alcaide & Hernández-Solís,

2016; Montagud & Gandía, 2014) and in massive open online courses (Ospina-Delgado, Zorio-Grima & García-Benau, 2016).
For each ICT tool, the nil hypothesis would suppose that the perceived usefulness of the ICT ($Y_i$) is independent of the numerical-technological perceptions ($X_i$ variables). Accepting $H_0$ would indicate that the model is not explanatory and that the numerical-technological skills of the student are not determining factors in the perceived usefulness of the learning tools. Accepting $H_1$, $H_2$ or $H_3$ would indicate that the model is explanatory. Thus, short videos usefulness ($Y_1$), online-test usefulness ($Y_2$) and forums usefulness ($Y_3$) would be explained by numerical-technological skills overall ($X_i$).

In order to measure the effectiveness of the linear relationship, the coefficient of linear determination ($R^2$) was taken, by means of its square root or coefficient of linear correlation (r). $R^2$ measures the realised linear goodness of fit. $R^2$ represents the percentage of common linear causes existing between the variables, taking values between "0" and "1". The value 0 indicates absolute linear independence and the value 1 indicates absolute linear dependence.

The coefficient "r" indicates whether there is a relationship of linear dependence. It can take values of "-1" to "+1". When "r" takes the value of "-1" there is perfect negative linear dependence and the variables evolve in the same proportion but in opposite directions. When it is "+1" it is a perfect positive linear dependence and the variables evolve in the same proportion and direction. If it takes the value of 0, there is no linear dependency between the variables, which would not impede the variables being able to have another type of relationship (logarithmic, etc.).

## FINDINGS

The findings of this research are shown in three lines of results on:

- The descriptive exploratory analysis;
- The multiple linear regression model of association between perceived usefulness by students and a set of numerical-technological skill of students; and
- The fit of the model according to work experience.

### Descriptive exploratory analysis

The sociodemographic profile of the students is shown in Table 3. It is observed how the profile of prior studies is framed in the social sciences (79 students). The mean age of the student is between 34 and 50 years (78 students), with the predominant sex being female (101 students). The majority of the students access the undergraduate studies by passing the entrance exam to the university (112 students).

Table **3.** Sociodemographic characteristics of the students

| **Profile of previous studies** | **Humanities and Legal Sciences** | **Social Sciences** | **Pure Sciences** |
|---|---|---|---|
| | 42 students | 79 students | 35 students |
| **Mean age** | **18-30 years** | **34-50 years** | **More than 50 years** |
| | 65 students | 78 students | 13 students |
| **Gender** | **Male** | **Female** | **No answer** |
| | 50 students | 101 students | 5 students |
| **Entrance exam** | **Entrance or access** | **Bachelor's degree, master's degree, certificate, or unfinished degree in engineering** | **Doctorate, master's degree, bachelor's degree, certificate or unfinished degree in engineering.** |
| | 112 | 18 | 26 |

The evaluations given by the students in relation to their numerical and technological skills are shown in Table 4. One may observe that most of the students perceive their numerical skills as medium (Likert 3), while the technological skills are perceived as high (Likert 4). The descriptive statistics for the numerical and technological skills are shown in Table 5. It can be highlighted that two variables related to numerical skill (X1 and X3), are situated above 3 points out of 5. The score related to prior knowledge (X2) is also near 3 points. Thus, the student perceives himself at a medium level of numerical skills in the framework of financial economics. The technological skills are self-perceived as higher (4.15 for X4 and 3.6 for X5). When the technological skills are related to communication (forums) they are perceived as lower. In general the students consider themselves adept in technology.

Table 4. Numerical and technological skills perceived by the student

| | **Self-evaluation of numerical skills in the framework of financial economics** | | | **Self-evaluation of technological skills** | |
|---|---|---|---|---|---|
| | **X1** | **X2** | **X3** | **X4** | **X5** |
| **Likert Scale 1** | 7 | 19 | 20 | 1 | 12 |
| **Likert Scale 2** | 17 | 41 | 22 | 7 | 14 |
| **Likert Scale 3** | **52** | **67** | **64** | 22 | 41 |
| **Likert Scale 4** | 45 | 25 | 33 | **64** | **46** |
| **Likert Scale 5** | 35 | 4 | 17 | 62 | 43 |
| **Total students** | 156 | 156 | 156 | 156 | 156 |

Table 5. Descriptive statistics of the financial-technological skills

| **Xj** | **N** | **Minimum** | **Maximum** | **Mean** | **Standard deviation** |
|---|---|---|---|---|---|
| Numerical preferences (X1) | 156 | 1 | 5 | 3.54 | 1.092 |
| Numerical knowledge (X2) | 156 | 1 | 5 | 2.71 | .965 |
| Numerical capacity (X3) | 156 | 1 | 5 | 3.03 | 1.144 |
| ICT management (X4) | 156 | 1 | 5 | 4.15 | .871 |
| Use of forums (X5) | 156 | 1 | 5 | 3.60 | 1.200 |
| Valid N (per list) | 156 | | | | |

The students' perception on the usefulness of the three ICT is shown in Table VI. Of the three dependent variables under analysis, the one related to the online self-evaluations is perceived as the most useful.

Table 6. Descriptive statistics of the ICT

| Yj | N | Minimum | Maximum | Mean | Standard deviation |
|---|---|---|---|---|---|
| Forums usefulness (Y1) | 156 | 1 | 5 | 3.153 | 1.443 |
| Online Self´-Test usefulness (Y2) | 156 | 1 | 5 | 2.946 | 1.255 |
| Short videos usefulness (Y3) | 156 | 1 | 5 | 2.303 | 1.153 |
| Valid N (per list) | 156 | | | | |

The introduction of two dichotomous variables in the model were considered. As an individual characteristic, the knowledge of the accounting subject of the previous course, which took the value "1" for being passed and "2" for failure. The second, within the sociodemographic characteristics is the work experience related to accounting. This variable was already used as a control variable in the analysis of the academic performance in accounting (Laffarga & Lucuix, 2012). This variable also takes the value of "1" or "2".

The results of the two dichotomous variables indicate that 87% of the students had the knowledge required to pass the preceding accounting course, therefore, this variable was not used for the division of our sample. As for the previous work experience, 61% of the students had such experience compared to 39%. This variable was considered for the division of the sample into two groups, one for students with work experience and the other for students without it.

**Lineal Regression Model**

The results that the multiple regression analysis summarise for each of the three models is shown in Table 7.

Table 7. Linear model of perceived usefulness related to the ICT

| **Short videos _ Usefulness ($Y_1$) Model** | | | | | | |
|---|---|---|---|---|---|---|
| Model | R | R-squared | Adjusted R-squared | Standard error of estimation | F | Sig. |
| 1 | .469[a] | .220 | .194 | 1.294 | 8.420 | .000[b] |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Forums _ Usefulness ($Y_2$) Model** | | | | | | |
| 2 | .453[a] | .205 | .178 | 1.124 | 7.680 | .000[b] |
| **Online Self-Test Usefulness ($Y_3$) Model** | | | | | | |
| 3 | .409[a] | .167 | .139 | 1.259 | 5.976 | .000[b] |
| a. Predictors: (Constant), Preferences_Numerical, Knowledge_Numerical, Capacity_Numerical, Management_ICT, Use_Forums | | | | | | |

**Fit of the model according to work experience**

Prior work experience could be contributing non-assessed knowledge. This knowledge could affect the perceived usefulness of the ICT. Prior financial experience can lessen the perceived usefulness, making the ICT tool less attractive by including the learning of knowledge they already possess. The usefulness models were tested but with the dichotomous variable "work experience", which divides the sample into two. In this way, in the regression lines the variable δ = "Work experience" was included, which only takes the value "1=Yes" or "2=No". The new results for the three ICT analysed are shown in Table 8. It is observed that only for the mini-videos does the "r" coefficient have a higher value (0.514) for the students with work experience. The same does not occur for the forums, or for the online self-evaluations, whose coefficient "r" is higher in the group of students without work experience.

Table 8: Linear model of perceived usefulness related to the ICT considering work experience

| **Summary of the Usefulness Short videos Model** | | |
|---|---|---|
| | r-MINI-VIDEOS | |
| Model | Finan._Work_Exp = Yes (Selected) | Finan._Work_Exp = No (Not selected) |
| 1 | .514[a] | .467 |
| **Summary of the Usefulness Forums** | | |
| | r-FORUMS | |
| Model | Finan._Work_Exp = Yes (Selected) | Finan._Work_Exp = No (Not selected) |
| 2 | .399[a] | .532 |
| **Summary of the Usefulness Online Self-evaluation** | | |
| | r-SELF-EVALUATIONS | |
| Model | Finan._Work_Exp = Yes (Selected) | Finan._Work_Exp = No (Not selected) |
| 3 | .408[a] | .461 |
| a. Predictors: (Constant), Preferences_Numerical, Knowledge_Numerical, Capacity_Numerical, Management_ICT, Use_Forums | | |
| b. Unless the contrary is indicated, the statistics are based only on the cases for which Exp_Laboral_Finan = Yes. | | |
| c. Dependent variable: Usefulness mini-videos, usefulness forums, usefulness self-evaluations. | | |

In the Figure 4, a comparative graphic analysis can be seen of the coefficient of linear correlation (r) before and after considering work experience.


Figure 4. Coefficient of linear correlation considering the variable "Work Experience"

## LIMITATIONS

Despite the positive outcomes, this study must acknowledge some limitations. No generalist results could be extrapolated for any accounting teaching in VLE, not even for any university or for any models of distance education, because sociodemographic characteristics of the students could affect results. Nevertheless, despite the limitations inherent to this experimental empirical analysis, results do show a certain impact of the numerical and technological skills on the perceived usefulness of the ICT in teaching in an accounting VLE. Thus, if researchers considered a more heterogeneous group of student there could be different findings. Also the context of the VLE could be affect to the results. Nonetheless, the results agree with previous studies, and because of that the findings regarding the perceived usefulness can be considered as a significant contribution to a greater knowledge of VLE in accounting education.

## CONCLUSIONS AND DISCUSSIONS

Regarding the first research question related to the perceived usefulness measured by a set of ICT applied in an accounting VLE, the results suggest that the students assign a medium-high usefulness in the ICT for the teaching of accounting in a distance education model. According to findings on the positive effect of the use of a VLE on the student (Fetters *et al.*, 1986, Abdolmohammadi *et al.*, 1998), Montagud & GAndía (2014), comparable results have been found in this research but focusing on the satisfaction related to the accounting VLE in a distance education model. Moreover, the findings of Magin (2001) and Bushell (2006) lead to the conclusion that methods that involve students can be considered as a positive stimulus in the deep and self-regulated learning. The self-regulated learning is a very important factor in a distance education model. Thereby, a first conclusion of this paper is that innovation by using of the educational technology in a VLE can be defended as an improvement of the learning process, and this experience is considered as a positive advance by students. This paper shows that in a distance education model applied to the degree studies, VLE can be considered as good system in order to support a learning process involving students, and thus, the VLE is perceived as a usefulness environment by them.

Specifically, students' perception on the usefulness of a set of distance learning tools in VLE takes good values. The short videos, forums and online self-evaluations used in this research have been valuated as a positive contribution to the VLE. The tool evaluated as the most useful for the sociodemographic profile of university distance education is that which encompasses the online self-test, with a very similar usefulness for the short video tool. The forums are perceived as less useful and this finding was already found in previous studies (Martínez *et al.*, 2016), in spite of students valued that this tool allows the development of communicative skills (Feliz, 2012; Rodríguez-Hoyos & Salvador, 2011). This may be an interesting line in future researches in order to analyse differences in the perceived usefulness between student in first year and student in second year of degree. Related to online-test, the findings of this research are according to other researches where students considered that online assessment add value to their learning (Sorensen, 2013; Petrisor *et al.*, 2016; Alsadoon, 2017) and they assigned a highly satisfaction by its advantages (Hassanien *et al.*, 2013).

For the second research question related to the statistical association between numerical-technological skills of the students and the perceived usefulness, results show that perceived usefulness of the ICT is explained to some extent by these skills. Findings suggest that numerical-technological skills could be introduced in a model as explanatory variables to the justification of the perceived usefulness in VLE. Nonetheless, in this paper only a first approach has been made. This approach indicates that these explanatory variables are perceived as an influent factor in the distance learning process in accounting. However, they could be analysed in a joint context with other variables. According to Montagud & Gandía (2014) the experience of educational innovation in an

accounting VLE has been valued positively by students and they perceived the usefulness for the accounting learning. Thus, such as the research line of the TAM, the perceived usefulness of the short videos, online-test and forums could be considered influent factors into a VLE and these should be included in a model focusing on predicting adoption of innovative technologies in VLE (Venkatesh *et al.*, 2003; Van Raaij & Schepers, 2008).

When the "work experience" variable is introduced, according to the third research question, it was verified that this affects in a positive way the perception that the students have of the usefulness of the short videos, but it does not influence in the perceived usefulness for online-test and forums. In learning accounting, some authors found that the academic results in the prior accounting subject was a significant control variable (Gandía & Montagud, 2011; Potter & Johnston, 2006). Nevertheless, this study is the first to find a positive relationship between the work experience and the perceived utility by students related to tools applied in a VLE. This finding may be due to that some skills could have been acquired outside the educational model through work and thus some tools could show a minor perceived usefulness due to students' work experience. This finding will be an important research line for the future. In distance teaching models for adult, educational model involves to students in the VLE without considering their prior work experience, but this experience is conditioning their learning process. For this reason, the inclusion of the work experience to analyse the model's usefulness is an important improvement.

For all above, the major objective of the research has been confirmed and thus, it is possible to understand that exits a statistical association between perceived usefulness of online tools applied in accounting VLE and the students' numerical-technological skills. Furthermore, these skills partially explain the perceived usefulness.

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## APPENDIX 1. QUESTIONNAIRE RELIABILITY AND VALIDITY

The questionnaire encompassed the following item. It was required to valuated the items on a Likert scale from 1 to 5 where "1"="strongly disagree" to "5"="strongly agree"

| | Mean | Standart desvitation | N | Alfa Cronbach | Alpha for each dimension |
|---|---|---|---|---|---|
| Dimension 1_Numerical-technolgical skills | | | | | |
| X1: I Prefer for subjects with a numerical and financial profile | 3,54 | 1.092 | 156 | ,843 | ,838 |
| X2: I have a high numerical knowledge in financial economics? | 2,71 | .965 | 156 | ,843 | |
| X3: I consider I have a good numerical capacity | 3,03 | 1.144 | 156 | ,852 | |
| X4: I manage well of IT technologies | 4,15 | .871 | 156 | ,830 | |
| X5: My participation in the VLE has been active | 3,60 | 1.200 | 156 | ,821 | |
| Short Videos Usefulness | | | | | |
| Y11: I am satisfied with short videos | 2,88 | 1,398 | 156 | ,827 | 0,692 |
| Y12: Short videos are suitable for learning the subject | 3,38 | 1,474 | 156 | ,823 | |
| Y13: My frequency of use of short videos | 3,20 | 1,475 | 156 | ,825 | |
| Online-Test Usefulness | | | | | |
| Y21: I am satisfied with online-test | 2,25 | 1,129 | 156 | ,826 | ,783 |
| Y22: Online-tests are suitable for learning the subject | 3,52 | 1,400 | 156 | ,822 | |
| Y23: My frequency of use of online-test | 3,07 | 1,238 | 156 | ,827 | |
| Forum Usefulness | | | | | |
| Y31: I am satisfied with forums | 1,88 | 1,087 | 156 | ,841 | ,893 |
| Y32: Forums are suitable for the learning the subject | 2,77 | 1,258 | 156 | ,830 | |
| Y33: My frequency of use of forums | 2,26 | 1,133 | 156 | ,827 | |

# Preservice Science Teachers' Collaborative Knowledge Building through Argumentation on Healthy Eating in a Computer Supported Collaborative Learning Environment

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## ABSTRACT
The purpose of this study was to investigate preservice science teachers' collaborative knowledge building through socioscientific argumentation on healthy eating in a multiple representation-rich computer supported collaborative learning (CSCL) environment. This study was conducted with a group of preservice science teachers (n=18) enrolled in a technology in science education course at a large, high research activity university in the Southeastern United States. Data sources were the representations created by the participants in a CSCL platform across three representational modalities, audio recordings of classroom activities and posters created by the groups. To investigate learning in the collective level social network measures of density and centrality were utilized. Furthermore, content analysis and text mining were used to analyze students' representations. Reflected in the participants' wikis, individual learning was assessed using argumentation analysis rubrics and content analysis of representations and posters. Results indicated that the knowledge base created jointly with different representations by the participants was improved, the written argument contents both shared more commonalities in terms of content and shared more common words as a reflection of the participants' collective effort. In an individual level, analysis of the learners' written arguments indicated that some participants increased their argumentation qualities in their final arguments, all participants incorporated more specific scientific knowledge and aspects from other participants' arguments. It was concluded that collaborative knowledge building with multiple representations increase learning both in the individual and collective levels.

**Keywords:** argumentation; collaborative knowledge building; computer supported collaborative learning; science education

## INTRODUCTION
In the intersection of science and social issues, socioscientific issues (SSI) have become an important research theme in science education (Sadler, 2004). Challenging life issues such as cloning, global climate change, stem cells, genetically modified organisms often emerge with the advent of science and technology and can affect multiple aspects of daily life. Therefore, these global and local issues have been used as engaging and authentic contexts for science teaching (Topçu, Yılmaz-Tüzün, & Sadler, 2011). SSI are dilemmas which include multiple perspectives and involve individuals in decision making processes. Making well-informed decisions about these complex issues require individuals to engage in evidence based reasoning and argumentation (Zeidler, Sadler, Applebaum, & Callahan, 2009). Through argumentation individuals can weigh evidence and reach a decision about these issues (e.g., Raven, Klein, & Namdar, 2016). Therefore, in science education research, identifying the mechanisms of socioscientific argumentation has become an emerging research agenda (Evagorou & Osborne, 2013).

Argumentation about SSI can be framed as a social activity in which learners "collaboratively build upon each other's knowledge, adding to the communal knowledge pool" (So, Seah, & Toh-Heng, 2010, p.480) as well as to improve their individual understanding (Scardamalia & Bereiter, 2003). One challenge for science educators is to provide environments that help students build and advance communal knowledge of these issues. Computer supported collaborative learning (CSCL) can be used as an effective medium for collaborative knowledge building for SSI. CSCL environments allow learners to co-construct knowledge with the help of computers within and across classroom settings (Stahl, Koschmann, & Suthers, 2006). CSCL supports the co-construction of knowledge with the aid of external representations (Cress & Kimmerle, 2008). As information about SSI is represented in multiple modalities and multiple formats such as in graphs, tables, text, audio, and pictures, CSCL offers a space for storing and sharing information in and across classrooms about complex SSI. The process of organizing knowledge using CSCL platforms make thinking visible and provide a space for exchanging ideas for

developing new knowledge through representations (Kimmerle, Moskaliuk, & Cress, 2011; Stahl, Ludvigsen, Law, & Cress, 2014).

Research on collaborative knowledge building indicated that learners use CSCL platforms to build knowledge to argue about different subjects (Namdar, 2015; Namdar & Shen, 2016). Considerably less attention was paid to the mechanisms of socioscientific argumentation in collaborative knowledge building communities that were supported with multiple representations. Therefore, the purpose of the current study is to explore the influence of collaborative knowledge building on preservice science teachers' (PSTs) collective learning and socioscientific argumentation on healthy eating. Understanding the influence of CSCL environments on PSTs collective and individual learning is crucial to scaffold PST education, if SSI are to be used in future science classrooms to promote argumentation and scientific literacy (Kolstø, 2006; Sadler, 2004). The research addresses the following questions,

In a CSCL environment:

1. How do PSTs build collective knowledge with multiple representations on healthy eating?
2. How is collaborative knowledge building related to PSTs' individual argumentation about healthy eating?

## THEORETICAL PERSPECTIVES

### COLLABORATIVE KNOWLEDGE BUILDING

Science is a social enterprise and scientific knowledge advances through collaboration (National Reseach Council, 2012). In educational settings, collaborative inquiry has become an important educational goal (NGSS Leads States, 2013). This emphasis on collaborative learning rather than individual inquiry gave birth to the notion of knowledge of knowledge (Scardamalia & Bereiter, 2006). Based on this emphasis, Scardamalia and Bereiter's (2006) conception of contemporary education focused on the idea of knowledge-creating civilization. As an overarching theoretical perspective, they suggested the knowledge building theory "to refashion education in a fundamental way, so that it becomes a coherent effort to initiate students into a knowledge creating culture" (p. 97). In short, this theory stems from the idea that a community of learners jointly creates knowledge (Scardamalia & Bereiter, 1994). It assumes that, individual learning and understanding scientific concepts are byproducts of this knowledge building activity (Moskaliuk, Kimmerle, & Cress, 2009) and the Internet becomes a mediating tool between classroom and the civilization-wide knowledge building community in this process (Scardamalia & Bereiter, 2006). Overall, collaborative knowledge building can be defined as "...the production and continual improvement of ideas of value to a community, through means that increase the likelihood that what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts" (Scardamalia & Bereiter, 2003, p.1370). Through collaborative knowledge building, one can be exposed to and evaluate alternative ideas brought from others' perspectives (Stahl, 2000).

CSCL environments act as scaffolds for collaborative knowledge building (Kimmerle et al., 2011). These environments incorporate representations in multiple modalities for users to build knowledge such as verbal-textual (written text, oral propositions), symbolic mathematical (i.e. formulas, equations), and visual graphical (i.e. simulations, diagrams, tables, graphs) (Wu & Puntambekar, 2012). The advantage of using multiple representations in learning can be three-fold: a) representations can either support complementary cognitive processes or include complementary information, b) one representation is used to constrain the misinterpretation of another representation, and c) representations foster deeper understanding (Ainsworth, 1999). Next, I explain how I approach collaborative knowledge building with multiple representations.

### COLLABORATIVE KNOWLEDGE BUILDING THROUGH REPRESENTATIONS: A SYSTEMIC AND COGNITIVE VIEW

In this study, I adopt Cress and Kimmerle's (2008) model to describe my approach to collaborative knowledge building with external representations in CSCL environments. Cress and Kimmerle (2008) offer systemic and cognitive view on collaborative knowledge building with wikis (i.e. a type of textual external representation) by combining the systemic approach of Luhman and Piaget's theory of equilibration. Luhman's systemic approach (Luhman, 1995) distinguishes social systems from cognitive systems. Cognitive systems operate through consciousness and cognitive processes such as recalling information. Social systems, on the other hand, operate by means of communication. As social systems are dependent on cognition, cognitive and social systems influence each other (Luhman, 1995).

To explain how social and cognitive system's borders are crossed during learning, Cress and Kimmerle (2008) built their argument on two processes: externalization and internalization. According to their view, representations help learners to externalize their knowledge (e.g. in a textual representation such as a wiki). Externalization of knowledge maps and reflects an individual's cognitive processes in a representation that exist

independent from the individual's cognition. During externalization individuals change, deepen, and extend their existing knowledge (Cress & Kimmerle, 2008). The internalization process occurs when an individual works with a representation and integrates information available in the wiki to their knowledge, thus extending their previous knowledge. Cress and Kimmerle (2008) further argued that through internalization people could infer new knowledge, which cannot be otherwise possible unless the information in a representation was internalized. As CSCL environments allow learners to create and share representations, people also develop new knowledge by the altering the knowledge in the representations. In return, the knowledge representation becomes an epistemic representation that exists independent from its creator (Popper, 1972; Sterelny, 2005).

Cress and Kimmerle's (2008) collaborative knowledge building approach also draws on Piaget's model of equilibration (Piaget, 1970). Equilibration explains the two processes when an individual is faced with new information and integrates it into their own knowledge: assimilation and accommodation. Assimilation is the process where an individual understands new information based on the existing prior knowledge and integrates the knowledge in their existing schema. Accommodation on the other hand, is the process in which an individual changes their existing knowledge to understand new information. In collaborative knowledge building these two processes occur both internally and externally and develops together (Luhman, 1995; Luhmann, 1986). Combining both systemic view and equilibration, in collaborative knowledge building with representations, therefore, learning and the collaborative knowledge building occurs in four ways: "a) Internal assimilation (quantitative individual learning), b) internal accommodation (qualitative individual learning), c) external assimilation (quantitative knowledge building), and d) external accommodation (qualitative knowledge building)" (Cress & Kimmerle, 2008, p113).

In this study, the learners were provided with a new CSCL platform (see technology platform section below). The platform incorporates three different representations. Different from previous studies on collaborative knowledge building, the technology the participants used visualizes connections between representation by the keywords learners assign to categorize, sort, cluster information (Namdar & Shen, 2016). In a previous study, for instance, students created representations to reflect their initial knowledge of nuclear energy (Namdar & Shen, 2016). Some learners only added different representations without adding/coediting others' representations or extending the knowledge represented in the platform. This process is an example of external assimilation. However, learners frequently created new representations in the platform to add distinct aspects of nuclear energy (e.g. radiation and cancer, nuclear energy dependency of US) and extended the knowledge base represented in the platform. Furthermore, learners coedited each other's entries and rearranged information. This revision and creating representations reflecting different aspects of a phenomena can be interpreted as external accommodation.

In the current study, collaborative knowledge building was further identified on two levels: collective and individual. In the collective level learners' externalization accommodations and assimilations contributes to a web of knowledge representations in the technology platform. Thus, representations created in the technology platform reflect collective understanding of the whole class (Figure 1). This digital artifact, in return, can influence individuals' cognitive assimilations and accommodations. In the individual level learners' build their individual knowledge reflected in a representation.

## SOCIOSCIENTIFIC ARGUMENTATION

In recent years, argumentation has received much attention from the science education community (Lin, Lin, & Tsai, 2014). It is the process of constructing, evaluating or validating claims through evidence (Jiménez-Aleixandre & Erduran, 2008). In science education, Duschl and Osborne (2002) defined argumentation in two forms: rhetorical and dialogical. Rhetorical argumentation includes the linguistic aspect of argumentation when creating arguments. Toulmin's (1958) model of argumentation components includes six categories: a) *Claim* conclusions, opinions and hypothesis or assertions made about facts; b) *data*: evidence that support claim; c) *warrants:* statements, rules, or principles that connect claim and the data; d) *backings:* statements that justify warrants; e) qualifiers: conditions where there is a restriction on the claim; f) *rebuttals*: statements that rebut and defeat the warranting conclusion. Furthermore, argumentation can also be framed from a social, dialogical perspective. In a dialogical argumentation perspective, another party comprises an important place in developing multiple perspectives and constructing knowledge in the argumentation process (Andriessen, 2006; Jonassen & Kim, 2010). Dialogical argumentation occurs with the presence of another individual or the interlocutor in mind. Different from dialogical argumentation, collaborative argumentation is the social construction of knowledge in which learners work to solve a problem through sharing ideas, challenging and justifying assumptions within and among groups. In the current study, Toulmin's model was adopted to analyze changes in learners' argument structures. Additionally, collaborative argumentation has also guided this work similar to other studies in the SSI literature for two reasons. First, as SSIs involve the negotiation of issues that has multiple solutions, learners use

collaborative argumentation to be exposed to distinct ideas and perspectives, as well as to weigh alternative ideas to reach well-informed decisions (Sadler & Donnelly, 2006). Second, collaborative argumentation was used in the current study to enhance knowledge base in the learning environment. This was ensured through engaging students in small group and whole class argumentation, and asking students to incorporate their arguments in a shared online platform so that their peers can be exposed to multiple arguments on different topics in the learning environment and finally can (co)construct their own understanding of healthy eating.

## METHODS

A *blended mixed methods research design* was employed to *better understand* collaborative knowledge building with multiple representations (Greene, 2007). In this design, methods assessed the different aspects of collaborative knowledge building and served for the *complementarity* purpose. A complementarity mixed method study enabled me to use both quantitative and qualitative methods to analyze different facets of the phenomenon, namely collaborative knowledge building in the collective level and in the individual level (Greene, Caracelli, & Graham, 1989). Qualitative and quantitative data were collected concurrently and the status of methods had equal weights (Greene, 2007).

## CONTEXT AND THE PARTICIPANTS

This study was conducted with a group of PSTs (n=18) enrolled in a technology in science education course at a large, high research activity university in the Southeastern United States in 2013-2014 fall semester. Demographically, the participants were 16 Caucasian and two Asian-American (11 female and seven male) PSTs. In the group, there were two graduate students. The class met once a week for a three-hour period at a computer lab and focused on teaching the ways to use technology. Due to missing students during the implementation, the groups had different number of students. Although all 18 PSTs who participated to study created representations in the technology platform (see below) six participants (two male and four female) were missing in the final presentation day. Even though the six participants did not do the final presentation; rest of their data were valid for use by all other participants. Therefore, we included six participants with missing representations in our analysis of collaborative knowledge building but we excluded them from the analyses regarding argumentation in the setting.

The reason for choosing a technology course to implement the current study unit was twofold. First, the literature supports the idea that PSTs are at the place to affect future students and preservice teachers' experiences during teacher education programs are fundamental. This study was aimed at familiarizing preservice teachers with a new CSCL platform so that they can consider using it in their future teaching. Second, I introduced preservice teachers to the ways to use such technologies to foster socioscientific argumentation in classrooms. During the study, each participant had a computer connected to the internet to work on and the participants were randomly assigned (Patton, 2002) to five groups (two groups of three, one group of four and one group of two students. During the semester, another instructor taught the course. To build a rapport with the participants, I attended all previous class sessions before teaching the current healthy eating unit and implemented the study towards the end of the semester.

## PROCEDURES

The study was implemented in four sessions. (a) Introduction (65 minutes): In the first session, the participants were introduced to argumentation, the use of representations, and concept mapping. They were also introduced to the technology platform and used it to get familiar with it. Then, the participants were asked to write what they understand from healthy eating on a Wiki. At the end of the session, the participants were assigned to groups and asked to decide on a topic of interest. (b) Individual knowledge organization: As homework (session 2), each participant was asked to find information about a topic of interest and create one entry on each representation mode in the technology platform on the topic that their group decided. (c) Collaborative learning (135 minutes): In the third session the participants used collaboration tools in the platform and reviewed other participants' representations. They were then engaged in small group argumentation. Based on the argumentation, they revised their entries in the technology platform and created posters reflecting their groups' positions about their topic of interest. (d) Presentations (100 minutes): In the fourth session groups presented their posters. Each participant had a chance to visit other groups' posters and took notes. Finally, the participants were asked to rewrite their what they understand about healthy eating on a wiki page in the technology platform. They were also given a questionnaire with open ended questions about the use of different representations in argumentation (Namdar, 2015).

## TECHNOLOGY PLATFORM (Innovative Knowledge Organization System: iKOS)

The participants used a hypertext, web-based CSCL platform that supports individual and collective learning through knowledge organization and collaborative knowledge building: innovative knowledge organization

system, iKOS (http://ikos.miami.edu/). iKOS incorporates three modes of representations: textual (Wiki), pictorial (Event, since renamed PicTag), and Concept Map. Wiki is similar to the popular Wikipedia, that allows learners to create primarily textual representations. The Wiki space also allows users to insert up to three visuals next to their text. In Event, users can insert static pictures. With an annotation tool, users can tag and insert words and short phrases in their tags to highlight important parts of the picture and reflect understanding of scientific phenomena depicted in the picture. Users can also create Concept maps to show and build relationships within a set of concepts.

What is unique to iKOS is that it creates a knowledge web (Figure 1) of entries (i.e. each representation created by a user/users) based on the keywords that users assign for organizing their entries. Knowledge web is a tool that visualizes the representations that were linked in our CSCL platform. The platform creates this web of entries and users can easily move in between representations that are created on the similar topics. The links between representations were created automatically by the platform based on the keywords learners generated.

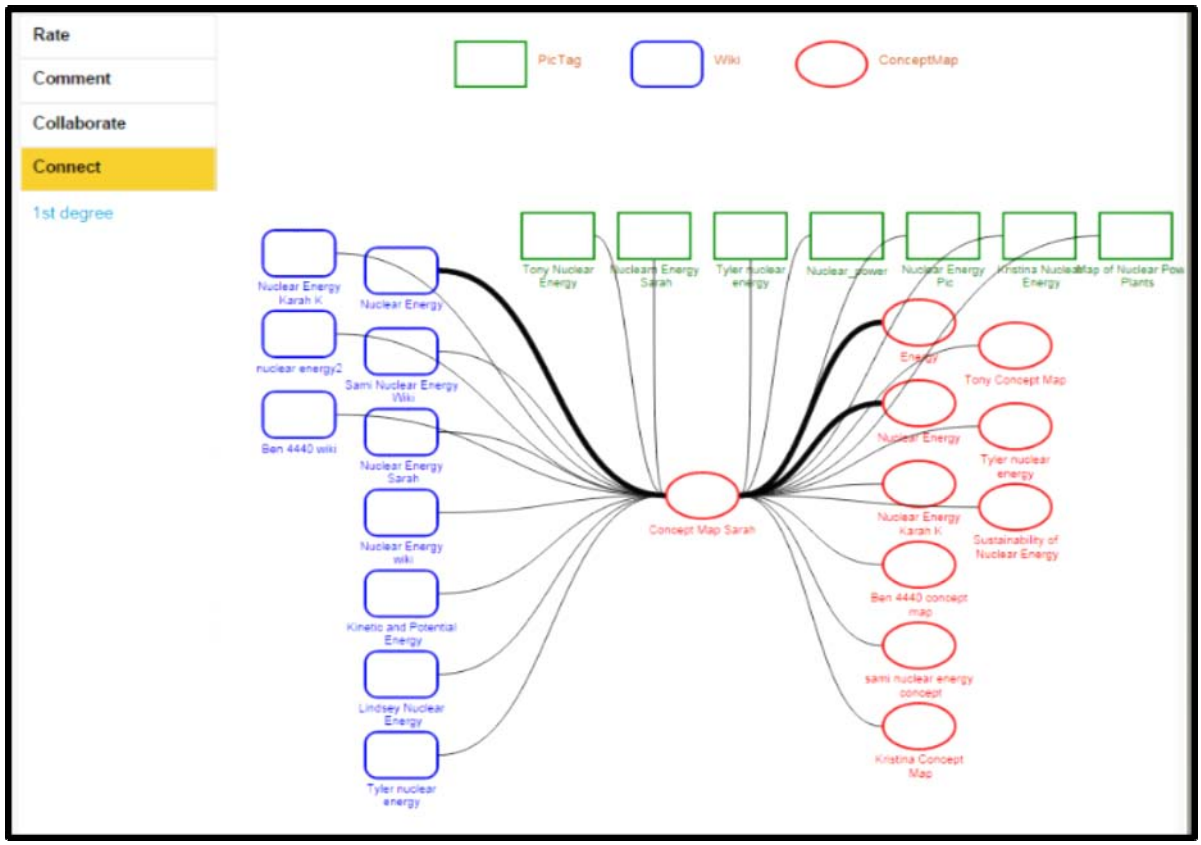


**Figure 1**. Knowledge Web in the iKOS

## DATA COLLECTION

The participants' entries in the technology platform and their written arguments were the primary data sources and the audio recordings of the classroom interactions were the secondary data sources in this learning environment. All audio recordings were transcribed verbatim. The participants' names were changed to pseudonyms where the letters represented group names and numbers represented each participant in the group.

## DATA ANALYSIS

Social network analysis measures were used to identify collaborative knowledge building reflected through the participants' representations (Knoke & Yang, 2007). First, to understand how learners build knowledge using different modalities of representations in the knowledge network, social network measure of *density*, after the first and the fourth sessions were calculated and compared. Density is a social network measure that indicates how well a knowledge base is connected. Therefore, an increase in the density indicates stronger social dynamics in the study (Hong, Chai, & Tsai, 2015) and thus it indicates how well collaborative knowledge building occurs and how dense the interaction is in the learning community. Density is calculated by dividing the total number of existing links between the participant generated representations by possible links between entries in the knowledge web (Knoke & Yang, 2007). Second, content analysis was used to analyze the participants' wiki entry content (Neuendorf, 2002). As the participants were not instructed to modify their concept map and event

entries, only the changes in wikis were analyzed. Through content analysis the key phrases were identified and put into a one by one matrix. Then, if the key phrases of one participant's entry matched another participant's in the class it was identified as a connection. Based on the connections, density was calculated and the network was visualized (Figure 2). Third, *text mining* strategies were used to identify the changes in the collaborative knowledge base (Feldman & Sanger, 2006). The participants' initial arguments in their wiki entries were logged into .txt files. Using the *R* statistical package, I ran text mining analysis. During the analysis, repeated and unnecessary words were deleted from the files and the strength of connections based on the *words* used were shown in diagrams (Figure 3).

To answer the second research question, I compared participants' first and final arguments reflected in their wiki entries. First, to understand how individual learning progressed in the learning environment, we described and compared learners' written argumentation qualities (see Table 1) using Toulmin's Argument Pattern (TAP) framework (Erduran et al., 2004). Although this framework has been widely used in science education (Kaya, 2013; Kim, Anthony, & Blades, 2014; Ozdem, Ertepinar, Cakiroglu, & Erduran, 2013), it does not address the level of scientific knowledge or number of aspects used to construct arguments. Hence, to identify the changes in individual arguments, a structure of argumentation in terms of the (a) level of scientific knowledge incorporated (no mention, superficial, general, specific) and (b) the number of aspects incorporated were coded (Tal & Kedmi, 2006). The coding rubric for the level of scientific knowledge is illustrated in Table 2. The number of aspects incorporated in the arguments referred to the reasoning modes utilized to negotiate the healthy eating issue (Wu & Tsai, 2007). The aspects included different types of healthy eating option arguments, such as low fat. We counted the number of different aspects (reasoning modes) incorporated in an argument.

**Table 1.** TAP Analysis Rubric (Erduran et al., 2004)

| Level | Explanation | Example |
|---|---|---|
| Level 1 | Arguments that are a simple claim versus a counter-claim or a claim versus a claim. | Low fat diet is the best way of healthy eating. |
| Level 2 | Consist of a claim versus a claim with either data, warrants, or backings but which does not possess any rebuttals. | Low fat diet is better for health because studies show that low fat diet helps losing weight and decrease the risk of heart attacks. |
| Level 3 | Consists of a series of claims or counter-claims with either data, warrants, or backings with the occasional weak rebuttal. | Low fat diet is better for health because it decreases the hearth attach risk. It also decreases the bad cholesterol. Some people are against this type of diet but they are usually not knowledgeable about the issue. |
| Level 4 | Arguments with a claim with a clearly identifiable rebuttal. Such an argument may have several claims and counter-claims. | Low fat diet is better for health because it decreases the hearth attack risks by lowering the bad cholesterol. Although some people say that low fat diet is dangerous due to lack of essential fatty acids, low fat diet promotes the intake of all essential fatty acids in proper amounts. |
| Level 5 | An extended argument with more than one rebuttal | Low fat diet is better for health because it decreases the hearth attack risks by lowering the bad cholesterol. Although some people say that low fat diet is dangerous due to lack of essential fatty acids, low fat diet promotes the intake of all essential fatty acids in proper amounts. Some people also argue that low fat diet is bad for lowering cholesterol for neural impulse transfer but low fat diet controls the minimum amount of cholesterol that should be taken. |

**Table 2.** Coding the Level of Scientific Knowledge Incorporated

| Level of Scientific Knowledge | Explanation | Example |
|---|---|---|
| No mention | A claim is not justified by scientific concepts, principles or theories. These arguments often include intuitive responses given to the SSI or claims not supported by any data, warrants or backings. | I think eating healthy means not putting empty calories in your body. |
| Superficial | An argument mentions scientific concepts or scientific principles but these are not either elaborated. | I think eating healthy means eating low fat meals because it lowers bad cholesterol. |
| General | An argument with general scientific knowledge mentions the abstract, generalized scientific principles to justify the claim but does not elaborate on the scientific principle | I think eating healthy means eating low fat meals because it lowers bad cholesterol that is deposited into the arteries. |
| Specific | These arguments either references very detailed science content or has a specific science phenomena followed by elaboration to justify a claim. | I think eating healthy means eating low fat meals because it lowers cholesterol. Cholesterol is transferred in the arteries via low density lipoproteins (LDL). LDL raises cholesterol level. When the LDL levels increases high density lipoproteins decreases which takes the extra cholesterol from cells. High fat diet increases the LDL and this develop plaques in the arteries. |

Second, although the participants' argumentation interactions were reflected through the text mining and social network analyses, it was not evident where exactly the participants acquired their new knowledge. To identify the source of changes in the final argument, subjects in the written arguments were identified and compared with the keywords and phrases found through content analysis of the posters and the representations. For all qualitative analysis, another expert researcher in science education coded all data as well as the author of this paper. The interrater reliability was calculated .85 for the argumentation analysis coding and .80 for the content analysis coding for posters and written arguments (Miles & Huberman, 1994). Through four cycles of peer debriefing sessions, all inconsistencies in the coding were discussed and codes were compared until the disagreements were resolved (Lincoln & Guba, 1985).

## RESULTS

### COLLABORATIVE KNOWLEDGE BUILDING AT THE COLLECTIVE LEVEL

Results indicated that 18 participants generated 37 Wiki, 15 Event, and 15 concept map entries in the platform. The number of links each representation had were 224 for Wiki, 105 for Event, and 224 for concept map at the end of this unit. Overall, the knowledge base created with multiple representations had the density of 0.09 and this increased to 0.13 at the end of the unit. This increase in the overall knowledge network indicates an improvement in the collaborative knowledge building through externalization. This small increase might be the result of students' limited experience with the technology platform. On the other hand, an earlier analysis of the student reflections regarding the use of the technology platform also indicated that some learners had difficulty understanding the utility of concept maps and event entries embedded in the platform (Namdar, 2015).

As the participants were explicitly instructed to revise their written arguments in the learning environment, 12 participants' (i.e. students who completed all the activities in the platform) initial and final written arguments about healthy eating were analyzed using content analysis (Neuendorf, 2002). A two-mode matrix has been generated based on the codes which emerged from the data. It was found that the density of the knowledge base increased from 0.23 to 0.53, meaning 53% of the possible links were present at the end of the intervention. Figure 2 shows the connections between learners' written arguments on healthy eating. In the figure 2 each square indicates a wiki entry created by a student and arrows indicate a relationship between two wiki entries in terms of their content. Figure 2 and the results indicate that the knowledge base reflected in wiki was increased. For instance, students A3 and C4 (Figure 2), who did not have matching ideas in their wiki entries with the rest of their peers also increased their knowledge through collaborative knowledge building by incorporating different ideas from other students.

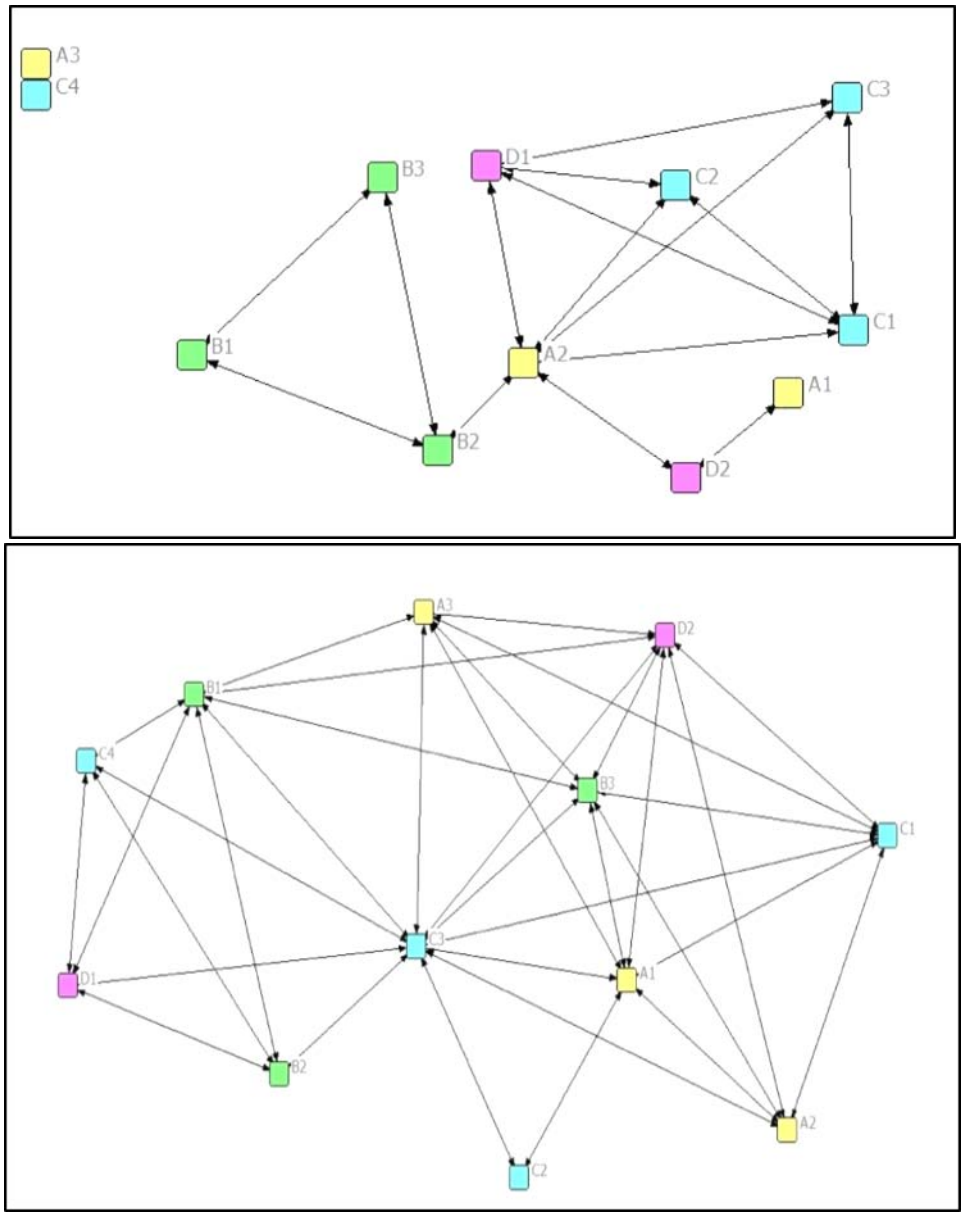


**Figure 2.** Connections between learners' argument contents before (top) and after (bottom) collaborative knowledge building

To look at the one mode network, learners' written arguments were analyzed using *R* statistical package. Unnecessary and repeated verbs (e.g., I, you, that, those, me, her, etc) were deleted. The bubbles in Figure 3 indicate the participants' written arguments and the diameter of each bubble shows the amount of common words that wiki entry had with the others in the network. Figure 3 reveals that after collaborative knowledge building activities on healthy eating, the participants' arguments shared more common words in their final arguments.

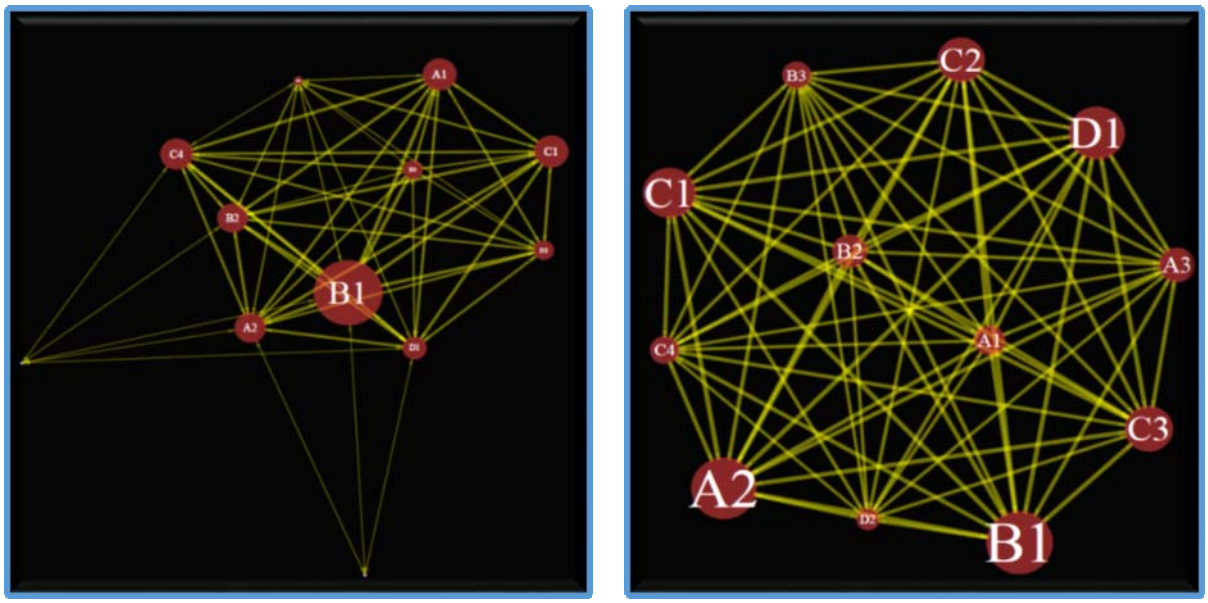


**Figure 3**. Amount of common words in wiki entries in learners initial (left) and final (right) arguments

## COLLABORATIVE KNOWLEDGE BUILDING AND INDIVIDUAL ARGUMENTS

**Written argument qualities.** Results indicated that the participants' initial and final written arguments had two differences. First, utilizing the TAP (Erduran et al., 2004) framework to analyze participants' argument qualities, it was found that at the individual level, seven participants increased their argumentation quality, two participants had the same level of arguments and three participants' argumentation quality decreased (Table 3).

**Table 3**. Argumentation Qualities of Each Participant

| Student ID | Argument Quality | | Argument Structure | | | | The sources of aspects incorporated in the final argument |
|---|---|---|---|---|---|---|---|
| | | | Scientific Knowledge | | Aspects Incorporated | | |
| | Initial Arg. | Final Arg. | Initial Arg. | Final Arg. | Initial Arg. | Final Arg. | |
| A1 | 3 | 4 | N | G | 1 | 4 | Poster presentation & representation |
| A2 | 3 | 4 | Su | G | 2 | 4 | Poster presentation & representation |
| A3 | 1 | 4 | N | G | 1 | 2 | Poster presentation & Initial argument |
| B1 | 3 | 3 | Sp | Sp | 3 | 2 | Initial argument |
| B2 | 4 | 2 | G | Sp | 1 | 2 | Poster presentation & representation |
| B3 | 4 | 2 | Su | Su | 1 | 3 | Initial argument |
| C1 | 2 | 5 | Su | Sp | 2 | 1 | Initial argument |
| C2 | 1 | 5 | N | G | 1 | 5 | Poster presentation & Initial argument |
| C3 | 1 | 4 | N | Sp | 1 | 3 | Poster presentation & representation |
| C4 | 1 | 3 | N | G | 1 | 1 | Poster presentation |
| D1 | 2 | 2 | G | G | 3 | 1 | Representation |
| D2 | 2 | 2 | G | Sp | 1 | 3 | Poster presentation & Initial argument |

N: No mention, Su: Superficial, G: General, Sp: Specific

**Written argument structures.** Utilizing argumentation analysis tools, it was found that the participants' arguments on healthy eating after collaborative knowledge building changed in two domains: (a) use of scientific knowledge and (b) aspects incorporated. Through investigation of the participants' use of scientific knowledge in their written arguments I found that ten participants increased their use of scientific knowledge while one

participants' scientific knowledge incorporation remained the same and the other participant already had specific use of scientific knowledge in her initial and final arguments. For instance, in her initial argument C4 only incorporated claims while not supporting it by providing justifications which is a level 1 argument.

> Eating healthy means taking care of your body. Although eating healthy is not necessary for normal body functioning, it does increase the productivity of the body system. If we want our bodies to function to the best of their ability, we must input the best food that we can to fuel the functions that the body carries our daily routine (C4, initial wiki entry).

It is evident from this argument that there is no incorporation of justifications as in the form of specific scientific knowledge. The student however, indicated that her views changed based on the unit, especially on a gluten free diet.

> My opinion did change on the issue of gluten free vs gluten enriched diets. *Celiac disease causes gluten intolerance and leads some people to not digest gluten.* With the rise of gluten free options in many stores and restaurants, it seems that there is a spike in the number of people believing that they have celiac disease. In fact, only 1 % of the population has been diagnosed with celiac disease making it seem as though the popularization (C4, final wiki entry).

On the other hand, collaborative knowledge building helped some of the participants to see different aspects of healthy eating. Initially most participants (n=8) argued their position from one aspect associated with the issue. Aspects included ideas and knowledge about genetically modified organisms, gluten free diet, vegetarian diet, low calorie, low fat diet and sport and exercise. Only four participants used multiple aspects of healthy eating subject to construct arguments. After the intervention, it was found that eight participants incorporated more aspects, three students who initially used multiple aspects decreased the number of aspect incorporated, and one participant constructed their argument using only one aspect. However, increased incorporation of aspects did not always indicate increased quality of scientific knowledge used in the argumentation. For example, B3 increased the aspects incorporated in his argument from one to three but scientific knowledge used remained as superficial in his written arguments. B3 in his initial argument mentioned that

> Gluten allergies are all the rage in today's society. With the actual percentage of American's with Celiac disease at about 1%, why are so many people switching to a gluten-free diet? Many argue that the pros of a gluten-free diet offer a healthier diet. Actually, a gluten-free diet can rob you of many essential nutrients. A gluten-free diet has become more of a gluten-free lifestyle, and it is about time gluten started fighting back (B3, initial wiki entry).

On the other hand, B3's final argument included aspects of moderation, hazardous materials on food, and exercise but did not include any identifiable rebuttals.

> There is no one secret to eating healthy and living a healthy lifestyle. You must contribute a number of things into your daily life in order to ensure that your daily nutrition is being met without unhealthy excess. One common theme that I observed is moderation. You can eat most things, even the gluten devil, and still eat healthy as long as it is in moderation. Also, it is important to remember that some normally healthy foods, may be tainted with genetic hormones, pesticides, and other health hazardous materials. Exercise and diet are the key to living a healthy lifestyle. Quick diet fixes or extreme weightlifting alone will not make you a healthier person. It takes effort to live a healthy lifestyle, but the pros definitely outweigh the cons (B3, final wiki entry).

Similarly, a decrease in the aspects incorporated did not necessarily indicate a decrease in scientific knowledge quality. C1 for instance in her initial argument incorporated two aspects associated with healthy eating: calorie intake and eating vitamin-mineral rich foods. However, her initial argument did not include counter claims or identifiable rebuttals. In her final argument, she had a level 5 argument which included identifiable arguments but only included one aspect of the issue without incorporating ideas from others in the class.

> With proper planning, vegetarians can be as healthy, if not healthier, than non-vegetarians. A plant-based diet is linked with cardiovascular health, reduced risk diabetes and some types of cancer prevention. However, maintaining a balanced diet as a vegetarian takes work. Just like non-vegetarians, vegetarians are susceptible to the allure of refined sugars and fats. Additionally, one can argue that most plants do not contain all the essential amino-acids necessary for the body to make proteins. However, vegetarians vary the types of protein rich-foods they eat to include some legumes (beans, nuts, and soy) and some whole grains and seeds (cereals, breads, rice etc.). Additionally, one can also argue that they are vulnerable to certain types of nutrient deficiencies--which can be remedied by eating a well-balanced diet. In order to stay healthy, a vegetarian must consider the amount of calcium, iron, and other nutrients he or she is eating on a daily basis. In light of the research, it seems that vegetarians that

> are willing to put in the work to maintain a balanced diet are probably healthier than the rest of us (C1, final wiki entry).

**The sources of aspects incorporated.** Regarding the aspects incorporated in the final written arguments, eight students incorporated ideas presented during the final presentations. Additionally, five students also incorporated ideas that other students included in their representations. There were six students who also incorporated their initial ideas in their final written wikis.

> Eating healthy means a *balanced level of calories for your activity level*, [drawn from the initial wiki] age, gender, and health concerns, and should include a moderate level of meats, vegetables, gluten, as well as exercise to keep your metabolism up. *GMO's even have a place in our society as the foods produced can yield foods with higher nutritional content and give our society to keep up with our ever-increasing population demands* [drawn from the poster presentation of Group A] (D2, final wiki entry).

For instance, D2 in his final argument incorporated one aspect from his initial wiki and another aspect that was emerged from a poster presentation.

## DISCUSSION

In summary, the participants in this study were provided with a CSCL platform that incorporates three different modalities of representations and were asked to organize and build knowledge collaboratively on healthy eating. Results indicated that the knowledge base created jointly by the participants were improved and the written argument content both shared more commonalities in terms of content and shared more common words as a reflection of a collective effort through wikis. On an individual level, analysis of learners' written arguments indicated that some participants increased their argumentation qualities in their final arguments, most participants increased scientific knowledge use, and incorporated more aspects in their arguments.

CSCL environments provide learners with tools and representational modalities to support intersubjective knowledge creation and creation of group artifacts (Stahl et al., 2014). Argumentation-based CSCL environments known as ABCSCL offer knowledge representation tools to support argumentation (Noroozi, Weinberger, Biemans, Mulder, & Chizari, 2012). Although these representational tools are provided in the forms of schemas, visualizations, and scripts and tables, in this study learners were provided with a hypertext platform including distinct representational modalities. In particular, what was unique to our platform was that it generated a web of knowledge based on learners' representations in the platform. The results of this study suggest that providing students with different representational tools in an argumentation setting enhances group products. Although the increase in the connectedness of the network through three representational modalities was small, there was an important increase in the connectedness of textual representations. Therefore, as an implication I suggest providing students with multiple representational modalities in a CSCL environment to foster group products and teaching the purposes and uses of visual representations to better support argumentation.

Collaborative knowledge building studies often identify collaboration in wikis through content analysis (Lin & Reigeluth, 2016) and log file analysis (Kimmerle et al., 2011). Different from the literature, I used distinct and multiple methodological approaches to identify collaborative knowledge building reflected in learners' wikis. I used namely, text mining, content analysis and density measures to identify collaboration in wiki representations. Text mining strategies and density measures together indicated the collaboration degrees in the learning environment. These approaches also allowed me to identify students with isolated ideas and how collaborative knowledge building activities allowed them to incorporate ideas from different learners. As an implication, CSCL researchers could combine social network analysis techniques such as text mining and density along with content analysis to show collaboration in the network.

Despite the variety of instructional tools in CSCL settings such as shared work spaces, gaming environments and knowledge representations, learners may have difficulties arguing in these environments either face to face or online (Noroozi et al., 2012). The results of the current study showed ature that some participants had either the same or decreased argumentation qualities. This might be the result of design of the iKOS platform as well as the design of the learning unit. Literature suggests that providing highly structured collaboration scripts in these CSCL environments may increase students' learning outcomes during complex collaborative problem solving activities (Beers, Boshuizen, Kirschner, & Gijselaers, 2005). Therefore, researchers may provide structured scripts to enhance argumentation qualities and thus individual learning.

SSI-based curricula have been criticized because it could degrade the integrity of science (DeBoer, 1991). However, recent empirical studies have shown that SSI-based curricula can increase students' scientific content

knowledge (Dori, Tal, & Tsaushu, 2003; Klosterman & Sadler, 2010; Zohar & Nemet, 2002). Furthermore, SSI-based curricula interventions increase students' scientific knowledge incorporations in arguments (Tal & Kedmi, 2006). In this study, on an individual level, learners who had distinct ideas in their wiki entries (A3, C4, see figure 2) incorporated more specific scientific knowledge on healthy eating in their argumentation at the end of collaborative knowledge building activities. All but one participant increased their level of specific scientific knowledge incorporation in their arguments. Therefore, SSI-based argumentation interventions should provide learners with opportunities for collaborative knowledge building so that the learners can interact with their peers and adopt scientific knowledge to use in their arguments.

CSCL classrooms present different challenges for monitoring argumentation, as much of the discourse occurs face to face and were also mediated by the information embedded in co-created digital artifacts in technology platforms (Philip, 2010). Therefore, there is a call for combining different methodologies to understand complex interactions in collaborative environments because students work both in collaborative groups and individually (Jeong, Hmelo-Silver, & Yu, 2014). To understand collaborative knowledge building on healthy eating, I used mixed methods research and benefited from social network measures, argumentation, and content analysis. I provided empirical evidence on the use of social network techniques to visualize and describe relationships between digital artifacts to identify collective learning (de Laat, Lally, Lipponen, & Simons, 2007). As there is a call for combining different methodologies for investigating individual and collective learning (Jeong et al., 2014), I used a common coding and counting approach to understand the differences in individual learning (Chi, 1997). By implication, I suggest that CSCL researchers use multiple methodologies to investigate learning at the individual and collective levels and to reach deeper understanding of their relationship (Greene, Benjamin, & Goodyear, 2001). This can be established through utilizing multiple data sources and analysis techniques (Smith, 2006; Teddlie & Tashakkori, 2003).

## CONCLUSION AND FUTURE RESEARCH DIRECTIONS

This study serves as an initial attempt to identify collaborative knowledge building's effect on students' socioscientific argumentation. Although multiple data sources were presented in the study, the technology platform did not tell us which student visited which representation and for how long. Future design of such CSCL platforms might log this information to show possible links between time spent to study a representation and using this information in argumentation. In the study, the participants' in class interactions were not video recorded. Therefore, the amount of time each participant spent, for instance, listening to poster presentations or reading other groups' posters were not identified. This might have influenced students' written argumentation. Hence, future studies should also pay attention to the amount of time spend in verbal discourse and students' physical actions should also be studied to identify the underlying mechanisms of collaborative knowledge building. The current study was also limited by the small number of participants and the representational modalities that the platform was able to offer. Therefore, results should be interpreted cautiously.

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# Teachers' Use of Information and Communications Technology in Education: Cameroon Secondary Schools Perspectives

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**ABSTRACT**
Information and Communications Technology (ICT) offers innovative tools for restructuring teaching and learning processes in preparing students for the 21st Century skills. However, there is no sufficient and reliable data concerning how the use of ICT fit in different school cultures in Cameroon, and how teachers with varying pedagogical and domain expertise and learning experiences are able to function with various network learning environments. This paper discusses teachers Use of ICT in Education on the basis of intensive case studies conducted in Cameroon secondary schools. A total of 320 teachers from 16 public, denominational and lay private schools from two regions in Cameroon participated in this study. The survey was used for data collection. Descriptive statistics and independent sample t-tests and ANOVA were used to analyse the data. The results of this study indicate teachers' perceived ICT usage, perceived access to ICT, perceived ICT competence and perceived ICT training support were low. Furthermore, the analysis showed that teachers in an urban area perceived the use of ICT and perceived access to ICT was higher than teachers in the rural area. Finally, this study discovered that there was no significant difference in public, private and denominational school teachers' use of ICT, access to ICT, competencies and training support. The results provide insights into factors that teachers perceived as obstacles to the use of ICT in their teaching, particularly in developing nations.

**Keywords:** Information and communications technology (ICT), ICT competence, training support

## INTRODUCTION

Information and communication technology (ICT) plays a crucial role in the knowledge and information society by increasing economic productivity through digital economies, enhancing the delivery of public and private services and achieving broad socio-economic goals in education, health care, employment and social development (UNESCO-UIS, 2015). ICT in education can help individuals to compete and adapt to the knowledge and information society by achieving the 21st-century skills which can enhance skilled workforce and social mobility. ICT in education has a multiplier effect throughout the school system, by; enhancing learning and providing students with new sets of skills (Balanksat et.al., 2006); reaching students with poor or no access(Young, 2002; UNESCO-UIS, 2015).); facilitating and improving the training of teachers (KERIS, 2011); increasing the possibilities of communication and reinforcement of the development of skills of coordination and collaboration between peers ( Dede, 2009); and minimising costs associated with the delivery of traditional instruction(Gulati, 2008; KERIS, 2012). Research studies have also found that positive perceptions of teachers on ICT integration into schools and ICT usage in their teaching are essential to successful implementation of ICT in education (Almekhlafi and Almeqdadi, 2010; Aydin, 2013; Sipilä, 2014; Choy and Ng, 2015). Teachers' attitudes towards the use of ICT impact on their ICT integration in the classroom, decisions they make and actions they take in classrooms (Shaibou, 2015).

Teachers' use of ICT in Cameroon has been less than optimal, and in spite of its potential educational benefits of ICT in Education, teachers may not have benefits, for various reasons (for example lack of training, resistance to change, among others). Perhaps this is because of the lack of focus on ICT in Cameroon. For example, in 1995, when the National Forum on Education took place in the country's capital, Yaoundé, from the 22nd to the 27th of May nothing was said about the use of ICT in schools. However, the Law of Orientation of Basic and Secondary Education (Law No. 98/004 of April 14, 1998) which is mostly based on the recommendations of the National Education acknowledges in general terms the potential contributions of ICT in education. It states in Section 25 (Part III) that "the education provided in schools shall take into account scientific and technological advancement and shall be tailored in terms of content and method, to national and international economic, scientific, technological, social and cultural trends". ICTs were officially introduced into the Cameroon secondary education system in February 2001 by the president in his message to the youth, in which he called on them to embrace the knowledge economy (Mbangwana, 2008). As a consequence, computers were introduced into many General Secondary schools, and secondary technical/vocational schools and many schools benefitted

from presidential grants of multimedia centres connected to the internet.

This initiative has started to address the many problems that plague secondary education in Cameroon, among them acute shortages of basic pedagogic material and human resource inputs, overcrowded classrooms, problems of relevance, and quality, and inadequate access, among others. The use of ICT has the potential to address some of these problems. For example, ICT can improve access to education, equity and the quality of teachers' professional development (Robinson, 2008; Mervyn, 2002). With all these initiatives in place, there is no clear, recognisable national strategy plan for the integration of modern technology within the school curricula and pedagogical activities. The use of ICT in Cameroon secondary schools mostly depends more on the school leadership and dynamism and enthusiasm of teachers.

Many Secondary Schools have adopted ICT policies and are in the process of implementation. Although significant educational research has been carried out in other countries on the use of ICT in schools, the results were mostly context-specific due to population, sampling, and/or design limitations. In other words, the findings cannot be applied to Cameroon because of contextual differences. Apart from the contextual factors, findings may not apply because of potential differences among participants. That is, Cameroonian teachers have differing experiences with modern technology due to the recent presence of modern technology in their schools and their distinct cultural background (Shaibou, 2015). However, there is no study on ICT integration by teachers in Cameroon secondary schools. Hence, it is important to investigate teachers' perceptions of ICT access, ICT training, ICT competencies, leadership support, and ICT integration. Research findings from teachers' perceptions and ICT usage may have important implications for administrators, departments, students, and employers and may enhance educational delivery to students' learning experience in secondary school, and students' application of knowledge and skills in the real world of work. Therefore, we reason that it is necessary to investigate teachers' perceptions and ICT usage in education.

**Purpose**

The purpose of this paper is to investigate Teachers Use of ICTs in Cameroon Secondary Schools.

**Research questions**

1. What are teachers' levels of ICT use in secondary schools?
2. What are teachers' perceived ICT access, competence, training and ICT support?
3. Are there differences in perceptions of teachers' ICT use, access, competence, and support with regards to school location (Urban and Rural)?
4. Are there differences in perceptions of teachers' ICT use, access, competence, and ICT support with regards to school type (Public, Denominational, and Lay Private)?

**THE STUDY**

ICT is considered as a tool to transform teaching and learning the process, improve students' learning, to supplement the curriculum and the develop pedagogy (KERIS, 2005, Malaysian Ministry of Education, 2006). The integration of ICT in teaching and learning depend very much on the teachers' initiatives. The main objective of using ICT in the school is to make the teaching and learning process more effective, efficient and appealing. However, to achieve this, the teachers themselves have to be well prepared and competent in ICT. They have to be ready in terms of ICT competences to face their students who are mostly 'Digital Natives' and are generally comfortable using ICT devices.

Nowadays many different types of technology are used to support and enhance the teaching and learning process. This includes everything from surfing the internet to collecting information for lessons preparation and using applications to prepare presentations, creating digital learning materials for students. Also, using ICT to provide feedback, assess students' learning, communicating online with parents, download and upload material from the school's portals or learning management system to looking for online professional development opportunities.

In this study, 16 public, private and denominational secondary schools were randomly selected. The schools comprised three public Secondary Schools, three private Secondary schools and two denominational in each region. The categorization of the schools was urban schools and rural schools. The participants were randomly selected. A total of 302 questionnaire were received, representing 94.38 percent return rate from 320 questionnaire distributed to teachers. Of these, 12 questionnaire were deemed unusable, due to data incompleteness, and were subsequently dropped from the data set leaving 290 questionnaire for data screening. Of these, 8 questionnaire were detected as outliers and deleted from the data set leaving 282 cases for the data analysis. The questionnaire consisted of 53 items and was categorised into three sections. Section A consists of

seven demographic items, section B consists of ten items of teachers' ICT usage, and section C contains nine items of perceived access to ICT, twelve items of competency, ten items on training and five items of on types of support training that were related to teachers' use of ICT. A reliability test was carried out to determine the internal consistency of items in the questionnaire using Cronbach's α reliability test. Cronbach's α coefficient for the pilot questionnaire was 0.80, and the final questionnaire used for the study was 0.84. According to Kline (2016), α-value of 0.90 is considered excellent, 0.80 very good and 0.70 acceptable.

## FINDINGS

Of 282 respondents, 56.6% were males, and 43.4% were females. The age of the teachers ranged from 20 to over 50 years. 29.3% were between 20 and 29 years old; 39.1% were between 30 and 39 years old; 16.0% were between 40 and 49 years old; 15.6% were over 50 years old; 50.4% of the teachers taught in public schools; 25.2% taught in denominational schools, and 24.5% taught inlay private schools. In total 57.4% of the teachers came from urban and 42.6% from rural schools. In terms of academic qualification, 30.1% had DIPES I, 35.5% had bachelor's' degree, 19.5% had DIPES II, and 4.6% had other qualifications. In addition, 35.5% had more than no ICT training experience, 42.6% had had basic ICT training experience, 14.9%t had intermediate level ICT training and 7.1% had other ICT training experience.

### What are teachers' levels of ICT use in secondary schools?

In analysing Table, I, the mean values greater than 3.0 is considered high ICT integration in teaching, while mean values less than 3.0 is considered low integration.

Table 1: Percentage, mean and standard deviation of perceived teachers ICT use

| Item | Mean | Std. Deviation |
|---|---|---|
| Surf the internet to collect information to prepare lessons | 2.79 | .4434 |
| Browse the internet to collect learning material or resources to be used by students during lessons | 2.58 | .5084 |
| Use applications to prepare presentations for lessons | 2.15 | .5236 |
| Create your own digital learning materials for students | 1.67 | .7371 |
| Prepare exercises and tasks for students | 2.26 | .4701 |
| Post homework for students on the school website | 1.66 | .7387 |
| Use ICT to provide feedback and/or assess students' learning | 1.66 | .7387 |
| Communicate online with parents | 2.15 | .4004 |
| Download/upload/browse material from the school's website or virtual learning environment / learning platform | 2.65 | .5354 |
| Look for online professional development opportunities | 2.80 | .4443 |
| Overall ICT Use | 2.24 | .3298 |
| Note: Cronbach's α=0.78 | | |

The table above shows that teachers' use of ICT in teaching and learning process is low (m=2.24, SD=.33). Among the 10 items that were designed to measure teachers' use of ICT, none of the elements has a mean of 3 which is the cutoff mean. This shows that ICT integration in Cameroon secondary schools is low partly due to poor or no proper ICT infrastructure.

### Teachers' perceived ICT access

In analysing Table, 2, the mean values greater than 2 is considered good access to ICT in teaching, while mean values less than 2 is considered low Access to ICT.

Table 2: Percentage, mean and standard deviation of perceived Teachers' perceived ICT access

| Item | % No Access | Access on demand | Permanent Access | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Desktop computer without internet access | 20.9 | 57.4 | 21.6 | 2.01 | .6535 |
| Desktop computer with internet access | 20.9 | 56.4 | 22.7 | 2.02 | .6614 |
| Non-internet-connected laptop, tablet PC, netbook or mini | 21.3 | 60.6 | 18.1 | 2.00 | .6277 |
| Internet-connected laptop, tablet PC, netbook or mini | 42.6 | 57.4 | 0 | 1.58 | .4953 |
| Photocopier | 57.4 | 42.6 | 0 | 1.58 | .4953 |
| Have a Smartphone | 0 | 0 | 100.0 | 3.00 | .0000 |
| Projector | 45.0 | 55.0 | 0 | 1.55 | .4984 |

| | | | | | |
|---|---|---|---|---|---|
| Digital camera or camcorder | 37.9 | 62.1 | 0 | 1.62 | .4861 |
| Computer laboratory | 21.3 | 58.2 | 20.6 | 2.00 | .6480 |
| Overall Access | | | | 1.92 | .4045 |
| Cronbach's Alpha= .91 | | | | | |

Table 2 shows that the overall teachers' perceived ICT access is low (M=1.92, SD=.41). However, teachers have good access to; desktop computer without internet access (M=2.01, SD=.65), desktop computer with internet access (M=2.02, SD=.66), Non-internet-connected laptop, tablet PC, netbook or mini (M=2.00, SD=.63), and Computer laboratory (M=2.00, SD=.65).Even though all the teachers have smartphone (M=3, SD=.00) but only very few of them use it in their teaching and learning process as teachers' use of ICT in teaching and learning process is low (m=2.24, SD=.33)

**ICT competency**

In analysing Table, 3, the mean values greater than 3.0 is considered high ICT competency, while mean values less than 3.0 is considered low ICT competency.

Table 3: Percentage, mean and standard deviation of perceived ICT Competencies

| ICT Competence Item | % Very much Competence | Moderate Competence | Little competence | No Competence | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| Produce a text using a word processing programme | 2.5 | 70.6 | 2.5 | 5.3 | 2.70 | .6054 |
| Use emails to communicate with others | 2.1 | 53.2 | 37.2 | 7.4 | 2.50 | .6656 |
| Capture and edit digital photos, movies or other graphics | 2.8 | 40.8 | 49.3 | 7.1 | 2.40 | .6624 |
| Edit text online containing internet links and images | 0.7 | 42.2 | 52.8 | 5.3 | 2.37 | .5963 |
| Create a database | 2.5 | 45.4 | 40.8 | 11.3 | 2.39 | .7186 |
| Organise computer files in folders and subfolders | 2.5 | 62.4 | 29.8 | 5.3 | 2.62 | .6268 |
| Use a spread sheet | 2.1 | 62.1 | 31.6 | 4.3 | 2.62 | .6037 |
| Create a presentation with simple animation functions | 2.5 | 53,9 | 37.2 | 6.4 | 2.53 | .6544 |
| Create a presentation with video or audio clips | 2.1 | 57.8 | 31.9 | 8.2 | 2.54 | .6751 |
| Participate in a discussion forum on the internet | 0.7 | 61.0 | 32.6 | 5.7 | 2.57 | .6119 |
| Create and maintain blogs or web sites | 1.8 | 28.7 | 53.2 | 16.3 | 2.16 | .7054 |
| Participate in social networks | 2.5 | 56.0 | 34.4 | 7.1 | 2.54 | .6645 |
| Overall Competence | | | | | 2.49 | .4950 |
| Cronbach's Alpha=.93 | | | | | | |

Table 3 shows that teachers' ICT Competence is low (M=2.49, SD=.50). Among the 12 items that were designed to measure teachers' ICT Competence, none of the elements has a mean of 3 which is the cutoff mean. This shows that teachers need to be trained on the use and integration of ICT in their classrooms. Teachers' ICT Competence is low partly due to little or no support (M=1.95, SD=.53

**To what extent do you agree with the following professional development opportunities provided by the school in the past one school year?**

In analysing Table, 4, the mean values greater than 3.0 is considered high ICT support, while mean values less than 3.0 is considered low ICT support. 10 items were designed to measure ICT support type provided by the school in the last one year. Table 4 shows that teacher received very low support (M=1.95, SD=.53) in integrating ICT in their teaching and learning process. Only Personal learning about ICT in own time (M= 2.80, SD= .44) and receiving other professional development opportunities related to ICT (M= 2.64SD=1.26) have average means showing that teachers in Cameroon secondary schools try to learn and use ICT on their own.

Table 4: Percentage, mean and standard deviation of perceived ICT training

| ICT Training Support item | % SA | A | D | SD | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| Introductory courses on internet use and general applications (basic Word processing, spread sheets, presentations, databases, etc.) | 0 | 14.2 | 46.8 | 39.0 | 1.75 | .6870 |
| Advanced courses on applications (advanced word-processing, complex relational databases, Virtual Learning Environment etc.) | 1.4 | 12.4 | 39.7 | 46.5 | 1.69 | .7416 |
| Advanced courses on internet use (creating websites/home page, video conferencing, etc.) | 1.4 | 14.5 | 41.1 | 42.9 | 1.75 | .7537 |
| Equipment-specific training (interactive whiteboard, laptop, etc.) | 0.7 | 10.6 | 47.2 | 41.5 | 1.71 | .6817 |
| Courses on the pedagogical use of ICT in teaching and learning | 1.1 | 14.5 | 54.3 | 30.1 | 1.87 | .6877 |
| Subject-specific training on learning applications (tutorials, simulations, etc.) | 0.0 | 13.8 | 51.8 | 34.4 | 1.79 | .6645 |
| Participate in online communities (e.g. mailing lists, twitter, blogs) for professional discussions with other teachers | 0.7 | 12.8 | 45.0 | 41.5 | 1.73 | .7058 |
| ICT training provided by school staff | 1.1 | 13.8 | 42.9 | 42.2 | 1.74 | .7320 |
| Personal learning about ICT in your own time | 1.4 | 77.3 | 20.9 | 0.4 | 2.80 | .4443 |
| Other professional development opportunities related to ICT | 0.4 | 57.4 | 41.8 | 0.4 | 2.64 | 1.2610 |
| Overall ICT Training | | | | | 1.95 | .5338 |
| Cronbach's Alpha=.89 | | | | | | |

**ICT support type**

In Table 5, shows the percentage of perceived ICT support types received by the teachers.

Table 5: Percentage, perceived ICT support type received

| ICT Support item | % Never Used | Mostly technical Support | Mostly Pedagogical Support | Both technical and pedagogical Support |
|---|---|---|---|---|
| A more experienced / knowledgeable teacher | 34.4 | 36.2 | 25.9 | 3.5 |
| School ICT/technology coordinator | 20.9 | 37.2 | 24.5 | 17.4 |
| Other school staff | 25.9 | 35.5 | 33.3 | 5.3 |
| Experts from outside the school | 35.5 | 36.9 | 29.5 | 8.2 |
| An online helpdesk, community or website | 35.8 | 36.5 | 29.4 | 9.2 |
| Cronbach's Alpha=.77 | | | | |

The table above shows that teachers receive some types of ICT supports. However, the received support level is very low as only 17.4% of the teachers received both technical and pedagogical support from school ICT coordinator, 9.2% received from an online helpdesk, community or website.

**Are there differences in perceptions of teachers' ICT use, access, competence, and training support with regards to school location (Urban and Rural)?**

An independent-samples t-test was conducted to compare teachers' ICT use, access, competence, and training support in Urban and Rural schools.

Table 6: t and p values for teachers' ICT use, access, competence, and training support with regards to school location

| Variables | Location | N | Mean | Std. Deviation | t-test | Sig. (2-tailed) |
|---|---|---|---|---|---|---|
| Overall ICT use | Rural | 120 | 2.18 | .34259 | -2.27 | .024 |
| | Urban | 162 | 2.27 | .31564 | | .026 |
| Overall Access | Rural | 120 | 1.56 | .33041 | -19.88 | .000 |
| | Urban | 162 | 2.19 | .19427 | | .000 |
| Overall Competence | Rural | 120 | 2.54 | .48011 | 1.33 | .185 |
| | Urban | 162 | 2.46 | .50448 | | .181 |
| Overall Support | Rural | 120 | 1.91 | .53837 | -1.00 | .317 |
| | Urban | 162 | 1.97 | .53033 | | .318 |

Note: p 0.05

There was significant difference in ICT use for teachers in Urban area (M=2.27, SD=0.32) and teachers in Rural area (M=2.18, SD=0.34); t(280)= -2.27, p=0.024. Based on Cohen's (1988) criteria of effect size, the magnitude of the differences in the means was very low (η2=0.018). Also there was significant difference in ICT access scores for teachers in Urban area (M=2.19, SD=0.19) and teachers in Rural area (M=1.56, SD=0.33); t(280)= -19.88, p=0.00. Based on the effect size, the magnitude of the differences in the means was large (η2=0.585).

Furthermore, t-test conducted to compare teachers' ICT competence and support training scores for Urban and Rural schools. There was no significant difference in teachers' ICT use, competence, and training support for teachers in Urban and Rural schools as presented in Table 6.

**Are there differences in perceptions of teachers' ICT use, access, competence, and ICT training support with regards to school type (Public, Denominational, and Lay Private)?**

A one-way between subjects ANOVA was conducted to compare teachers' ICT use, access, competence, and ICT training support on Public, Denominational, and Lay Private schools

Table 7: F and p values for Research Question four

| | | Sum Squares | of df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Overall ICT use | Between Groups | .086 | 2 | .043 | .394 | .675 |
| | Within Groups | 30.473 | 279 | .109 | | |
| | Total | 30.559 | 281 | | | |
| Overall Access | Between Groups | .369 | 2 | .184 | 1.128 | .325 |
| | Within Groups | 45.604 | 279 | .163 | | |
| | Total | 45.973 | 281 | | | |
| Overall Competence | Between Groups | .733 | 2 | .366 | 1.501 | .225 |
| | Within Groups | 68.105 | 279 | .244 | | |
| | Total | 68.837 | 281 | | | |
| Overall Support | Between Groups | .748 | 2 | .374 | 1.316 | .270 |
| | Within Groups | 79.311 | 279 | .284 | | |
| | Total | 80.059 | 281 | | | |

Note: *p 0.05

There is no significant difference in teachers' ICT use (2, 279) p=.68, access (2, 279) p=.33, competence (2, 279) p=.23, and ICT training support (2, 279) p=.27 with regards to school type (Public, Denominational, and Lay Private).

## CONCLUSIONS

The use of information and communication technologies in teaching and learning in Cameroon secondary schools has been clearly low due to: low confidence and low competencies of the teachers, formal opposition by teachers to use pedagogical tools that they were not initially trained to utilised in a professional way. Also, schools are unevenly equipped with ICT: in some schools, computers are concentrated in computer laboratories or school libraries, in others computers are only found in the staffrooms and administrative offices. Even though, there are no differences in teachers' ICT competence and support training scores for urban and rural schools; teachers in rural area have less opportunity in using ICT in their teaching compare to their colleague in the urban areas. This is partly due no electrical connectivity in the countryside. Low teachers' support: both pedagogical and technical other forms have dramatically led to low teachers' use of ICTs in the teaching and learning process.

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# Tracing the Knowledge Building Process through Discussions Mediated by a CSCL Environment: A Case Study

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## ABSTRACT
This case study demonstrates the use of interaction analysis techniques to explore students' knowledge building process evidenced in time-stamped logs of a CSCL environment that consists of chat, shared whiteboard, and wiki features. The study was performed in a graduate level course, which covers online assignments that expect students to collaboratively discuss questions regarding statistical methods in chat sessions and share their solutions by co-authored wiki documents. More specifically, by applying the Progressive Knowledge Building Inquiry cycle, we investigated how learning groups enhanced their understanding of variables concepts of statistics in their collaborative activities in one of the assignments. The results cover learners' progress in their chat discussions and wiki submissions.

## INTRODUCTION
The Knowledge Building (KB) theory proposes that knowledge is produced through mutual goals and negotiation of diverse viewpoints (Scardamalia & Bereiter, 2003). The theory offers a distinction between learning and knowledge building that considers the learning as an internal process which results in changes in beliefs, attitudes, or skills. Yet, knowledge building is respected as the process of construction or modification of public knowledge. According to the theory of knowledge building, learning is progressing by forming new cognitive artifacts as a result of common aims, group conversations, and synthesis of ideas. The process should advance the current understanding of individuals in a team and should aim to improve the understanding of what is known about topics or tasks.

Twelve "Knowledge Building principles" were developed for the purpose of various goals such as instructional guidelines, technology design definitions, and fundamentals for investigating existing practices (Scardamalia, 2002, p. 9-12):

- **Real Ideas, Authentic Problems:** Knowledge problems are caused by the aims of understanding the real world. Ideas are offered like real structures.
- **Improvable Ideas:** Ideas of individuals are respected as improvable objects.
- **Idea Diversity:** Idea diversity is essential for the development of knowledge. Ideas are constructed through comparisons, combinations and arrangements with other ideas.
- **Rise above:** The continuous development of ideas and understanding allow students build high level concepts.
- **Epistemic agency**: Individuals attain a personal and mutual responsibility in order to achieve knowledge building purposes.
- **Community Knowledge:** Knowledge Building attempts to advance collective knowledge of individuals.
- **Democratizing Knowledge:** All members of the learning groups are expected to make contributions to the knowledge development.
- **Symmetric Knowledge Advancement:** The transfer of knowledge is not only from more knowledgeable to less knowledgeable ones. The structure should be like that all members gain knowledge through their mutual efforts.
- **Pervasive Knowledge Building:** Students' contributions are important factors for collective knowledge building.
- **Constructive Uses of Authoritative Sources:** Knowing a discipline refers knowing authoritative sources that contribute to the current knowledge.
- **Knowledge Building Discourse:** With the help of discursive activities of the community, the knowledge is enhanced and transformed.

- **Concurrent, Embedded, and Transformative Assessment:** Assessment aims to identify problems while the process continues and integrated to the works of the community. Internal assessments are performed by the community to ensure that community work addresses to expectations of external assessors.

According to the knowledge building theory, one significant sense of the team should be functioning mutually rather than gathering individuals. This purpose of teams can be achieved by different Web 2.0 tools such as blogs, wikis, virtual worlds and CSCL environments, as well as with discussion tools integrated to learning management systems. Computer-supported Intentional Learning Environments (CSILE) project is the first attempt to provide schools with technology for the purpose of achieving knowledge building communities (Scardamalia & Bereiter, 1994). CSILE with its up-to-date variation named as the Knowledge Forum was offered as an instructional software to support collaborative knowledge building activities by demonstration of ideas in textual, audio, graphical, and video formats, and the organization of instructional artifacts. The project principally considers the production of knowledge by the collaborative study of learners and assistance of teachers. Hence, the distributed cognition model was applied, and social formations and discourse characteristics were considered in this social learning environment. The study investigates characteristics of knowledge building communities in three categories (Scardamalia & Bereiter, 1994). The first one considers that the focus should be on problems instead of knowledge types or topics. The depth of understanding is accomplished through argumentation and active participation. The second category offers that the community is a decentralized and open learning environment that facilitates collective knowledge building. More knowledgeable learners are expected to take participative roles in the learning process rather than standing outside the community. Participation of less knowledgeable learners is also significant to detect which topics are difficult to understand and whether explanations are adequate for understanding. The third category proposes that technology provides learners with access to databases, videos and other resources as well as live experts and more advanced learners. The other large-scale implementation of the knowledge building theory was performed by the Learning through Collaborative Visualization (CoVis) Project which aims to transform traditional science learning by the use of networking technologies which provide students with collaborating with distant students, instructors and scientists (Edelson & O'Neill, 1996). The envisioned and implemented learning environment supports and facilitates inquiry oriented collaborative activities through collaboration and communication tools like desktop video teleconferencing, shared software environments for remote/realtime collaboration, access to the World Wide Web resources, a multimedia scientist's notebook and scientific visualization software. This project is still being pursued for supporting science education at urban schools in Illinois, USA.

Some methods have been proposed for the assessment of group or community knowledge as they are captured in knowledge artifacts in environments such as CSILE and CoVis. In general, assessment can be performed in terms of group products, like a report, a plan, a software application, a design artifact, etc. Yet, group works may not be a well-defined, coherent product, and products may not represent contributions and understandings of all group members. Hence, it becomes difficult to investigate the development of knowledge at the individual and group levels by only investigating the knowledge artifacts. In majority of online learning contexts, online discussions are considered as the main learning activity and online activity logs are treated as the groups' main knowledge building outputs. Studies focusing on time-based organization of these logs trace the knowledge building trajectories of every group and individual. However, such an undertaking results in challenges, because of emergent structures and discontinuities in interaction. As an alternative method, some researchers employ peer assessment methods for the investigation of group learning, which searches for indication of learning considering students' reflections on each other's activities, omitting the need for applying detailed log analysis (Strijbos & Sluijsmans, 2010). In spite of these benefits, the investigation of group products brings additional duties on the students and assessments of their peers and the group work may be too narrow in coverage for a complete analysis of knowledge building processes (Hong & Scardamalia, 2014). In addition, alternative methods have been proposed for the investigation of knowledge building. For example, learners may submit portfolios to deliver reflections on their learning throughout their collaborative study. In other assessment method, students are required to conduct some tasks named as "guided inquiries" that investigate what they explored together, where the goals, key questions and procedures are submitted by teachers or facilitators (van Aalst, 2012). Portfolios and guided inquiry activities provide researchers with more evidence related to learning through knowledge building at the individual level. On the other hand, these approaches are inadequate in terms of assessment of group level phenomena and accounting for what causes learning outcomes evidenced in portfolios or guided inquiry exercises.

Statistics that capture various sides of knowledge building activities are also used for assessment purposes. The majority of research employs assessment measures like average number of notes created, notes read, notes revised, words per note etc (Hong & Scardamalia, 2014). Although these kind of measures are effective in

detecting behavioral patterns of learners and interaction patterns of groups, they are not suitable for analyzing contents of the knowledge elements the groups are working on. In order to get rid of this problem, content analysis methods are generally applied to examine the knowledge content produced by learners. Procedures and a set of knowledge building principles are offered for the assessment of activities in collaborative learning environments (Scardamalia & Bereiter, 2003).

Every course is structured according to its learning goals, content and plan. This structure indicates the concepts that students should understand and think about. According to knowledge building theory, learning is not seen just a simple knowledge acquisition process, instead it is an active process of social inquiry in terms of a social constructivist perspective. Therefore, while collaborating to comprehend the course concepts, students may have problem in understanding some of them, and may build special terms and behaviors while making a discussion regarding problematic issues. This kind of practices or shared concepts developed by learners while discussing about problems is of theoretical importance for knowledge building theory and CSCL field. After the learning session ends, the teacher or a system designer may attempt to understand whether the session is effective or not for the learners, and which instructional gains learners acquire throughout the session. In the collaborative learning context, learners' gains are parallel to their interaction in the group. In order to explore these benefits, one can collect the protocol data of the session, then make a deep analysis and examine the benefits (Inaba, 2002). Moreover, it is significant to trace these developments based on instructional goals of the collaborative activity.

In this research, we analyzed learners' interaction in a CSCL environment according to some key concepts of a course and explored the outcomes they achieve by the help of the research that we performed. For our purposes, the qualitative analysis is especially significant to provide interpretations about the knowledge building processes supported by chat and wiki activities. In this study, we considered sentences of chat messages as the unit of analysis and examined them based on Progressive Knowledge Building Inquiry cycle (Hakkarainen, 2003; White & Frederiksen, 1998), which generally begins with a trigger activity and covers four major stages; (a) idea generation, (b) idea connection, (c) idea improvement, and (d) rise above. The details of the cycle were provided in the Methodology section. The remainder of the paper is organized as follows. In the section 2, we presented our methodology. We dedicated the section 3 for providing findings of the study. In the final section, we presented the summary and implications of the results for researchers and practitioners.

## METHODOLOGY

We conducted the study in the setting of a graduate level course of one large university in Turkey. This course integrates major concepts of empirical research and experimental design. The instruction was performed in a face-to-face manner and assignments were collaboratively conducted in online means. In total, the course has 15 registered learners. Each learner was assigned to a group and five teams were constructed. Teams were required to execute course assignments by collaboratively studying online in the Virtual Math Teams (VMT) environment (figure-1), hence their whole interaction could be investigated. The aim of the assignments was to provide students with extending their understanding of key statistics concepts by collaborative studies where they perform a specific type of analysis by using SPSS software. During their works in assignments, teams initially conduct online chat meetings, then submit their solutions as online documents.

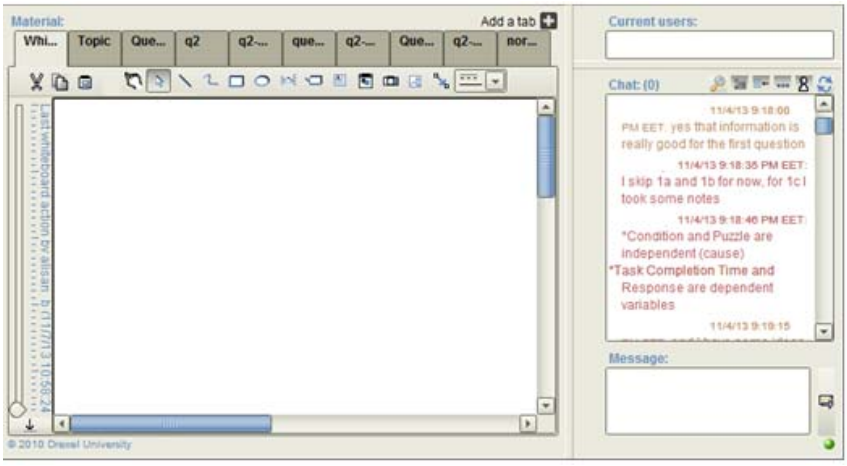


**Figure 1 – VMT Environment**

Throughout the term, learning teams collaborated on seven assignments and shared their solutions as co-authored reports in the online wiki environment. The chat tool of the VMT enables students to collaborate in a synchronous manner. In the chat context, learners can additionally use the whiteboard tool to explain their work by constructing shapes or submitting screenshots of their SPSS outputs. After the discussion ends, students summarize results of their work as Wiki outputs which covers both textual information and visual demonstrations. After the term completed, we gathered teams' data which includes chat logs produced by the VMT system and the wiki content submitted by teams for each assignment. The chat log principally involves teams' textual messages and whiteboard activities with corresponding author and time information. The wiki content is submitted online, structured in terms of assignment questions, and consists of both textual and graphical elements to provide explanations for solutions.

In this research, we aimed to employ methods for evaluating knowledge building processes which were observed in multiple media (chat and wiki) and multiple time periods (synchronous and asynchronous). For this purpose, we attempt to apply qualitative interaction analysis methods in order to detect whether learners show conceptual development or not. In order to investigate learners' knowledge construction process in the VMT system, we considered their verbal interaction related to assignments of the course. Knowledge construction is seen as a social and dialogical process where learner participation is significant. We employed sentences of messages as the unit of analysis and investigated them according to the Progressive Knowledge Building Inquiry cycle (Hakkarainen, 2003; White & Frederiksen, 1998), which starts with a trigger activity and consists of four main phases; (a) idea generation, (b) idea connection, (c) idea improvement, and (d) rise above. Trigger activity often covers the question statement that allows learners to offer ideas and solutions. The stages are explained as follows (So et al., 2010):

- **Idea generation:** In this stage, students produce ideas or questions about the theme or topic. In other words, in their collaborative activity, students propose their ideas and related intentions for the answers of questions.
- **Idea connection:** In this stage, learners compare and contrast diverse ideas for the purpose of idea connection.
- **Idea improvement:** Learners search for new information and knowledge in this phase.
- **Rise above:** This phase considers learners' reflections about their own learning. More specifically, "students think about what they have learnt, how this new knowledge has helped them in answering their initial questions about the theme or topic of study, and what new perspectives of knowledge has been built from the activities" (So, et.al, 2010, p. 482).

We explained our research with a case study which focuses on learners' progress in identifying the scales of variables. The chat logs and wiki content that were analyzed as part of the case study were obtained from the first assignment, which included the following instructions:

> *In an eye tracking experiment a researcher asked participants to solve two puzzles in 3 different conditions; namely picture, blank and fixation. 94 subjects attempted two different puzzles called Towers of Hanoi and River Problem. The task completion times and the responses provided by the participants are displayed in cogs536_hw1.sav.*
>
> *In the Towers of Hanoi (TOH) puzzle the goal is to move all the disks on peg A to peg C so that the disks will appear in the same order in size (i.e. smallest on top). A larger disk cannot be placed on top of a smaller disk at any intermediary state of the solution. Given this restriction the participants were asked to figure out what would be the minimum number of moves required to reach the desired state (i.e. all disks are on peg C, ordered from smallest to largest).*
>
> *In the river problem (RP) subjects are given a situation where a man buys a sheep, a wolf and a box of cabbage from a village across a river. The man has to use a boat to return home, but the boat can only load one of the sheep, wolf and the box of cabbage at a time. If he leaves the wolf and the sheep on the same side, the wolf will eat the sheep and if he leaves the sheep and the cabbage on the same side alone, the sheep will eat the cabbage. Subjects are asked what would be the minimum number of trips required to pass all items across the river without losing any one of them.*
>
> *Each participant was informed about the rules of the puzzle and then randomly assigned to one of the puzzle groups, and then to one of the picture, blank and fixation conditions. In the picture condition, subjects were presented a picture that represents the initial state of the problem as a visual aid. In the blank condition subjects look at a black screen after they finish reading the instructions. In the fixation condition participants have to fixate on a cross sign located at the center of the screen (i.e. their eye movements were restricted) while they are thinking about the problem.*
>
> *In each condition participants pressed the SPACE bar when they are ready to report the answer. The duration between the slide presenting the question and the key press is considered as the task completion time. Participants then entered their answers into the box that appear after they press the space button.*

*Given the description above, answer the following questions with your teammates:*
*a. What are the dependent/independent variables? What do you think is the goal of this study?*
*b. On what scale are the variables measured (i.e. nominal, ordinal, interval, ratio) and why? Note: don't just say that a variable is measured at the interval scale, but also justify your answer by mentioning the properties satisfied by that variable.*

## RESULTS

In this paper, we present results of first assignment belong to the team-1. Demographic characteristics of team-1's students are provided in the Table 1.

**Table 1**: Demographic characteristics of students

| **Subject Handle** | **A_S** | **G_C** | **Y_A** |
|---|---|---|---|
| **Gender** | Male | Female | Male |
| **Grade** | PhD | Masters | Masters |
| **Undergraduate major** | Physics | Foreign Language Education | Electric and Electronics Engineering |
| **Graduate major** | Biomedical Engineering | Cognitive Science | Cognitive Science |
| **Current GPA** | 3.00-3.50 | 3.00-3.50 | 3.00-3.50 |

### Learners' Knowledge Building Process

***Topic: Dependent and Independent Variables***

The team's discussion about the variables concept was initiated with the question of A_S in line 64 for detecting variables in the study. As a reply to this question, G_C considered the type of dependent variable and offered that the task completion time is in this type (line 65). The question covers an experiment that examines effects of three conditions on participants' task completion time and responses, hence G_C classified the task completion time in correct way. In order to be sure about this offer, G_C requested for ideas of other members (line 66). A_S thought in similar way and offered G_C to share this idea in the whiteboard area by stating her contribution to this question (line 67). Yet, this solution was not sufficient since the response variable should be considered as the other dependent variable. Analysis of the messages between lines 64 and 68 based on Progressive Knowledge Building Inquiry cycle leads to the next interpretations. Initial message (line 64) involves the question (i.e. variables), therefore it is a trigger activity that encourages members to produce ideas about the variables. In the message in line 65, G_C offered the "task completion time" as a dependent variable, which classifies this activity in the phase of *idea generation*. In the line 67, A_S stated his agreement about this idea.

**Table 2:** Learners' Discussions between lines 64 and 75

| **Line** | **Date** | **Post Time** | **Chat Message / Whiteboard Activity** |
|---|---|---|---|
| 64 | 11.07.2013 | 5:52 PM | A_S: what about the variables? |
| 65 | 11.07.2013 | 5:53 PM | G_C: task completion time is dependent; |
| 66 | 11.07.2013 | 5:53 PM | G_C: right? |
| 67 | 11.07.2013 | 5:54 PM | A_S: I think the same, so lets you add it by 4 tildes :) |
| 68 | 11.07.2013 | 5:54 PM | G_C: ok :) |
| 71 | 11.07.2013 | 5:57 PM | G_C: how about the independent variables? |
| 72 | 11.07.2013 | 5:57 PM | A_S: experiment condition? |
| 73 | 11.07.2013 | 5:58 PM | A_S: picture, blank, fixation |
| 74 | 11.07.2013 | 5:59 PM | G_C: well yes, i believe |
| 75 | 11.07.2013 | 6:00 PM | A_S: I believe so :) Ok I write it |

After finding the dependent variable, G_C wanted to identify independent variables (line 71). As an offer, A_S stated that experiment conditions (i.e. picture, blank, fixation) are independent variables (line 72,73) and G_C confirmed this offer (line 74).This was a right solution since the experiment considers effect of conditions on participants' task completion time and responses. In parallel to the team's decision, A_S propose to share the solution (line 75). As in the messages in lines between 64 and 68, the team has a similar performance between messages in lines 71 and 75 in terms of Progressive Knowledge Building Inquiry cycle. In the message in line 71, G_C indicated the question (i.e. independent variables), hence encouraged members to generate proper solutions, which can be considered as trigger activity. In the messages in line 72 and 73, A_S provided his idea by stating experiment conditions as independent variables, which demonstrates the phase of *idea generation*. In lines 74 and 75, members approved this idea.

***Wiki Reflection of Dependent and Independent Variables***

The wiki output consists of the team's all decisions in the chat environment about the variables concept. As offered in the chat, G_C reported the results that "The task completion time is the dependent variable. Independent variables are the experiment conditions, namely, picture, blank and fixation. The puzzle type is another independent variable."

***Topic: Scales of Variables***

The team started to discuss about scales of variables, which were decided in the previous discussion. G_C proposed that the task completion time is on ratio scale (line 79). A_S provided confirmation to this idea and advised G_C to share it in the whiteboard environment (line 82). G_C wrote the solution and provided rationale that "the task completion time is measured on the ratio scale since it is the response time that is shown in milliseconds." This interpretation was not actually appropriate for the ratio scale. G_C tried to provide further justification but stated that she couldn't find the content related to the scales of measurement (line 83). Thus, A_S indicated that he could wait while G_C was looking for the content (line 84). After some time, G_C provided the further interpretation that "each response says something about the performance of each participant under a certain condition" in the whiteboard area and stated the completeness of the interpretation (line 86). However, these solutions do not demonstrate the appropriate reasoning about ratio variables. She could indicate the representation of identical intervals in the scale and the existence of meaning regarding ratio of values.

**Table 3:** Learners' Discussions between lines 79 and 92

| Line | Date | Post Time | Chat Message / Whiteboard Activity |
|---|---|---|---|
| 79 | 11.07.2013 | 6:04 PM | G_C: for part d, i think task completion time is on ratio scale. |
| 82 | 11.07.2013 | 6:04 PM | A_S: Okey, you write it then :) |
| | | | *G_C wrote "The task completion time is measured on the ratio scale since it is the response time that is shown in milliseconds" to the whiteboard* |
| 83 | 11.07.2013 | 6:10 PM | G_C: I will add my justification in a minute. I just lost the slides that explains the scales of measurement |
| 84 | 11.07.2013 | 6:10 PM | A_S: okey... I'm waiting |
| 85 | 11.07.2013 | 6:10 PM | G_C: ok |
| | | | *G_C continued to add justification by writing "each response says something about the performance of each participant under a certain condition." to the whiteboard* |
| 86 | 11.07.2013 | 6:11 PM | G_C: i think it's ok now |
| 87 | 11.07.2013 | 6:12 PM | G_C: what about the other variables? |
| 88 | 11.07.2013 | 6:17 PM | A_S: independent variables are in nominal scale? they are ordered in numbers |
| 89 | 11.07.2013 | 6:19 PM | G_C: yes, definitely, moreover i think we can even take the puzzle group here since they are also categorical ?? |
| 92 | 11.07.2013 | 6:19 PM | A_S: Okey..your are right... |
| | | | *G_C wrote "The independent variables are all measured on the nominal scale since they display categories." to the whiteboard* |

In the next message, G_C expected her team members' opinions about the scales of other variables (line 87). A_S answered that independent variables are in nominal scale and they are ordered in numbers (line 88). G_C provided confirmation to this offer and additionally offered to consider puzzle group in nominal scale since they have some categories (line 89). A_S approve the idea of G_C (line 89). Then, G_C reported the solution in the whiteboard that "The independent variables are all measured on the nominal scale since they display categories. "Although the final solution was correct, one could criticize A_S's first statement that nominal scale refers to a variable ordered in numbers. The appropriate interpretation should consider existence of more than two categories. According to Progressive Knowledge Building Inquiry cycle, in the messages in lines 79, 88, and 89, the team stated answers and a line of reasoning for detecting the scale of a variable, so they are considered in the phase of *idea generation*. The messages in lines 82, 89 and 92 showed agreements to these ideas.

***Wiki Reflection of Scales of Variables***

As a report, G_C shared the solution that "The task completion time is measured on the ratio scale since it is the response time that is shown in milliseconds and each response says something about the performance of each

participant under a certain condition" and A_S indicated the statement that "The independent variables are all measured on the nominal scale since they display categories."

## DISCUSSION AND CONCLUSION

In order to investigate how learners accomplish knowledge building in their collaborative study in chat environments, we analyzed the verbal interaction among learners in the VMT system while they were discussing about assignment related content. By applying the Progressive Knowledge Building Inquiry cycle (Hakkarainen, 2003; White & Frederiksen, 1998), we investigated how learning groups enhanced their understanding of major concepts of statistics in their collaborative activities. The Progressive Knowledge Building Inquiry cycle begins with a trigger activity and covers four phases; (a) idea generation, (b) idea connection, (c) idea improvement, and (d) rise above. The results showed that learning groups' discussions usually started with the trigger activity which consists of the textual statement or number of the question. Then, learners' activities continued with idea generation and idea connection stages. Members' solutions offered for the question showed the phase of idea generation. However, idea connection, idea improvement and rise above phases were absent in our results. Comparisons and decisions regarding the solutions demonstrated the idea connection phase. During the idea improvement phase, learners utilized proper sources for the answer of the question, which wasn't considered as preference of our learners. The reason may be that they preferred to consider knowledge and experience of their peers in a collaborative learning environment. During the rise above phase, learners provided reflections about their existing understanding. Our findings are parallel with the study of So et al. (2010), which applied content analysis to Knowledge Forum postings for investigating learning teams' improvement in terms of their ideas. Results of the study showed that learners lacked the ability of improving their ideas and providing sources in their solutions.

We considered the content where the "variables" concept was discussed by the team. Our goal is to investigate how learners made progress during chat activities while working on this concept. We presented the corresponding results for the Team-1. That is, we showed learners' conflicts, explanations, opinions, and final solutions regarding the concept. In addition, we investigated adequacy of their final solutions. In summary, these results explored the instructional advantages that learners acquired in their collaborative study.

Wiki output is structured according to questions of the assignment. Therefore, each wiki segment directly maps onto a question. For each question, we firstly applied interaction analysis to chat segment and then applied the content analysis to wiki output. We compared the wiki content with the solutions offered in the chat environment, therefore discovered the similarities and differences in the final wiki solution as compared to the solution provided in the chat environment. Furthermore, we examined the adequacy of the content provided as the solution of the question. In this regard, our analysis is consistent with the completeness aspect of the final product of the assessment framework offered for the evaluation of the wiki based team work (Putro, Carbone, & Sheard, 2014). With the completeness attribute, the framework examines the sufficiency degree of the final product as compared to task specifications. Yet, the framework additionally investigates the integration and synthesis of individual contributions by the cohesiveness attribute, which can be added to our methodology as a future study.

On the basis of first assignment that team-1 discussed in the chat, we presented the analysis results of wiki content after the interaction analysis of their chat discussions. As in the former stage, we considered the wiki content where the "variables" concept was covered as the solution of the questions and provided the content analysis results of wiki output. While some of the decisions taken in the chat environment were directly reflected to the wiki content, some additions or removals were performed in the wiki content as compared to chat discussions. The content analysis of wiki output enabled us to identify similarities and differences in the finalized wiki solution in comparison to solution decided in the chat environment. Additionally, we revealed the adequacy of the wiki content provided for the solution of the question. These results are important to understand efficiency of team-1's chat discussions in these concepts and solving questions.

In order to check reliability of our content analysis, we applied the interrater reliability and compared interpretations performed by two different researchers. As a result, the percent agreement was found as 87%, which highly satisfies the reliability.

First limitation of this research was its scope. Its scope was limited to a graduate course of Informatics Institute in a public university in Ankara, Turkey. Other limitation was that we investigated data of one team out of five teams in the course. The future study could consider all teams of a course. The chat corpus had two main challenges for the analysis that it covers non-English words and it had noisy structure. Hence, we were required to perform preprocessing of data before conducting the main analysis. Through the interaction analysis, we

analyzed learners' knowledge building in variables concept of the course content. The future study could make an investigation according to all concepts of the course. We performed analysis of wiki contents in parallel to contents of chat discussion. In other words, wiki content submitted as an answer of a question was analyzed if this question was discussed in the chat environment. As the future study, all wiki outputs could be in consideration by our study.

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# Validation of a Conceptual Quality Framework for Online and Blended Learning with Success Factors and Indicators in Adult Education: A Qualitative Study

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**ABSTRACT**
This qualitative study was designed to identify a framework for the quality of OBL in adult education (AE), which are of interest to the needs of students. Following a review of the literature, we opted for the theoretical framework as proposed by Ossiannilsson and Landgren (2012). This framework suggests success factors for OBL that are of interest to the needs of students. Qualitative data was collected through group interviews (n=12 groups) with stakeholders involved in AE. Professionals from five institutions, at the policy level (n=17) or programme level (n=20) were interviewed. Findings were discussed and agreed upon by the researchers to validate a quality framework for OBL in AE. At the level of the success factors, it is useful to underpin the adoption of OBL, to formulate a mission statement. The indicators can help set goals, identify resources and strategies and measure whether the provision aligns with adult students' needs. All success factors and indicators are linked to quality areas and dimensions most existing quality frames are built on. At this level the framework is useful to mainstream the quality of OBL into traditional frameworks.

**Keywords**: Quality, Success Factors, Blended Learning, E-learning, Online Learning, Quality enhancement.

## INTRODUCTION

Online and blended learning (OBL) is highly valued in education but at the same time challenges educational institutions. It is valued e.g. to enhance accessibility and flexibility in education (Graham & Robison, 2007; Shea, 2007), to reduce the costs of instruction (Shea, 2007) and even to transform traditional approaches to instruction and teaching(Garrison & Kanuka, 2004; Graham & Robison, 2007). OBL is appealing for institutions in order to tailor the educational provision to the needs of (adult) students in terms of pedagogy and to support them to balance education with other responsibilities. OBL is equally highly challenging for institutions because quality assurance and improvement (QA&I) requires a systemic approach and the involvement of many, including students (Deepwell, 2007; Jara & Mellar, 2009). Yet it is not easy in education to consult students, and even more difficult in the case of OBL as a result of the limited presence of students (Bloxham, 2010; Jara & Mellar, 2009).

Knowledge of what defines quality of OBL from the student perspective is therefore beneficial but was lacking until recently. This knowledge can support institutions to underpin the adoption of OBL and set goals, identify resources and strategies and measure whether the provision aligns with (adult) students' needs.

We firstly present commonalities in existing quality frameworks for OBL from the providers' perspective reported in literature. Then we will discuss aconceptual framework for quality of OBL to meet students' needs. Finally,we will address both empirical studies and studies on existing quality models that define quality of OBL for (adult) students in the context of HE in relation to the conceptual framework and the commonalities in existing quality frameworks.

## LITERATURE REVIEW ON QUALITY FRAMEWORKS FOR OBL

With the rise of OBL in HE, the issue of quality assurance and improvement (QA&I) was raised(Jara & Mellar, 2009). Institutions, governments and QA agencies needed to know how to assess the quality of OBL (Jara & Mellar, 2009). In order to meet this need, several quality frameworks were developed for OBL-education in higher education (HE) worldwide (Ossiannilsson, Williams, Camilleri & Brown, 2015). These frameworks differ by scope, structure, type of institution they are aimed at and intended way of use (Inglis, 2005). Nonetheless the differences between quality frames, scholars noted that they have similar '*constituents*'(Frydenberg, 2002; Jung, 2011; Phipps & Merisotis, 2000). According to Ossiannilsson and Landgren (2012) these can be clustered in three quality areas (management, services and products) and six quality dimensions: management, student support, support to teachers and staff, curriculum design, course design and delivery.

**Quality of OBL from the providers' perspective in Higher Education**

The concept of quality dimensions originates from the total quality movement (TQM) in industry during the previous century (Srikanthan & Dalrymple, 2002). Srikanthan and Dalrymple (2002) advocate for holistic quality models that address service and pedagogical aspects.Quality frameworks are traditionally presented from an institutional perspective by the quality areas and quality dimensions (Frydenberg, 2002; Jung, 2011; Phipps & Merisotis, 2000). This is important because the deployment and QA&I process (of OBL) demands a holistic, often also called systemic or process approach. The consensus in the scientific community for this statement (Hansson, 2008; Ossiannilsson et al., 2015) is clearly expressed by Hansson*(2008a)*: *"When implementing e-learning, it is important to adopt a holistic approach. … aspects … are part of a puzzle in which all the pieces have to fit together. When one part of the puzzle changes, e.g. technology, student behaviour, knowledge needs, society, finances or staff requirements, all other parts needs to be re-aligned accordingly" (Hansson, 2008a, p. 56).*

TQM frameworks cover management processes, but miss the focus on the student learning experience (Srikanthan & Dalrymple, 2002). Dumont and Sangra (2006) came to the same conclusion when assessing different quality frameworks in European HE. Scholars report that quality frameworks in HE are often conceived from the perspective of the provider (i.e. institutions, government) (Frydenberg, 2002; Jung, 2011). Ehlers and Pawloski (2006) state that the student perspective of quality does not necessarily coincide with other stakeholders' views.In view of recent literature which emphasises that educational quality is the result of a negotiation process between all participating parties in education (Ehlers, 2009a, 2009b) the student perspective is important. Moskal et al. (Moskal, Dziuban, & Hartman, 2013) refer to alignment as 'institutional alignment', which implies that institutional (meso level), faculty (micro level) and student goals are aligned. Institutional alignment requires a culture focused on quality in which key stakeholders actively participate in dialog (Ehlers, 2009a, 2009b; Moskal et al., 2013). However, the limited opportunities to interact with students in OBL puts pressure on their involvement (Jara & Mellar, 2009). It is thus important that quality frameworks comply with the needs of students. However, the question to what contributes to quality of OBL from a student's point of view remained unanswered until recently.

**Quality of OBL from the students perspective in Higher Education**

**Conceptual framework of Ossianilsson & Landgren (2012)**
The work of Ossiannilsson and Landgren (2012) focuses on the quality frameworks for OBL in HE. These authors compared the output of international benchmarking projects, the e-learning quality model (ELQ) outlined by the Swedish National Agency for Higher Education (NAHE) (Hansson, 2008) and analysed literature from that comparison. A conceptual framework with a range of critical success factors: accessibility, flexibility, interactivity, transparency, participation, personalisation and productivity for quality in e-learning to meet students' needs emerged (Ossiannilsson & Landgren, 2012). The latter three success factors are related to pedagogy (McLoughlin & Lee, 2008). Success is described by Ossiannilson and Landgren (2012) as: *'to be successful in e-learning from an academic and educational point of view but also with regard to their personal and social life'*(Ossiannilsson & Landgren, 2012, p. 49). The authors (Ossiannilsson & Landgren, 2012) suggest that the success factors should be embedded in all quality areas and quality dimensions: managerial levels (strategic planning and development), services (staff support and student support) and products (curriculum and course design, course delivery).

This conceptual framework presents a view to what '*constituents'* add to quality of OBL when looked at from the students' perspective. While the authors describe the success factors, definitions of the concepts are not given. How the quality dimensions are connected to the success factors is neither made explicit. The self-assessment tool e-xcellence (Kear et al., 2016; Ubachs et al., 2007; Williams, Kear & Rosewell, 2012), developed by the European Association of Distance Teaching Universities (EADTU), is built upon this conceptual framework and contains benchmarks. Yet, the assessment tool is presented from the traditional institutional perspective i.e. quality areas and quality dimensions instead of the students' perspective.

**Empirical studies on quality dimensions from the (adult) student perspective in Higher Education**
The scarce studies in search for quality dimensions of OBL from the (adult) students' perspective indicate that the framework of Ossiannilsson and Landgren these (2012) can be fine-tuned for application in the context of adult education. While several of the quality dimensions reported in these studies coincide with the success factors reported by Ossiannilsson and Landgren (2012) also differences appear.

In an empirical study Ehlers (2004) interviewed experienced students in OBL in the European context of HE. From these interviews Ehlers (2004) constructed a questionnaire answers of students were analysed by principal component analysis and cluster analysis, seven quality fields (key factors): tutor support, cooperation, technology, costs-expectations-value, information transparency, course structure and didactics, and thirty quality dimensions for OBL were identified. Several of these quality fields, with their underlying quality dimensions seem to coincide with the success factors reported by Ossiannilsson and Landgren (2012) (see tTable 1). Ehlers (Ehlers, 2004) identified different student preference profiles for the quality of OBL. Although the perception of quality can differ between students it can be defined by a limited number of quality fields or '*constituents*'.

Table 1: Comparison of success factors reported by Ossiannilsson and Landgren (2012) with reported quality fields and quality dimensions by Ehlers (2004) and quality dimensions by Jung (2011).

| **Ossiannilsson and Landgren (2012)** | **Ehlers (2004)** | **Jung (2011)** |
|---|---|---|
| *Reported success factors* | *Reported quality fields or quality dimensions* | *Reported quality dimensions* |
| - | - | Institutional credibility |
| A. Flexibility | - | - |
| B. Transparency | Information transparency (QF 5) | Information and publicity |
| C. Accessibility | - | - |
| D. Personalisation | Student vs. Content centeredness (D3) | - |
| E. Interactivity | Collaboration (QF 2)<br>Interaction centeredness (D1) | Interaction |
| F. Productivity | - | - |
| G. Participation | - | - |
| ***Quality areas**/Quality dimensions* | *Reported quality fields* | |
| **management** | | |
| • Strategic planning and development | - | Institutional QA mechanism |
| **Services** | | |
| • Student support | Tutor support (QF 1) | Student support |
| • Support to teachers and staff | | Staff support |
| **Products** | - | - |
| • Programme design | - | - |
| • Course design | Course structure (QF 6)<br>Didactics (QF 7) | - |
| - | - | Learning tasks |
| • Delivery | Technology (QF 3) | - |
| - | Costs – expectations – value (QF 4)<br>Moderation of learning processes (D2) | - |

Based on literature Jung (2011) developed a questionnaire with seven quality dimensions: institutional support, course development, course structure, teaching and learning, student support, faculty support, and evaluation and assessment. Responses of students familiar with OBL were analysed by exploratory and confirmatory factor analysis to determine the number of common factors and to examine the structure of those factors and intercorrelations among them. Jung (2011) empirically identified the following quality dimensions important to Korean adult students in HE: information and publicity, student support, staff support, institutional quality assurance mechanisms, institutional credibility, learning tasks and interaction. Several of these quality dimensions also coincide with the success factors reported by Ossiannilsson and Landgren (2012) (seeTable 1).

Next to the similarities presented above, differences also emerged. No reference towards attributes for**accessibility** is found in Jungs' study (2011) and Ehlers (2004) indicates that students acknowledge the importance of technology for quality of OBL only when it is lacking. **Productivity** and **participation** were also not mentioned by Jung (2011) and Ehlers (2004).

One might expect that **flexibility** is a prerequisite for the quality of OBL, crucial for adult students to keep professional obligations balanced with educational engagement. However, indicators related to flexibility e.g. 'flexibility of the learning pace' were excluded from the final indicator list in Jungs' study (2011). Little

reference towards attributes for flexibility is found in Ehlers (2004) study. Inglis (2008) indicates that the validation processes of quality frameworks take place against (geographical) contexts which have an impact on the result(ing) current practices, e.g. the way OBL is conceived in a region, can have an impact on what is reported as important. This might be the reason why the indicator 'flexibility of the learning pace' was excluded in Jungs' study (2011) and not reported by Ehlers (2004) as both studies were conducted in the context of HE. A context in which the flexibility of the learning pace for students is likely limited. Contextualization of the findings to the context of adult education seems thus necessary.

Another difference reported by Jung (2011) relates to the quality dimension 'course design'. It appeared that content and structure of courses was not important for adult students per se. Jung (2011) concluded that the design of learning tasks might be crucial for adult students instead. It should be noted that attributes of learning tasks (Jung, 2011) are similar to the concept of personalization: Problem-based learning tasks, individualized learning tasks and collaborative learning tasks.Neither assessment and evaluation nor technological support appeared to be critical for adult students (Jung, 2011).

Jung (2011) reports that 'institutional quality assurance (QA) mechanism' and 'institutional credibility' were important for adult students. These were not reported by Ehlers (2004).Respondents valued that the institution was accredited at the national level and had installed a QA policy with clear policies and guidelines (Jung, 2011). It is not clear how 'institutional credibility' is to be seen. It can be either interpreted as a quality dimension i.e. 'management' in Ossiannilsson and Landgren's (2012) conceptual model or a new success factor i.e. 'credibility'. Credibility, according to Jung (Jung, 2011), stands for external accreditation, international recognition and strong leadership.

**Studies on existing quality models, their quality aspects and quality indicators that define quality of OBL for adult students in the context of HE.**

Findings in Ehlers (2004) and Jungs' (2011)study support the claim of Ossiannilsson and Landgren (2012) that several success factors for quality of OBL in HE exist. Studies in HE about existing quality models/systems or quality aspects/indicators that define quality of OBL for AE provide additional support (Table 2).

Table 2: Overview of articles (author and title) and comparison with success factors reported by Ossiannilsson and Landgren (2012) and Jung (2011)*.

| nr. | Author | Title | Success factors | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C* | F | T | A | I | Pe | Pr | Pa |
| 1. | Korres, Karalis, Leftheriotou, & Barriocanal (2009) | Integrating Adults' Characteristics and the Requirements for Their Effective Learning in an e-Learning Environment | X | | | | X | X | X | |
| 2. | Dzakiria (2012) | Illuminating the importance of learning interaction to open distance learning (ODL) success: a qualitative perspectives of adult learners in Perlis, Malaysia | | | | | X | | | |
| 3. | Zhang & Cheng (2012) | Quality assurance in e-learning PDPP evaluation model and its application | X | | | | | | | |
| 4. | Volungeviciene, Tereseviciene, & Tait, (2014) | Framework of quality assurance of TEL integration into an educational organization | X | | | X | | | X | |
| 5. | Stodel, Thompson, & MacDonald (2006) | Learners' perspectives on what is missing from online learning: interpretations through the community of inquiry framework | X | | | X | X | X | | |
| 6. | MacDonald & Thompson (2005) | Structure, content, delivery, service and outcomes: Quality e-learning in higher education | | | | X | X | X | | |
| 7. | Harroff, P.A. (2002) | Dimensions of quality for web-based adult education | X | | X | X | | | | |

**Credibility,** Volungevience et al. (2014)provide an argument to see 'credibility' as a new success factor related to the quality dimension 'management' because they plead for a clear vision on the reason for implementating OBL. This is in line with Zhang and Cheng (2012) who advocate for clear OBL implementation processes and

guidelines. Strong leadership is apparent when teachers who experiment and implement OBL are credited (Harroff, 2002). Besides strong leadership, installation of adequate resources is considered necessary by several authors, ranging from staff support through clear roles (Korres, Karalis, Leftheriotou, & Barriocanal, 2009; Volungeviciene et al., 2014), adequate technical training (Harroff, 2002) and training in applying new pedagogy (Korres et al., 2009; Stodel, Thompson, & MacDonald, 2006). Finally, credibility refers to an internal QA system with a focus on written QA guidelines for OBL (Jung, 2011), specific quality measures (Jung, 2011; Volungeviciene et al., 2014; Zhang & Cheng, 2012) and consultation with different stakeholders such as students (Harroff, 2002) and staff (Jung, 2011). All these quality attributes are important to install a sustainable OBL programme, and can be considered management responsibilities, no different from a standard education programme, but with a specific focus for OBL. It is clear that this success factor is important from a provider's perspective and is indirectly relevant for students. However Jung's (2011) study indicates that adult students also consider these attributes important.

**Transparency** is important for adult students because it gives them a clear idea of what to expect and to consider if the programme can be combined with their professional and personal occupations. It is crucial to provide correct information, before and during the programme, about: admission requirements (Harroff, 2002), costs (Harroff, 2002; Jung, 2011), programme length, expectations of technical knowledge and information on course requirements (Harroff, 2002).

**Accessibility** can be looked at from different perspectives. Products such as courses should be easily accessible and easy to use (MacDonald & Thompson, 2005; Volungeviciene et al., 2014). This is equally true for services such as learning support (Harroff, 2002; MacDonald & Thompson, 2005) that are provided. Stodel et al. (2006) focus on accessibility of the design on a deeper, pedagogical, level. The use of technologymust be in line with the chosen pedagogy by using appropriate tools e.g. tools for synchronous and asynchronous communication.

**Personalisation** seems also present in the literature on OBL in AE. It ranges from content (Korres et al., 2009) or design (Stodel et al., 2006) that meets expectations and interests of the students, over providing authentic and personally meaningful problems (Jung, 2011), to even rapid redesign to adapt to the students' needs (MacDonald & Thompson, 2005). Not only does the design refer to personalisation, also the students' support is personalised or need based (Jung, 2011).

The instructional design needs to provoke activation or **interactivity** of the students with the materials by providing authentic materials (MacDonald & Thompson, 2005) or to initiate interaction between students by collaborative tasks (Korres et al., 2009) and meaningful dialogue (MacDonald & Thompson, 2005). The student-student interaction is also intended as technical support (Stodel et al., 2006) or emotional support (MacDonald & Thompson, 2005). Finally literature refers to student-teacher interaction with a focus on the quality of the feedback from the tutors (MacDonald & Thompson, 2005).

**Productivity** is mentioned in relation to an indicator i.e. problem based learning (Jung, 2011) or higher-order thinking (analysis, synthesis, evaluation) (Korres et al., 2009) and complex tasks integrated with assessments (Volungeviciene et al., 2014).

The way McLoughlin and Lee (McLoughlin & Lee, 2008) describe **participation** (communication, collaboration, connectivity and community) is similar to the way interactivity is described by Ossiannilsson and Landgren (Ossiannilsson & Landgren, 2012) (interactivity with content, peers and teachers). It appears thus that 'participation' and 'interactivity' are closely related. However, both success factors do not seem interchangeable. It can be argued that participation is key to turning all factors into success factors for OBL given that the right decisions are made, either by enabling participation (flexibility, accessibility, transparency) in education or by inviting students to participate actively in the learning process (interactivity, personalisation, productivity). This is in line with the concepts of enabling blend and transforming blend reported by Graham (Bonk & Graham, 2012; Graham, 2005; Graham & Robison, 2007).

In summary, it appears that frameworks for quality of OBL are often conceived and presented from the perspective of the provider (i.e. institutions, government, QA agencies), lacking the student perspective (Frydenberg, 2002; Jung, 2011). Yet in education the concept of quality is a client-oriented i.e. a student oriented concept defined by dialogue between students and providers (Ehlers, 2007). Because it is not easy ineducation to consult students in the quality dialogue, and even more difficult in the case of OBL as a result of the limited presence of students (Bloxham, 2010; Jara & Mellar, 2009) this is an issue.

Despite all differences between quality frameworks for OBL (Inglis, 2005) it appears they have similar '*constituents'* (Frydenberg, 2002; Jung, 2011; Phipps & Merisotis, 2000), which can be clustered in three quality areas and six quality dimensions (Ossiannilsson & Landgren, 2012). Scientific knowledge about the '*constituents*' of quality of OBL from the students perspective and how these are related to quality areas and quality dimensions present in most current quality frameworks is lacking. This knowledge is beneficial because it can allow institutions to underpin the adoption of OBL, set goals, identify resources and strategies and ultimately measure whether their provision is tailored to the needs of (adult) students.

Until recently it was not clear how quality of OBL from the students' perspective could be defined. The conceptual framework by Ossiannilsson and Landgren (2012) provides an answer to this question. Although literature supports it, the framework remains conceptual. It appears that until now HE institutions have been the central focus in research regarding the use of quality frameworks in education (Contreras, Torres, Palominos & Lippi, 2015). It is not clear if the findings from studies (with adult) students in HE are transferable to students in other educational contexts.

This study is designed to provide scientific knowledge about the '*constituents*' by which students measure quality of OBL in adult education and how these are related to quality dimensions present in most quality frames. The work of Ossiannilsson and Landgren (Ossiannilsson & Landgren, 2012) is chosen as a theoretical framework.

The research questions in this study are:
1. Which success factors are essential for the success of OBL in adult education as perceived by adult education stakeholders (RQ1)?
2. Which quality areas and dimensions are essential for the success of OBL in adult education as perceived by adult education stakeholders (RQ2)?
3. Which quality framework can be validated for OBL in AE and which indicators for quality can be identified (RQ3)?

## METHODOLOGY

According to Inglis (2008), quality frameworks can be validated by either reference to appropriate research literature or against the knowledge of experts in the field or through a combination of both. While it is appropriate to draw on literature it may not be sufficient especially in new contexts (Inglis, 2008). Stakeholders can be assembled to elicit their expert knowledge, which is tacit as well as explicit (Inglis, 2008). Therefore, qualitative data were drawn from group interviews (n=12 groups) in five institutions in addition to literature to validate the framework. Professionals were interviewed at the policy level (n=17) and programme level (n=20).

The principles of thematic analysis is chosen as a method. This method allows to combine deductive matrix analysis with the principles of grounded theory (Corbin & Strauss, 1990). Grounded theory is a method which is based on inductive analysis from the data focused on creating conceptual frameworks (Charmaz, 2006).

### Research context

This study was conducted in Flanders (the Dutch speaking part of Belgium). The Flemish government, operating at the macro level, promotes OBL in AE to satisfy the demand for flexible education for adults (Decree 15/06/2007). The Flemish Inspectorate is responsible for the external evaluation of institutions in this context. The Context, Input, Processes, and output model (CIPO-model) (Scheerens, 1990, 2006) is a generic quality model that is used by the Flemish Inspectorate to perform quality audits in different educational contexts amongst which are adult education institutions. Currently the quality of OBL in AE institutions is assessed separately by the Inspectorate based on a minimal set of criteria by decree (Decree 15/06/2007). Another governmental body, 'verification', exerts control on attendance of adult students to the educational provision on which institutional funding is based.

While external quality control of OBL is not part of the regular procedure used by the Inspectorate their reports reveal information about the centers with respect to their internal QA&I. Inspection reports (N=4) not older than five years of the centers involved in this study were scanned. Analysis of these indicates that: '*... Digital learning in specific courses. .... currently internal quality is implemented at institutional level, the institution is still looking ... for indicators to measure the educational process. Align the (internal) quality assurance with monitoring the quality of the core process'*.

Institutions, operating at the meso level, can apply for a financial incentive if they choose to adopt OBL in their educational provision. Beyond adoption of OBL, institutions of AE are challenged to incorporate quality of OBL

into the institutional quality procedure. They have been compelled to examine and systematically monitor the quality of their provision since 2009(Decree08/05/2009). Institutions offer programmes for a diverse audience, from participants in basic education (primary and middle school education for adults), (vocational) second chance education, to courses at Level 5 of the European Qualification Framework and teacher training.For QA&I of OBL institutions either turn to what is available in HE or adopt an ad hoc approach. They need to know how to mainstream the quality of OBL into their implemented QA&I approach.

**Procedure**

To explore the current approaches and experiences with QA&I, qualitative data were drawn from semi-structured interviews in five institutions for AE. In each institution an interview was conducted with policy makers and QA coordinators (n=17) followed by an interview with professionals at the programme level (n=20). Respondents were interviewed about current approaches and experiences with QA&I in general and OBL specifically. Although the interviews focused on QA&I, the topic of the quality of OBL was omnipresent, interviewees talked about the quality of OBL in adult education.

The interview guideline was structured by the PDCA-cycle (Plan, Do, Check, Act) (Deming, 1950) and addressed topics regarding QA&I of OBL in the institution: institutional policy, implemented framework (including quality domains and indicators), implementation of QA&I in the institution and involvement of different stakeholders, effect and impact of quality assurance and plans for improvement.

**Participants**

Principles of theoretical sampling (Corbin & Strauss, 1990) were used to select centers and respondents. To be selected, centers had to: (a) currently provide (or have provided in the past) part of their provision through OBL; (b) have experience with OBL exceeding more than one year. Sample characteristics are displayed in Table 3. Centers were contacted and informed about the purpose of the study and about criteria for the inclusion of respondents. The researchers aimed for programmes at secondary education level and at Level 5 of the European Qualification Framework.

Table 3: sample characteristics of centers.

| | **Case a** | **Case b** | **Case c** | **Case d** | **Case e** | **Total** |
|---|---|---|---|---|---|---|
| **Number of respondents at policy level** | | | | | | |
| | N=3 | N=3 | N=3 | N=5 | N=3 | **N=17** |
| **Number of respondents at programme level** | | | | | | |
| **Interviews** | N=3* | N=1** | N=7** | N=2** | N=3** | **N=20** |
| | | | | N=2** | | |
| | | | | N=2** | | |
| *** Level 5 of the European Qualification Framework, ** Secondary education** | | | | | | |

Criteria for inclusion of respondents at the programme level were: (a) to have at least one year of experience with OBL; (b) all teachers participating in an interview had to teach in the same programme. For details of their experience in education and with OBL see Table 4. The selection of programmes and respondents was trusted to the institutions. One institution pointed out that in total three programmes were experienced with OBL. All were included to increase data saturation.

The interviews (N=12) were conducted over a period of three months. During each interview two researchers were present. One acted as the moderator and one as the observer, which allowed the interviewer to focus on the discussion. The observer took notes and assured all topics were covered. The first author was present at all the interviews. Interviews were transcribed in full and are the focus of this analysis.

Table 4: Experience of respondents in years.

| Experience: | <5y | 6y - 10y | 11y – 20y | 21y – 30y | >30y |
|---|---|---|---|---|---|
| Institutional level | | | | | |
| In Education | 1 | 1 | 8 | 4 | 3 |
| In Current position | 4 | 5 | 7 | - | - |
| With OBL | 8 | 8 | 1 | - | - |
| Programme level | | | | | |
| In Education | 3 | 2 | 8 | 3 | 4 |
| In Current position | 3 | 1 | 14 | 1 | 1 |
| With OBL | 13 | 5 | 2 | - | - |

**Data analysis**

Interviews were coded and analysed by the first researcher, according to the coding scheme as proposed by Corbin and Strauss (1990): open, axial and selective coding.

First all parts in the interviews in which respondents expressed anything that from their perspective was important for either OBL or QA&I were free coded (open coding). Only explicitly mentioned success factors were coded according to pre-defined codes, but not limited to: flexibility, accessibility, transparency, interactivity, personalisation, productivity, participation (Ossiannilsson & Landgren, 2012).

During a second phase, firstly, open codes were thematically clustered based on the quality areas and quality dimensions, but not limited to, the work of Ossiannilsson and Landgren (Ossiannilsson & Landgren, 2012): management (strategic planning and development), products (design – (curriculum/programme, course, learning activities and assessment) and delivery) and services (teacher and staff support, student support). Distribution (over cases and interviews) and frequency of coded statements were used as the criteria to identify themes.For inclusion, it was decided that themes were to be coded in at least four cases or seven interviews because of scientific consensus in literature about their existence. Then, axial and selective coding were performed to establish relationships between them and quality areas and dimensions. Thematically clustered codes were re-coded in terms of the success factors. Descriptions of these concepts that are mentioned in the e-xcellence manual (Kear et al., 2016; Ubachs et al., 2007; Williams, Kear, & Rosewell, 2012)which is built upon the conceptual framework for quality in e-learning developed by Ossiannilsson and Landgren (Ossiannilsson & Landgren, 2012) and the three P's of pedagogy (McLoughlin & Lee, 2008) were used to guide the analysis.

During a final coding round of the interviews, remaining codes were re-examined and coded in terms of success factors, after which seventy-four codes remained distributed over all cases and interviews.

The results from the interviews and literature e.g. 'Credibility', 'external QA' and 'internal QA' (Jung, 2011)were combined to validate the conceptual framework with success factors and determine indicators for OBL in AE. To enhance credibility results from the interviews were challenged and discussed with another researcher who was not involved in the analysis of the interviews. The processes from the CIPO-model were used to structure this iterative process. Concordance between researchers was reached by agreement about success factors, indicators and their links to quality areas and dimensions. The integration resulted in an adapted framework.

**RESULTS**

Findings from the interviews are presented in relation to each of the research questions.

**RQ 1 – Which success factors are essential for the success of OBL in adult education as perceived by adult education stakeholders?**

Except 'productivity' and 'credibility' all success factors were explicitly mentioned and coded during the first coding phase, but not all success factors were distributed (mentioned) equally over cases or interviews (see Table 5). While 'flexibility' and 'personalisation' were explicitly mentioned in all cases (resp. in ten and eight interviews), 'interactivity' and 'participation' were mentioned respectively in three cases (four interviews) and in three cases. 'accessibility' and 'transparency' were mentioned only once.

Table 5: coding by success factors by coding round.

| Success factors | 1st coding round | | 2nd coding round | | Final coding round | |
|---|---|---|---|---|---|---|
| | Distribution over cases, interviews | Frequency | Distribution over cases, interviews | Frequency | Distribution over cases, interviews | Frequency |
| **Flexibility** | 5,10 | 74 | 5,11 | 110 | 5,11 | 121 |
| **Accessibility** | 1,1 | 1 | 3,7 | 27 | 3,7 | 29 |
| **Transparency** | 1,1 | 1 | 5,11 | 90 | 5,11 | 96 |
| **Interactivity** | 3,4 | 14 | 5,8 | 33 | 5,8 | 33 |
| **Participation** | 3,3 | 5 | 4,4 | 9 | 4,4 | 13 |
| **Productivity** | 0,0 | 0 | 4,4 | 6 | 4,4 | 6 |
| **Personalisation** | 5,8 | 22 | 5,9 | 29 | 5,9 | 29 |
| **Integration** | - | - | 4,6 | 37 | 4,6 | 37 |
| **Credibility** | - | - | - | - | - | - |

During the second coding phase, remaining free codes were thematically clustered based on, but not limited to, the quality areas and quality dimensions reported by Ossiannilsson and Landgren (2012) and Jung (2011): Management (strategic planning and development), products (design – curriculum/course/learning activities and assessment; delivery) and services (teacher and staff support, student support), 'external QA' and 'internal QA'. The thematically clustered free codes were then recoded in terms of the success factors. After this, distribution and frequency increased for all success factors except credibility. All were mentioned in at least three cases and at least four interviews.

After this coding phase, remaining free codes and thematically clustered based were re-examined and coded in terms of success factors to establish relationships between the themes and the success factors. After this, third and final coding round, distribution and frequency increased for all success factors exept 'credibility'. After this coding round seventy-four codes remained.

**RQ 2 – Which quality areas and dimensions are essential for the success of OBL in adult education as perceived by adult education stakeholders?**

Several themes emerged that could be categorised within Ossiannilsson and Landgrens' (Ossiannilsson & Landgren, 2012)and Jungs' (2011)quality areas and quality dimensions; see Table 6. Two themes did not fit with the pre-defined quality areas and quality dimensions (n=4). These were labelled: 'integration' and 'evolution'.

Table 6: thematical clustering of elementary codes from interviews.

| | External QA | Management* | Teacher and staff support** | Student support** | Design *** | Delivery *** | Evolution | Internal QA |
|---|---|---|---|---|---|---|---|---|
| **Distribution over articles** | 4,4 | 5,12 | 5,11 | 5,12 | 5,11 | 4,7 | 4,7 | 5,12 |
| **Frequency** | 18 | 103 | 132 | 198 | 163 | 44 | 9 | 68 |

Ossiannilsson and Landgren (2012): Management* (strategic planning and development), products** (design – curriculum/course and assessment; delivery) and services *** (teacher and staff support, student support).

By recoding the remaining free codes that were thematically clustered in terms of success factors, relationships between themes and success factors were established (Table 7). The 'design' of the provision (course, programme, learning activities and assessment) could be linked to 'flexibility', in total thirty-six statements, distributed over all cases and ten interviews. Both 'student support' (2,3-6) and '(online) delivery' (3,6 -20) could be linked to 'accessibility'. 'Interactivity' (nineteen statements distributed over all cases and seven interviews) appeared to be a success factor for the 'design' of the provision (course, programme, learning activities and assessment). 'Design' could also be linked with 'personalisation', (2,3-7) while only six statements

from the 'design' of the provision (course, programme, learning activities and assessment) could be linked to 'productivity' (4,4). Both 'student support' (1,1-2) and 'design' (1,1-5) could be linked to 'participation'. All quality dimensions, with the exception of 'support for teachers and staff', are linked to 'transparency' ('management' 3, 3 – 7; 'student support' 5,10 – 49; 'design' 5,6 – 14 and 'delivery' 2,3 – 19). Within 'design' (course, programme, learning activities and assessment) thirty-seven statements (4,6) which were labeled as 'integration' emerged which appeared to be important, but could not be linked to a success factor reported by Ossiannilsson and Landgren (2012). Management and the themes: 'external QA, 'evolution', 'integration' and 'internal QA' could not be linked to any of the success factors.

Table 7: connections between success factors and emerging themes.

| **Success factors** | **Management** | **Teacher and staff support** | **Student support** | **Design** | **Delivery** |
|---|---|---|---|---|---|
| | (5,12 – 103) | (5,11 – 132) | (5,12 – 198) | (5,11 – 163) | (4,7 – 44) |
| **Distribution over cases, interviews – frequency** | | | | | |
| **Flexibility (5,11 – 110)** | - | - | - | 5,10 – 36 | - |
| **Accessibility (3,7 – 27)** | - | - | 2,3 – 6 | - | 3,6 – 20 |
| **Transparency (5,11 – 90)** | 3,3 – 7 | - | 5,10 – 49 | 5,6 – 14 | 2,3 – 19 |
| **Interactivity (5,8 – 33)** | - | - | - | 5,7 – 19 | - |
| **Participation (4,4 – 9)** | - | - | 1,1 – 2 | 1,1 – 5 | - |
| **Productivity (4,4 – 6)** | - | - | - | 4,4 – 6 | - |
| **Personalization (5,9 – 29)** | - | - | | 2,3 – 7 | - |
| **Credibility** | - | - | - | - | - |
| **Integration (4,6 – 37)** | - | - | - | 4,6 – 37 | - |

**RQ3 – Which quality framework can be validated for OBL in AE and which indicators for quality can be identified?**

Flexibility and transparency are mentioned in all cases and interviews. The use of technology helps students to combine education with professional and private obligations. The way OBL is designed i.e. flexible deadlines for learning activities: *'…if they give me a reason, it's good I'll mention: "has a reason." or "will catch up later'*, and the programme: '*… there are not enough days in a week to actually do it all (ed.* the programme*) in one year. Plus also the people who work, … full time…', 'we think if we are targeting students for distance learning in programme X, we'll start with a percentage of OBL in the range from 25% to 35%'. … 'students ask for distance learning occasionally to not come some evenings' …'yes' … 'but they surely still want to come to class'*. Transparency is seen as important to empower students, from enrolment throughout the programme. This success factor could be linked to all quality areas and domains: Management: *'…you should, indeed, have a vision on OBL. … but you must also make a lot more advertising for it. … 'yes' … 'we make informational films which we put on our website', Services: '… there are students who enroll in a programme and realise that it will not work (for them), in which case the counselor has a conversation with the student to redirect him/her to a different programme'* and products: *'…I wrote: "create more uniformity." Not that I like … would like all to be the same will but ... that students can still find their way in that course…'*.

Accessibility, linked to delivery and student support, is mentioned in not more than half of the interviews and three cases. Online delivery has to be accessible at all times via mainstream technology which students are able to use: '*I choose the tools that are not so difficult for them. I would like to use smartphones, but if I notice that there are only one or two who have one, I will choose not to use it*'. Accessibility was mentioned in not more than half of the interviews and three cases.

It seems that **flexibility**:'*Flexibility related to time. When do you study, when do you learn? But also flexibility in terms of pace (going slower or faster through the programme)…'* and **accessibility**: *'...because one needs performant internet connection to be able to play al those movies...'*, are crucial to enhance access to education

and make participation in education convenient for students, while **transparency**: '*…we try to advise students, we have extensive information sessions at the start of the school year. …'*, is important to inform students of what is expected or possible.

Success factors related to pedagogy (**productivity, personalization, interactivity** and **participation)** are less prominent in the interviews. The quality dimension 'design' is related to the success factors productivity: '*… for validity of assessment … language training implies for example, that there are assignments that require individual processing by students. A set of grammatical or lexical exercises which is not an example of a good assignment.'*, and personalisation: '*... assessment is no longer a purpose in itself. … now you are working with the student for the added value. For their independence and for (ed. to achieve) those competencies*'.

Statements coded for online interactivity between peers is under-reported or even absent in favor of interactivity with content: *'…you, give a bit of info (ed. online) ... And they must apply that. And then click on the button submit and they see 'what you've done now is right or wrong.'* and teachers: '*…when I give feedback I keep in mind that … not in the style of "this is not good" or "this was a bit too weak." But that really is about what is wrong and what they can do to remedy it…*'.
The codes for the success factor 'participation' were scarce. What is mentioned is similar but not equal to codes related to 'interactivity'. It seems that participation can be seen as a central success factor. It can be argued that decisions taken at the level of the other success factors have consequences on the way students participate in the educational provision: '*... the way of looking 100%, because ultimately you look at some: is there participation, is there material available and is it being worked with, is there feedback to the students?'*.

The theme '**evolution'** could not be linked to a success factor. In this theme respondents state that the way OBL is designed and the amount of OBL in the provision evolved over time: '*Indeed, I think that our distance education and the way we use it to work has evolved tremendously*', *'And that really is also a choice that we made as an institution. And we really want to go for it. In the past it was blended learning. But now is what we call open CVO, in which almost the entire course is given in distance education'*. Although mentioned in only half of the interviews, codes for the theme 'evolution' were present in four cases.

None of the themes 'management', 'internal QA' and 'external QA' could be linked to the success factors. What is mentioned focuses on the management principle of integration of the vision into the organization: '*… Yes, distance learning and contact education should be structurally aligned to each other. That's in terms of documents etc… So, that the rules, are uniform, ECTS sheets are uniform…'* Researcher: '*And you mean are "aligned with each other", it is about the provision. Not the course but,...'*, respondent: *'Yes, both with respect to the courses as anything outside of the courses. Where do I have to go for a document when I need one, when do I have to do this or that? if I have to. Oh, boy sometimes at times this is very difficult ...'*. Management is also about providing clear roles for educators, staff support and internal QA processes. In that respect respondents mention: *'We therefore work with projects or project groups, … to actually learn from collaboration…','… there is so much expertise yet everyone is still … working on an island, I think. I think there could be much more cooperation','…collaboration divides the work and strengthens it … I think is a creative way of using resources. But yeah, that's easy for meto say, because we were forced at some time because we had to survive. But I am a believer of supporting micro design teams rather than individual teachers'*.

The theme of 'external QA' is related to the topics of external quality assurance, verification and funding. Respondents report that how funding and external quality assurance are conducted impinges on how they organise OBL. Respondents complain about external QA and verification: '*… now we are funded based on attendance. For distance education this is based on participation which is operationalised as how long someone is logged into the system, what they (students) have actually done is not taken into consideration, this tells nothing'*.

The theme 'integration' is related to 'design'. Respondents refered to different thingsabout this theme:program - '*distance education and face to face education should be structurally aligned*', course/learning activities and assessment - '*The goals or better skills, which are important, how they relate to the course material. And how it relates to your assessment. That should actually be all in one, all in the same line, which is not so evident.'*, *'I've added here: fraud resistance. Sooner or later we're going to be caught on. How can you prove that an assignment is really made by student X? Oh yes, by the end through an oral exam, a jury or whatever….'*, *'(they) can have their tasks made by someone else*'. It seems thus that the emerging theme 'integration' cannot be seen as a success factor in its own right because it appears related to different things i.e. design and assessment. Researchers agreed that this is not specific for OBL. Integration also refers to how face-to-face and online education is structurally aligned to one another and to 'assessment' i.e. validity. The researchers agreed that

these concepts were covered by other success factors, respectively 'productivity' and 'flexibility'.From the analysis an adapted framework is proposed, an overview of the success factors, their connections to quality dimensions and the number of indicators can be found in table 8.

Table 8: list of seven success factors with tentative definitions, citations from interviews, connections to quality areas/dimensions and number of indicators (Appendix 1). (Kear et al., 2016; McLoughlin & Lee, 2008; Ubachs et al., 2007; Williams et al., 2012).

| Success Factors and Tentative Definition | Connections to quality areas/dimensions |
|---|---|
| **Credibility**– Credibility implies the translaties of a clean view on OBL into measurable targets. It implies efficient use of potential means and personnel. Finally, it entails the integration of these targets into the quality assurance system, monitoring the development of OBL and adjusting it if necessary. | • Management (N=13)<br>• Support for teachers and staff (N=10) |
| **Flexibility –** The degree in which students have the possibility to fine tune educational needs to professional or private needs and obligations.<br>*"Flexibility related to time. When do you study, when do you learn? But also flexibility in terms of pace (going slower or faster through the programme). Intensity, time, intensity, learning style…". – A_B_1* | • Programme (N=4)<br>• Learning activity (N=1) |
| **Transparency –** All initiatives taken to inform potential students about the programme from enrolment until graduation.<br>*"… also we try to advise students, we have extensive information sessions at the start of the school year. …" – E_L_3* | • Management (N=1),<br>• Programme (N=4)<br>• Course (N=4)<br>• Student support (N=7) |
| **Accessibilty -** Is determined by the online accessibilty of students and by what is available for them on the campus.<br>*"that student has no internet connection … our open learning center is also accessible to students. … We … train students in ICT skills. … the basics like an on/off button of a computer." – C_B_1* | • Delivery (N=5)<br>• Student support (N=2) |
| **Interactivity –** Refers to the online interaction that is supportive for the learning process between students and the material and students and teachers. Interactivity is related to design and student support.<br>*"…I think that if you design the learning path differently it is possible to do it online. But the learning path is like, well like mine that I now have developed for instance that you don't need to do that. Where you just, you're giving a piece of info and ok now let's apply that. And they (students) must do that. And they click on a button 'Submit' and they see: 'What you've done now is correct or is incorrect ' – C_L_?* | • Learning activity (N=6)<br>• Student support (N=4) |
| **Personalisation –** The extent to which students have, and (can) make use of the possibility to personalise (customise/maximise) their learning experience to personal needs by their own choice. Personalisation ranges from personal learning (a lot of freedom of choice for students) to personal instruction (absence of choice).<br>*"One part (online) is rehearsal of exercises and implementation of what we worked on in class. And the second part it entails new subjects. So if for example, they have understood well what we dealt with during class, for all I care they can skip the first part that or spend less time on it. They do what they want with it. They are free to decide for themselves. – D_L2_2* | • Learning activity (N=8)<br>• Student support (N=2) |
| **Productivity –** The extent to which learning activities (content and assessment) are designed to challenge/invite students in the process of knowledge creation rather than mere reproduction. Productivity is linked to design.<br>*"Yes, yes because we then surely knew: 'look, let those people (students) tell what they have learned and then you can dig much deeper, and really see if those competencies are acquired." E_B_1* | • Learning activity (N=3) |
| **Participation –** Participation is understood as the students' active involvement in their learning processes. Participation is linked to Student support and Design.<br>*"... the way of looking 100%, because ultimately you look at some: is there participation, is there material available and is that being worked with, is there feedback to the students?" – E_B_3* | – |

## DISCUSSION

This study has identified a framework with success factors and indicators for quality of OBL based on interviews in the field of AE. The results indicate that all success factors for quality in OBL are present in AE. The success factors and indicators are connected to quality dimensions present in existing quality frames. While some success factors and indicators enable participation others have an impact on the learning process of students. We will discuss these findings in relation to literature on quality from the adult student perspective in HE.

The discussion is structured in a similar manner as the findings were presented. Firstly, we will success factors that enable participation to education. Then we will discuss the pedagogical success factors and how they are related to the enabling success factors. Finally, we will address the emerging success factor, credibility.

While flexibility and accessibility are important to increase the accessibility of adult education and facilitate participation, transparency is important to inform students about the posssibilitiets of the modalities of OBL. These findings are in line with literature. Although not much specific reference to attributes of flexibility are reported in AE literature, with respect to transparency emphasis is given to the importance of transparent communication about flexibility (Harroff, 2002; Jung, 2011). Accessibility relates to the technical requirements of delivery and technical support to students in order to be able to participate (Harroff, 2002; Jung, 2011; Korres et al., 2009; MacDonald & Thompson, 2005; Volungeviciene et al., 2014). This is in line with Grahams' concept of enabling blend (Bonk & Graham, 2012; Graham, 2005; Graham & Robison, 2007) which aim to increase access and convenience to students.The finding that accessibility was not mentiond a lot could be explained by the fact that it is such a logical condition that it is easily overlooked (Ehlers, 2004).

Success factors related to pedagogy (participation, personalisation and productivity) were less prominent in the interviews. While 'personalisation' (Dzakiria, 2012; Harroff, 2002; Jung, 2011; MacDonald & Thompson, 2005; Stodel et al., 2006; Zhang & Cheng, 2012) is emphasized in literature, 'productivity' is to a lesser extent (Jung, 2011; Stodel et al., 2006; Volungeviciene et al., 2014). In contrast with our findings 'interactivity' of students is mentioned in relation to content, peers and faculty in literature (Dzakiria, 2012; Harroff, 2002; Jung, 2011; MacDonald & Thompson, 2005; Stodel et al., 2006; Volungeviciene et al., 2014; Zhang & Cheng, 2012). Although 'participation' and 'interactivity' are seen as distinct success factors (McLoughlin & Lee, 2008; Ossiannilsson & Landgren, 2012), analysis of interviews indicates that they are similar.

The theme 'evolution' indicates that the centers initially focused more on success factors that relate to lowering the threshold to education at the expense of pedagogical success factors, but, with time came to realise the importance of pedagogical success factors. It suggests that pedagogical success factors: personalization, interactivity and productivity became more important over time for a design of OBL which invites students to take ownership i.e. actively participate in the learning process.This provides evidence for of Ossiannilsson and Landgrens' (2012) statement that OBL is evolving towards paradigms of collaboration and networking could be true in AE. Findings suggest that an evolution occurred from a cognitive-behaviourist learning design towards a social constructivist design i.c. knowledge production and interaction (with material and teachers). It also suggests that institutions are challenged to take pedagogical success factors into consideration when they attempt to move from awareness or exploration of OBL and away from adoption and early implementation towards more mature implementation and growth or improvement (Graham, Woodfield & Harrison, 2013). Caution should be used over whether evolution in design should be interpreted as one learning theory being better than another, adding more to quality. It is important in this respect to take note that several generations of distance education pedagogy emerged over time: cognitive-behaviourist, social constructivist and connectivist pedagogy and that all add to quality (Anderson & Dron, 2011).

What respondents mention in the themes 'management', 'internal QA' and 'external QA' corresponds with what Jung(2011) reports as 'credibility'. What is mentioned is in line with what is reported in literature (Harroff, 2002; Korres et al., 2009; MacDonald & Thompson, 2005; Stodel et al., 2006; Volungeviciene et al., 2014; Zhang & Cheng, 2012). It focuses on the management principles of integration of the vision of OBL into the organization and also about providing clear roles for educators, staff support and internal QA processes. Not different from a standard education programme, but with a specific focus for OBL.

It appears that institutions that want to become successful adopters of OBL need to decide how to use their resources in such a way that the participation of the students is maximized. The predominant question for institutional QA&I process is therefore indeed if institutional, faculty and student goals are balanced (Moskal et al., 2013).

Findings indicate that institutional alignment (Moskal et al., 2013) might not be sufficient. The macro and meso level should be aligned too. Institutional alignment (Moskal et al., 2013) can be hampered by how legislation regulates external quality assurance, verification and funding of educational institutions. Findings indicate that decisions taken at the macro level influence both the meso- and the micro level in institutions. The legislative framework provided by the government, the way external accreditation bodies assess quality, and operationalise attendance negatively affects funding and in this way interferes with institutional practices related to the design and implementation of OBL. This is in line with Ossianilsson et al. (Ossiannilsson et al., 2015) who point out that *"…Other systems (national approaches to quality)"* that *"have not considered the impact of e-learning onto their criteria,"* should integrate quality of OBL into their external quality frameworks to avoid *"creating sometimes perverse results, such as limitations on the size of classrooms, or requirements for physical facilities which are not required for e-learning."*(Ossiannilsson et al., 2015). Findings also stress the importance to move from a time-based, towards a mastery-based measurement of student performance in OBL (Graham et al., 2013) for this context.

**Limitations and prospects for future research**

An evidence-based validation processes for quality frameworks is important (Inglis, 2008). The focus of this study lies in the development of a conceptual framework in the context of AE and relevant literature by determining success factors for the quality of OBL in AE and linking these to quality aspects and searching for indicators.

Although all success factors for quality in OBL are present, they are distributed unevenly over the interviews and the frequency of mentions between success factors differs. This could be attributed to the design of the study. For the interviews a semi-structured interview guideline was used to give respondents the opportunity to speak freely with, as a possible result, the low frequency of some success factors. A rival explanation is that the number of interviews was not sufficient for the data to reach saturation. Yet, it can be argued that the total number of respondents and the number of respondents per group at policy level and programme level, should be sufficient to reach a point of data saturation. Other than the design of the study, it is possible that not all success factors are mentioned equally because an evolution is occurring in the field. Therefore, further validation by consultation with experts in the field is necessary.

## CONCLUSION

A modified conceptual framework for OBL in AE has emerged from this study. Success factors with supporting indicators that contribute to lowering threshold to education (flexibility, accessibility, transparency, credibility) as well as success factors with indicators that have a direct impact on the quality of the learning process (interactivity, personalisation, productivity) determine participation (access) of students in education or the active participation of students in the educational process. The success factors and indicators are linked to quality dimensions and areas, present in most quality frameworks.

This framework will enable institutions to reflect about how technologyreduce the barriersfor participation and how it can support active participation of studentsin theeducation process. The link of the success factors with the concepts of enabling and transforming blend(Bonk & Graham, 2012; Graham, 2005; Graham & Robison, 2007)supports institutions to strategically integrate OBL in into its mission and assess the maturity of their OBL provision. The framework allows for growth from an enabling blend towards a transforming blend and can be used to determine if the provision of OBL is aligned with the needs of the students.

Until now quality frameworks for OBL are used in addition to general quality frames in education. Yet recently it has been argued that OBL quality should be mainstreamed into traditional quality frameworks used by either educational institutions or accreditation bodies and not assessed separately (Grifoll et al., 2010; Hansson, 2008; Ossiannilsson et al., 2015). The framework that resulted from this study can be used to mainstream quality of OBL in traditional QA&I frameworks. This is possible because success factors and indicators are linked to quality dimensions and areas, present in most quality frameworks.

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**Appendix 1 – List of indicators**

| **Success factor** | **Link to quality dimensions and CIPO** | | |
|---|---|---|---|
| **Indicator** | **Description of indicator** | **AE Literature Reference*** | **AE Interview Reference**** |
| **1. Flexibility** | | | |
| **F_PR** | **Quality Dimension: Design – Programme**<br>**CIPO: Education-Curriculum-Organisation of the education** | | |
| F_1 | Duration of the programme matches the needs of the students | | E_L_3;A_L_1; E_B_1 |
| F_2 | The ratio contact education vs. Online education of the programme matches the needs of the students | | D_B_5;D_B_2; E_B_1;B_B_1; C_B_1;C_B_2; C_B_3 |
| F_3 | Students are given pacing opportunities in the curriculum | Lit_Vol; Lit_Kor | |
| F_4 | Students are able to follow a flexible path throughout the curriculum | Lit_Sto; Lit_Vol | |
| **F_LA** | **Quality Dimension: Design – Learning activity**<br>**CIPO: Education-Curriculum-Content of the education** | | |
| F_5 | Students are given flexibility in deadlines for assignments | | E_B_2; D_L2_2 |
| **2. Accessibility** | | | |
| **A_DEL** | **Quality Dimension: Delivery**<br>**CIPO: Absent** | | |
| A_1 | The technical infrastructure meets current connectivity requirements | Lit_Vol; Lit_Kor | |
| A_2 | Students can access the learning environment with mainstream hardware and software | Lit_Mac | D_L2_2<br>C_B_2 |
| A_3 | The online learning environment supports the intended interaction between all participants. | Lit_Vol; Lit_Kor | |
| A_4 | The usability of the learning environment takes the students' technical skills into account. | Lit_Kor | D_L2_2 |
| A_5 | The learning environment accommodates students with special needs | Lit_Kor | |
| **A_LS** | **Quality Dimension: Learner Support**<br>**CIPO: Absent (A_6) - Pupils' guidance-career guidance (A_7)** | | |
| A_6 | Students have access to technical assistance | Lit_Mac; Lit_Kor; Lit_Har | B_B_1; C_B_1 |
| A_7 | Students have access to resources e.g. library, open learning center, career guidance,… | Lit_Jun | C_B_1 |
| **3. Transparency** | | | |
| | **(Prior to enrolment in the programme)** | | |
| **T_M_V** | **Quality Dimension: Management-Vision**<br>**CIPO: General-Development of vision** | | |
| T_1 | The institutional mission and vision on OBL is made available to prospective/potential students | | D_L2_2; D_L2_1 |
| **T_ LS** | **Quality Dimension: Learner support – Administrative support**<br>**CIPO: Pupils' guidance-career guidance** | | |
| T_2 | Prospective students are informed of conditions of admission | Lit_Har; Lit_Jun | |
| T_3 | Prospective students are informed about costs related to the OBL programme | Lit_Har; Lit_Jun | |
| T_4 | Prospective students are informed about financial aids related to the OBL | Lit_Har; | |

| | | | |
|---|---|---|---|
| | programme | | |
| T_5 | Prospective students are informed about software and hardware requirements | Lit_Har; | C_B_1 |
| T_6 | Prospective students are informed about required technical skills | Lit_Har; | C_B_1 |
| T_7 | Prospective students are informed about the duration of the programme | Lit_Har; | |
| T_8 | Prospective students are informed about possibilities of personalized pathways through the programme | | B_B_2 |
| | **After enrolment in the programme** | | |
| **T_ PR** | **Quality Dimension: Design - Programme**<br>**CIPO: Education-Curriculum-Organisation of the education** | | |
| T_9 | Students experience a uniform online design throughout the programme/curriculum | | D_L2_2 |
| T_10 | The importance of online interaction (materials, peers, tutors) as part of the learning process is made explicitly clear to the students. | Lit_Dza;<br>Lit_Sto | E_B_2; E_B_3;<br>D_L2_2;<br>D_L2_1 |
| T_11 | The intended learning outcomes are transparently translated in learning activities and assessments | Lit_Har; | D_L1_2 |
| T_12 | Students are informed about tutors' response time on assignments, questions,… | Lit_Har;<br>Lit_Dza | B_B_1 |
| **T_ LA** | **Quality Dimension: Design – course**<br>**CIPO: Education-Curriculum-Organisation of the education** | | |
| T_13 | Students are fully informed about the course requirements. | Lit_Har; | |
| T_14 | Students are provided with clear information about course assignments | Lit_Har; | D_L2_2; A_L_3 |
| T_15 | Students are provided with a clear online course lay-out | | D_L2_1; D_L2_2 |
| T_16 | The lay-out of the online course is mad explicit to the students | | C_B_2 |
| **4. Credibility** | | | |
| **C_ M_CR** | **Quality Dimension: Management - Compliance and recognition**<br>**CIPO: Context-Legislative framework-specific legislation (C_1) – Absent (C_2)** | | |
| C_1 | The educational provision meets the quality requirements assessed by external assessors (inspectorate, accreditation bodies,…) | Lit_Jun | |
| C_2 | The educational provision meets the requirements of international copyright legislation | | A_B_2 |
| **C_ M_L** | **Quality Dimension: Management - Leadership**<br>**CIPO: General-Leadership** | | |
| C_3 | The institutions' management develops institutional standards for the design of OBL | Lit_Zha | D_L2_1; D_L2_2 |
| C_4 | The institutions' management develops and deploys the OBL provision project based | | C_B_1; D_B_5 |
| C_5 | The institutions' management monitors the implementation of the institutional mission and vision of OBL | | D_L2_1; D_L2_2 |
| C_6 | The institutions' management gives credit to teachers and staff who develop OBL | Lit_Har | B_B_3 |
| C_7 | The institutions' management integrates OBL in all aspects of the organisation (teachers, support staff, administration,…) | Lit_Mac | A_L_2 |
| | **Management - Adequate use of resources** | | |

| | | | |
|---|---|---|---|
| **C_ M_R_L** | **Quality Dimension: Logistics – finance and equipment**<br>**CIPO: Logistics-Material management-financial means & equipment** | | |
| C_8 | The institutions' management provides sufficient personnel and other resources (infrastructure) to develop OBL adequately. | Lit_Har; Lit_Mac | C_B_2; D_B_2 |
| C_9 | The institutions' management provides adequate resources (people and infrastructure) for the coaching and guidance of students in the OBL provision | Lit_Har; | A_B_2 |
| C_10 | The institutions' management is able to maintain continuity in the use of its applications/ ICT-tools | | C_L_4; C_L_1 |
| **C_ M_STS_PO** | **Quality Dimension: Support for Teachers and Staff**<br>**CIPO: Staff-HRM-staff organization** | | |
| | Personnel organization | | |
| C_11 | Job descriptions for teachers and staff describe their role(s) related to the development and optimisation of OBL | Lit_Vol | |
| C_12 | Job descriptions for teachers and staff include pedagogical role(s) concerning the OBL-coaching of their students | Lit_Sto | |
| | Teams | | |
| C_13 | The design of OBL is the result of a multidisciplinary team | | D_B_4; E_B_1 |
| C_14 | The institutions' management fosters OBL learning communities for teachers and staff | Lit_Sto; Lit_Vol | D_L2_1; D_B_1; D_B_2 |
| | Technology | | |
| C_15 | Teachers and staff have access to technical support on demand | Lit_Har | D_B_2; D_L1_2 |
| | Pedagogy | | |
| C_16 | Teachers and staff are able to get expert support in OBL-pedagogy | Lit_Jun | D_B_2 |
| **C_ M_STS_PR** | **Quality Dimension: Professionalization**<br>**CIPO: Staff-HRM-competence development** | | |
| C_17 | Teachers and staff are trained in online design and didactics of online learning activities | Lit_Har | B_B_1 |
| C_18 | Teachers and staff are trained in online communication skills | Lit_Har | |
| C_19 | Teachers and staff are trained in international copyright legislation | Lit_Har | A_B_2 |
| C_20 | Teachers and staff have access to supply-and-demand driven professionalization. | Lit_Jun | |
| **C_M_CQI** | **Quality Dimension: Management - CQI**<br>**CIPO: General- Quality Assurance** | | |
| C_21 | The institutions' management has installed a quality assessment process that fosters a culture for quality improvement (e.g. internal and external audits) | Lit_Jun | A_B_2; B_B_1; B_B_2 |
| C_22 | The institutions' management has installed a quality survey process that monitors critical quality indicators for OBL (output measures e.g. drop-out, learning effectiveness, …) | Lit_Jun; Lit_Mac; Lit_Zha | A_B_1; B_B_1; B_B_2 |
| C_23 | The institutions' management has installed a quality assessment process (surveys, focus groups, …) in which different stakeholders (students, teachers, alumni, work field,…) are consulted | Lit_Vol; Lit_Kor | |
| **5. Interactivity** | | | |

| | | | |
|---|---|---|---|
| **I_D_LA** | **Quality Dimension: Design-Learning activity-with material**<br>**CIPO: absent** | | |
| I_1 | Online Learning activities contain a variety of learning resources | Lit_Vol | C_B_2 |
| I_2 | Assignments coerce students to engage actively with the online materials | Lit_Vol; Lit_Zha | C_L_X |
| I_3 | Assignments challenge students to approach learning content from different perspectives | Lit_Vol | |
| **I_D_LA** | **Quality Dimension: Design-Learning activity-with peers**<br>**CIPO: absent** | | |
| I_4 | Intended online interaction amongst peers fosters critical thinking | Lit_Har; Lit_Dza | |
| I_5 | Intended online interaction amongst peers supports knowledge building | Lit_Mac; Lit_Jun | |
| I_6 | Intended online interaction amongst peers fosters community building | Lit_Sto; Lit_Dza; Lit_Mac: Lit_Zha | |
| **I_D_LS** | **Quality Dimension: Learner Support – with materials**<br>**CIPO: Education-Evaluation-evaluation practice (I_7)** | | |
| I_7 | Learning activities contain a variety of self-assessment opportunities | | C_L_X |
| **I_D_LS** | **Quality Dimension: Learner Support – with teachers**<br>**CIPO: Education-Evaluation-evaluation practice (I_9) – Absent (I_8,I_10)** | | |
| I_8 | Students are supported in their ability to communicate online | Lit_Sto | |
| I_9 | Students are supported in their learning process with quality feedback by teachers | Lit_Mac; Lit_Dza | A_L_2 |
| I_10 | Online interaction between students and teachers fosters community building | Lit_Zha | |
| **6. Personalization** | | | |
| **Pe_D_LA** | **Quality Dimension: DESIGN – Learning activities**<br>**CIPO: absent (Pe_1,Pe_2,Pe_3,Pe_4), Education-Pupils' guidance-guidance of the learning capabilities (Pe_5,Pe_6), Education-Curriculum-Content of the education (Pe_7), Education-Evaluation-Evaluation practice (Pe_8)** | | |
| Pe_1 | Authenticity of learning activities matches the needs of the target group | Lit_Jun | |
| Pe_2 | Learning activities are meaningful for the target group | Lit_Jun; Lit_Zha | |
| Pe_3 | Learning activities accommodate differences within the target group (e.g. cultural differences, gender,…) | Lit_Har | |
| Pe_4 | Students are given the opportunity to customize the learning activities | Lit_Sto; Lit_Mac; Lit_Jun; Lit_Har | |
| Pe_5 | Design of learning activities allows random order usage | | D_L2_2 |
| Pe_6 | The design of learning activities contains remedial and deeper-level learning material to match students' needs | | A_B_1; A_B_2 |
| Pe_7 | the design of learning activities accommodates the students' different learning styles . | | A_B_2; A_L_2 |
| Pe_8 | Assessment modalities allow for active involvement of students | | E_B_2 |
| **Pe_D_LS** | **Quality Dimension: DESIGN – Learner support**<br>**CIPO: Education-Pupils' guidance-guidance of learning capabilities (Pe_9), Education-pupils' guidance-social and emotional guidance (Pe_10)** | | |
| Pe_9 | Students have access to need based learning support (through online tools, open learning centre, extra curriculum courses, …) | Lit_Jun; Lit_Har; Lit_Dza | |
| Pe_10 | Students have access to psychological and | Lit_Jun | |

| | | | |
|---|---|---|---|
| | social support | | |
| **7. Productivity** | | | |
| **Pr_D_LA** | **Quality Dimension: Design – learning activity**<br>**CIPO: absent (Pr-1, Pr_2), Education-Evaluation-evaluation practice (Pr_3)** | | |
| Pr_1 | Learning activities are problem-based | Lit_Jun; Lit_Vol | E_B_3 |
| Pr_2 | Learners are encouraged to take an active role in co-constructing knowledge | Lit_Sto; Lit_Vol | C_L_X |
| Pr_3 | Students are assessed in ways that exceed the mere level of knowledge reproduction. | Lit_Vol | B_B_1 |