TOJET
The Turkish Online Journal of Educational Technology

ISSN 2146-7242

Turkish Online Journal of Educational Technology

Volume 15, Issue 1
January 2016

TOJET
01.01.2016

THE TURKISH ONLINE JOURNAL OF EDUCATIONAL TECHNOLOGY

January 2016
Volume 15 - Issue 1

ISSN: 2146 - 7242

Indexed by
Education Resources Information Center – **ERIC**
SCOPUS - ELSEVIER

Published in TURKEY

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Message from the Editor-in-Chief

Dear Colleagues,

TOJET welcomes you. TOJET would like to thank you for your online journal interest. The online journal system has been diffused very fast for last ten years. TOJET has continued to diffuse new trends in educational technology to all over the world since October, 2002. We hope that the volume 15, issue 1 will also successfully accomplish our global educational technology goal. We celebrate the 15th anniversary of TOJET.

TOJET is confident that readers will learn and get different aspects on how to use educational technology in learning and teaching environments. Any views expressed in this publication are the views of the authors and are not the views of the Editor and TOJET.

TOJET thanks and appreciate Prof. Dr. Mukaddes ERDEM who is the guest editor of January, 2016 issue and all reviwers (Assoc. Prof. Dr. Alper Başbay, Assoc. Prof. Dr. Ebru Kılıç Çakmak, Assoc. Prof. Dr. Eylem Kılıç, Assoc. Prof. Dr. Kemal Oğuz Er, Assoc. Prof. Dr. Makbule Yurtluk Başbay, Assoc. Prof. Dr. Serçin Karataş, Assist. Prof. Dr. Alper Bayazıt, Assist. Prof. Dr. Betül Yılmaz, Assist. Prof. Dr. Bünyamin Yurdakul, Assist. Prof. Dr. Ebru Kuşçu Öztürk, Assist. Prof. Dr. Ferhat Kadir Pala, Assist. Prof. Dr. Fırat Sarsar, Assist. Prof. Dr. Gamze Özoğul, Assist. Prof. Dr. Gonca Kızılkaya Cumaoğlu, Assist. Prof. Dr. Güzin Mazman Akar, Assist. Prof. Dr. Hüseyin Özçınar, Assist. Prof. Dr. Kerem Kılıçer, Assist. Prof. Dr. Melih Engin, Assist. Prof. Dr. Meltem Kurtoğlu Erden, Assist. Prof. Dr. Salih Bardakçı, Assist. Prof. Dr. Selay Arkün Kocadere, Assist. Prof. Dr. Vildan Çevik, Assist. Prof. Dr. Yasemin Demirarslan Çevik, Assist. Prof. Dr. Yelkin Diker Coşkun, Assist. Prof. Dr. Yusuf Levent Şahin, Dr. Tuğba Öztürk) who have acted as reviewers for one or more submissions of this issue for their valuable contributions.

TOJET published all IETC-2015 English papers in special issue. These papers will be in Scopus databases in a short time.

TOJET, Governor State University, Sakarya University and Vienna University of Technology will organize International Educational Technology Conference-2016 (www.iet-c.net) between February 04-06, 2016 in Dubai, UAE.

Call for Papers
TOJET invites you article contributions. Submitted articles should be about all aspects of educational technology. The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET. Manuscripts must be submitted in English.

TOJET is guided by its editors, guest editors and advisory boards. If you are interested in contributing to TOJET as an author, guest editor or reviewer, please send your cv to tojet.editor@gmail.com.

January 01, 2016
Editor in Chief
Prof. Dr. Aytekin ISMAN

Editorial Board

Table of Contents

An Analysis of University Students' Attitudes towards Personalized Learning Environments

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ABSTRACT
The aim of this research is to analyze university students' attitudes towards personalized learning environments with respect to the independent variables of gender, age, university, year of study, knowledge about the environment, participation in the environment and being willing to participate in the environment. The correlative survey model is the method used in the research. The participants are 1,197 students of Computer Education and Instructional Technologies programs at 10 different universities. The personalized learning environment attitude scale (PLEAS) was used as an instrument to collSect data. The *t*-test, one way analysis of variance (ANOVA) and Tukey's test were used to analyze data.

The analysis found a significant difference in university students' attitudes towards personalized learning environment with respect to the variables of gender, age, year of study, knowledge about the learning environment, participation in the environment and being willing to participate in the environment. The university variable had no effect on attitudes.
Keywords: Personalized learning environments, attitude scale, university students.

INTRODUCTION
Recent developments in information technologies have influenced education as deeply as other fields. The adoption of information technologies in education has shown that learners' willingness to participate actively, to interact and to construct information is not adequate in face-to-face classrooms (Jaros and Deakin-Crick, 2007). Many learning environments such as computer-aided instruction, computer-based instruction and e-learning have been designed since the start of web technology use in education. However, these learning environments fail to provide an environment appropriate for the paces and learning styles and personal characteristics of learners (Martinez, 2001, El-Bakry and Mastorakis, 2009; Sahabudin and Ali, 2013; Savio-Ramos 2015). Individuals with different purposes and different levels of knowledge demand information presentation methods which offer alternatives and interesting to them (Brusilovsky, 1996). Personalized learning environments were designed to eliminate the limitations of other environments. Personalization is the presentation of correct information to right person at the right time (Speretta and Gauch, 2005). According to Gomez et al. (2013), personalized learning is learner-centered and provides content and guidance that fulfills the needs of individuals. Personalized learning environments offer learning experiences that are designed appropriately for individual learning styles and learning needs (Özarslan, 2010). The development of personalized learning environments is in its infancy, despite the fact that many personalized environments have already been developed (Kışla and Şahin, 2015).

In the literature, personalized learning environments are also referred to as adaptable learning environments. Adaptable learning environments were developed to offer an alternative to the"one size fits all" approach of traditional education (Brusilovsky, 2003; Lee, 2013). Instruction with one-type of content in a learning environment is not an appropriate approach for learners with varying amounts of prior knowledge, paces and learning styles. Knowledge should be presented by developing a learning environment which is suitable for learner's purposes and needs (Dağ, 2008).

Many personalized learning systems have already been developed and used. Şahin and Kışla (2013) reviewed these systems under three headings: (1) the development of personalized learning environments, (2) the development and use of personalized learning environments, and (3) research that describes the necessary features of personalized learning environments. This research tested the efficiency and effectiveness of these systems. Their positive and negative elements were investigated and studied to see if they affect learners' success positively or negatively.

Studies which developed personalized learning environments includes examples such as Schwarz et al. (1996) ELM-ART (Episodic Learner Model – Adaptive Remote Tutor), De Bra and Calvi (1998) AHA (Adaptive

Hypermedia Architecture), Kurzel et al. (2002) AMLE (Adaptive Multimedia Learning Environment), Pu et Al. (2004) DALE (Distributed Adaptive Learning Environment), Niyomiya et al. (2007) WebClass RAPSODY, Zhang (2008) PSSEM (Personalized Service System Based on E-learning Model), Li and Li (2009) PLSIA (Personalized Learning Environment based on Intelligent Agent), Muntean and Muntean (2009) PEACOCK (Performance-based E-learning Adaptive Cost-efficient Open Corpus Network), Hurson and Sedigh (2010) PERCEPOLIS (Pervasive Cyberinfrastructure For Personalized Learning And Instructional Support) and Sezer (2011) Ax2ELS (Adaptable-Adaptive English Learning Support).

Examples of studies which found that personalized learning environments affect learner's success positively include Wang (2008) IDEAL, Powell et al. (2008) Ultraversity, Bahçeci (2011) LessonTutor, Martinez (2001), Mustafa and Sharif (2011), Hwang et al. (2012) and Saiyd and Al-Sayed (2013).

The studies of Dimitrova (2003) STyLE OLM (Scientific Terminology Learning Environment Interactive Open Learning Modelling), Martinez (2001), Saiyd and Al-Sayed (2013) and Powell et al. (2008) Ultraversity are related to the design and construction of personalized learning environments. The results of these studies indicate that the systems were successfully implement and their construction was good.

Some research has examined the effects of personalized learning environments on the motivation of learners. Powell et al. (2008) Ultraversity, Popescu and Badica (2009) WELSA (Web based Educational system with Learning Style Adaptation) and Hwang et al. (2012) are examples of studies which found positive effects.
In addition, there is research that investigates the effects of personalized learning environments on the attitudes of learners. These studies include Powell et al. (2008) Ultraversity, Bahçeci (2011) and O'keeffe et al. (2012) AMASE (A Framework for Composing Adaptive and Personalized Learning Activities on the Web). These studies show that attitudes towards these environments are positive.

Nevertheless, there is not much research that investigates learners' attitudes towards these environments. According to Fishbein and Ajzen, "Attitudes are learned, they determine actions, and these actions are either positive or negative towards an object" (as cited in Köklü, 1995). Attitude studies are designed to obtain information about learners' approach to courses, levels of learning, interests, success and attitudes towards subjects (Demir and Akengin, 2010). Learners' attitudes towards personalized learning environments also determine their behaviors in the environment. To increase the success and the effectiveness of personalized learning environments, all the partners in the system must participate in the development of the environment. One of the partners is the individual who benefits from the environment. The opinions of these individuals should be taken, their motivation should be increased, and their attitudes towards the system should be positive. Attitude consists of aspects as direction (positive or negative feelings towards an event or subject, enjoyment), level (acceptance or rejection levels) and intensity (the possibility of becoming an extravert behavior) (Köklü, 1995). The aim of this study is analyzing the effects of different variables on university students' attitudes towards personalized learning environments. In accordance with this purpose, the sub-issues of this study are:

a) Are there any gender differences in students' attitudes towards personalized learning environments?
b) Are there any age related differences in students' attitudes towards personalized learning environments?
c) Are there any year of study differences in students' attitudes towards personalized learning environments?
d) Are there any differences related to the university variable in students' attitudes towards personalized learning environments?
e) Are there any differences related to the variable of students' knowledge about the environment in students' attitudes towards personalized learning environments?
f) Are there any differences related to variable of participation in personalized learning environments in students' attitudes towards personalized learning environments?
g) Are there any differences related to the variable of students' willingness to participate in personalized learning environments in students' attitudes towards personalized learning environments?

METHODS

This section includes detailed information about this research's design, sample, data collection instrument, procedure and data analysis.

Research Model:

The correlative survey model was used in this study to collect data about students' attitudes towards personalized learning environments. In survey research, the aim is to identify participants' opinions, attitudes and abilities regarding an event or a situation (Büyüköztürk et al., 2011). This study investigates the effects of

the variables such as gender, age, university, year of study, knowing about PLEs, having participated in PLEs and willingness to participate in PLEs on computer education and instructional technologies (CEIT) students' attitudes towards personalized learning environments (PLEs).

Population and Sample:
Random stratified sampling was used to select the sample. Stratified sampling assumes that population consists of strata, and sample selection is done independently from these strata. The population of this study includes the students of 42 different CEIT programs in public universities. The 2013 minimum national university entrance examination scores of the universities in the population were arranged in descending order. The first stratum consists of the top 21 universities, and the second stratum consists of the bottom 21 universities. Five universities from each stratum were randomly selected to sample. More detailed information is shown in Table 1.

Table 1. Information about the sample

	Gender		Total	Grade				
University	**Female**	**Male**		**1. Grade**	**2. Grade**	**3. Grade**	**4. Grade**	**Total**
Ağrı İbrahim Çeçen University	36 (%3.00)	41 (%3.42)	77 (%6.42)	0	20	34	23	77
Anadolu University	42 (%3.50)	66 (%5.51)	108 (%9.01)	28	47	33	0	108
Ankara University	53 (%4.42)	35 (%2.92)	88 (%7.34)	0	40	17	31	88
Balıkesir University	60 (%5.01)	49 (%4.09)	109 (%9.10)	31	25	22	31	109
Çanakkale 18 Mart University	114 (%9.52)	151 (%12.61)	265 (%22.13)	44	29	96	96	265
Gaziosmanpaşa University	64 (%5.34)	57 (%4.76)	121 (%10.10)	35	28	26	32	121
Hacettepe University	51 (%4.26)	51 (%4.26)	102 (%8.52)	15	21	28	38	102
Necmettin Erbakan University	33 (%2.75)	32 (%2.67)	65 (%5.42)	0	0	2	63	65
Osmangazi University	49 (%4.09)	64 (%5.34)	113 (%9.43)	35	41	35	2	113
Trakya Üniversitesi	65 (%5.43)	84 (%7.01)	149 (%12.44)	36	24	42	47	149
Total	**567 (%47.36)**	**630 (%52.64)**	**1197 (%100)**	**224 (%18.71)**	**275 (%22.98)**	**335 (%27.99)**	**363 (%30.32)**	**1197 (%100)**

The sample (n=1197) consists of first, second, third and fourth year CEIT students at 10 public universities.

Data Collection Instrument:
In this study, the personalized learning environment attitude scale (PLEAS) developed by Şahin (2014) was used to collect data. PLEAS consists of 27 items and one subcomponent. Its KMO score is .95. Its Barlett sphericity is (=6367.9, .000). Its content validity was determined by expert opinion. Its Cronbach alpha internal consistency coefficient is .95. It is a 5-point Likert-type scale which uses these responses: "strongly agree," "agree," "neither agree nor disagree," "disagree," and "strongly agree."

Procedure:
The researchers contacted the university instructors who administered the survey. The questionnaire took 5-7 minutes for the students to complete. The research ethics committee's approval was sent along with the questionnaires for administration. Detailed information about the procedure is shown in Table 2.

Table 2. Procedure

University	Procedure Start	Procedure Finish
Hacettepe University	06.12.2013	13.01.2014
Anadolu University	06.12.2013	31.01.2014
Ankara University	06.12.2013	20.01.2014
Balıkesir University	10.12.2013	28.01.2014
Çanakkale 18 Mart University	10.12.2013	30.01.2014
Ağrı İbrahim Çeçen University	07.12.2013	20.01.2014
Necmettin Erbakan University	06.12.2013	15.01.2014
Eskişehir Osmangazi University	06.12.2013	31.01.2014
Tokat Gaziosmanpaşa University	11.12.2013	31.01.2014
Trakya University	10.12.2013	23.01.2014

Data Analysis and Interpretation:
The *t*-test was conducted in order to assess whether there is a significantly meaningful difference among university students' attitudes toward personalized learning environment with respect to variables such as gender, knowing about PLEs, having participated in PLEs and willingness to participate in PLEs. The one-way analysis of variance (ANOVA) was conducted to assess whether there is a significantly meaningful difference among university students' attitudes toward personalized learning environment with respect to variables as age, university and year of study. The Levene test was used to assess homogeneity of variances. Tukey's test was used to determine the reason for the significant differences that were found.

FINDINGS AND INTERPRETATION
Extreme value and missing value analysis were conducted to investigate the attitude of the participants towards personalized learning environments. Missing values were removed from the dataset. Data that matched $|Z|<3.24$ was evaluated as outliers (Leech et al., 2008). The data for 8 students with $|Z|>3.24$ were removed, since they were specified as outliers.

When the coefficient of skewness is smaller than 2.5, or the kurtosis and coefficient of skewness is between +1 and -1, it indicates a normal distribution (Leech et al., 2008). The data used in the analysis is normally distributed. The results of the descriptive analysis for the set of data from 1,197 students are shown in Table 3.

Table 3. Result of descriptive analysis

Mean	105.2
Median	106
Variance	220.8
Std.	14.86
Range	81
Skewness	-.337 – .071
Kurtosis	.222 – .141
Minimum Value	54
Maksimum Value	135

The Effect of Gender on University Students' Attitudes towards PLEs

The *t*-test was conducted to determine whether the attitudes of students towards personalized learning environments varied by gender. Table 4 indicates that gender affects personalized learning environment attitude scale scores.

Table 4. Gender affects personalized learning environment attitude scale scores

Gender	N	—	SS	sd	t	p
Male	630	103.94	15.55	1195	3.146	.002
Female	567	106.64	13.92			

p< .05

The university students' attitudes towards personalized learning environments vary significantly by gender ($t(1,195)=3.146$, $p<.05$). Female students' attitudes (=106.64, s=13.92) are much more positive than those of male students (=103.94, s=15.55). This finding indicates a correlation between the student's attitude towards personalized learning environments and gender. The effect size calculated for the gender variable is .09. This result shows that 9% of the variance in the attitude scale scores is due to gender. The Cohen d value is .18, which means that the difference between the attitude scale mean scores of the male and female students equals a .18 standard deviation. The values calculated show that the effect size is small for the gender variable (Leech et al., 2008).

The Effect of Age on University Students' Attitudes towards PLEs

One-way analysis of variance (ANOVA) was used to determine whether the students' attitudes towards personalized learning environments varied by age. The descriptive statistics for the age groups are shown in Table 5, and the results of ANOVA are shown in Table 6.

Table 5. Descriptive statistics for the age groups

Age Group	N	—	SS
1 (17-19)	257	103.63	13.39
2 (20-22)	760	105.52	15.10
3 (23-25)	150	105.18	16.45
4 (26 and over)	30	111.43	9.74

Table 6. Results of ANOVA about age groups

	Sum of squares	sd	Mean Square	F	p	Difference
Between groups	1877.542	3	625.847	2.847	.037	4-1
Within groups	262284.903	1193	219.853			
Total	264162.445	1196				

p< .05

These results show that the students' attitudes towards personalized learning environments varies significantly by age ($F(3, 1193)=2.847$, $p<.05$). Tukey's test was performed to find the range of ages where the difference exists. According to the results, group 4 (26 and older) and group 1 (ages between 17 and 19) are significantly different. The attitudes of students who are 26 or older are more positive than those of other groups. The age groups, 17-19, 20-22 and 23-25, do not have significantly different attitudes towards personalized learning environments. No significant difference was found between the age groups, 23-25, 20-22 and 26 or older. These results show that the students' attitudes towards personalized learning environments are more positive as their age increases.

To identify the reason for differences in attitudes by age, the analysis of covariance (ANCOVA) method was performed. The adjusted scores are shown in Table 7.

Table 7. Adjusted scores about age groups

Age groups	N	Mean	Adjusted Mean
17-19	257	103.63	105.35
20-22	760	105.52	105.15
23-25	150	105.18	104.37
26 +	30	111.43	109.92

The results of ANCOVA determine if the difference in the age groups' adjusted attitude scores is significant. They are shown in Table 8.

Table 8. Results of ANCOVA

	Sum of squares	sd	Mean Square	F	p
Knowing about PLE	19060.922	1	19060.922	93.414	.073
Age Groups	777.646	3	259.215	1.270	.003
Error	243223.981	1192	204.047		
Total	13516872.6	1197			

p< .05

The results show that, if the variable of the students who know about personalized learning environments is controlled, the difference between the age groups' adjusted attitude scores is not statistically significant. It shows that the reason for the variance among attitude scale scores is not due to age, but due to knowledge about personalized learning environments.

The Effect of Year of Study on University Students' Attitudes towards PLEs

One-way ANOVA was used to determine whether the students' attitudes towards personalized learning environments vary by year of study. The descriptive statistics are shown in Table 9.

Table 9. Descriptive statistics about grade

Grade	N	—	SS
1. grade	224	103. 70	13.65
2. grade	275	102.28	14.07
3. grade	335	105.18	15.64
4. grade	363	108.41	14.86

The result of ANOVA for the students' attitudes towards personalized learning environments with respect to their year of study is shown in Table 10.

Table 10. ANOVA results about year of study

	Sum of square	sd	Mean square	F	p	Differences
Between groups	6597.126	3	2199.042	10.186	.000	4. sınıf – 1. sınıf, 4. sınıf – 2. sınıf, 4. sınıf – 3. sınıf
Within groups	257565.318	1193	215.897			
Total	264162.445	1196				

p< .05

The analysis shows that there is a significant difference in the students' attitude towards personalized learning environments with respect to their year of study (F(3.1193)=10.186, p<.05). To identify the year of study where the difference exists, Tukey's test was conducted. According to the results, the attitudes of seniors (=111.43) are more positive than those of students in other years of study. No significant differences were found between freshmen, sophomores and juniors.

The Effect of the University Variable on University Students' Attitudes towards PLEs

One way ANOVA was used to determine whether the students' attitudes towards PLEs vary by the university they attend. The descriptive statistics for the analysis of this variable are shown in Table 11.

Table 11. Descriptive statistics about university variable

University	N	—	SS
Ağrı İbrahim Çeçen University	77	109.25	12.25
Anadolu University	108	102.42	14.53
Ankara University	88	104.28	16.62
Balıkesir University si	109	106.94	13.45
Çanakkale 18 Mart University	265	106.48	14.63
Hacettepe University	102	105.80	16.17
Necmettin Erbakan University	65	108.76	12.99
Osmangazi University	113	104.54	13.77
Tokat Gaziosmanpaşa University	121	101.58	15.05
Trakya University	149	103.72	16.14

The results of ANOVA for students' attitudes towards personalized learning environments with respect to the university is summarized in Table 12.

Table 12. ANOVA results about university variable

	Sum of square	sd	Mean square	F	p	Differences
Between groups	5762.272	9	640.252	2.941	.002	Ağrı-Tokat
Within groups	258400.173	1187	217.692			
Total	264162.445	1196				

p< .05

Analysis shows that there is a difference in the students' attitudes towards personalized learning environments with respect to the university (F(9.1187)=2.941, p=<.05). To identify the universities where the difference exists, Tukey's test was used. The results showed a significant difference between Ağrı İbrahim Çeçen University (=109.25) and Tokat Gaziosmanpaşa University (=101.58). No significant differences were found for the other universities. Since there is no significant difference in 9 universities, but only in 2, it can be concluded that the university variable does not significantly affect students' attitudes towards PLEs.

Paired comparisons of universities only shows a significant difference between Ağrı İbrahim Çeçen and Tokat Gaziosmanpaşa University, in favor of Ağrı İbrahim Çeçen University. No significant difference was found in the paired comparisons of the other universities.

The Effect of Knowing about PLEs on University Students' Attitudes towards Them

The *t*-test was used to find out how knowing about PLEs affects attitudes towards them. The results of the test are shown in Table 13.

Table 13. Results of the t-test knowing about PLEs

Knowing about PLE	N	—	SS	sd	t	p
Yes	533	109.64	14.37	1193	9.69	.000
No	662	101.58	14.22			

p< .05

The results show a significant difference for students know about personalized learning environments (*t*(1,193)=9.96, p<.05). The attitudes of students who know about personalized learning environments (=109.64, s=14.37) are more positive than those who do not (=101.58, s=14.22). This means there is a meaningful correlation between the attitudes toward and knowledge about PLEs. The effect size calculated for the variable of knowing about PLEs is .27. According to this value, it can be stated that approximately 27% of the variance found in the attitude scale scores is due to knowing about personalized learning environments. The Cohen d value is .56, which shows that the difference between mean scores of attitude scales of 2 groups equals a .56 standard deviation. The values indicate that the effect size of the variable of knowing about PLEs is mid-sized (Leech et al., 2008).

The Effect of Participation in PLEs on University Students' Attitudes towards Them

The *t*-test was used to find out how having participated in PLEs affects the attitudes towards PLEs. The results of the test are shown in table 14.

Table 14. Results of the t-test about participation in PLEs

Participation of PLEs	N	—	SS	sd	t	p
Yes	244	109.62	15.63	1195	5.24	.000
No	953	104.09	14.45			

p< .05

There is a significant difference in attitudes towards PLEs between students who have participated in PLEs and those who have not ($t(1,195)=5.24$, $p<.05$). The attitudes towards PLEs of students who have participated in PLEs (=109.62, s=15.63) are more positive (=104.09, s= 14.45). This finding is interpreted as there is a significant correlation between attitudes towards PLEs and having participated in PLEs. Calculated effect size for having participated in PLEs is r=.15. This value shows that approximately 27% of the variance found in the scores of attitude scale is due to having participated in personalized learning environments. The Cohen d value is .30, which indicates that the difference between mean scores of attitude scales of the 2 groups equals a .30 standard deviation. According to the results, the effect size of this variable is mid-sized (Leech et al., 2008).

The Effect of Willingness to Participate in PLEs on University Students' Attitudes towards the PLE

The *t*-test was conducted to determine the difference in attitudes towards PLEs between students who are willing to participate in PLEs and those who are not. The *t*-test results are shown in Table 15.

Table 15. Results of t-test about willingness to participate in PLEs

Willingness to participate in PLEs	N	—	SS	sd	t	p
Yes	1034	106.86	14.19	1195	10.06	.000
No	163	94.76	14.76			

p< .05

According to results there is a significant difference between the two groups ($t(1195)=10.06$, $p<.05$). The attitudes of students who are willing to participate in PLEs (= 106.86, s=14.19) are more positive (=94.76, s=14.76). The effect size value calculated for the variable of willingness to participate in PLEs is r=.28. This value shows that approximately 28% of the variance in the attitude scale scores is due to willingness to participate in PLEs. The Cohen d value is .58, which indicates that the difference between the 2 groups mean attitude scale scores equals a .58 standard deviation. These results show that the effect size for the variable of willingness to participate in PLEs is mid-sized (Leech et al., 2008).

CONCLUSIONS AND RECOMMENDATIONS

This research attempts to investigate the effects of different variables on university students' attitudes towards personalized learning environments. The effects of variables as gender, age, year of study, university, knowing about personalized learning environments, participating in personalized learning environments and willingness to participate in personalized learning environments on students' attitudes towards personalized learning environments were investigated. The participants are 1,197 university students from 10 different universities.

According to their scores on the personalized learning environment attitude scale (PLEAS), university students' attitudes towards these environments are positive. Furthermore, gender, age, year of study, knowing about PLEs, participated in PLEs and willingness to participate in PLEs have a statistically significant effect on attitudes towards PLEs, whereas there is no significant difference according to university variable.

According to the grade there is significance difference. The difference of the seniors from the other groups may be due to the course, "The Principles of Distance Education," which they attend in their fifth semester. The syllabus of the course includes subjects such as the use of technology in education and applied technology. Students' attitudes towards personal learning environments may be affected by the subjects studied in this course. Like this study, Berkant (2013) found that seniors' attitudes towards Computer Aided Instruction (CAI) are more positive.

If students have information about PLE, this affect their attitude. A study called STyLE OLM (Scientific Terminology Learning Environment Interactive Open Learning Modeling) by Dimitrova (2003) supports the conclusion that there is a meaningful difference between individuals who know about personal learning environment and those who do not. The literature shows that having participated in PLEs affects students'

attitudes towards PLEs positively. The studies of Wang (2008), Powell et al. (2008), Popescu and Badica (2009), Bahçeci (2011), O'keeffe et al. (2012) also support this finding.

Also the studies in literature show that attitudes of people who have participated in PLEs are significantly more positive than those of people who have not. The results of this study are similar, showing that the attitudes towards PLEs of people who have participated in PLEs are significantly more positive direction than those of people who have not.

Finally attitudes are affected by positive or negative feelings towards a situation or event and being comfortable with a situation or event. Students' willingness to participate in PLEs is a positive attitude, and it affects their attitudes positively. The reason for the more positive attitudes of students who are willing to participate in PLEs may be higher motivation.

Future research should study all the partners who participate in the environment, including students, instructors, designers and technicians. Additionally, environments should be designed using assessment methods with better validity, consistency and adaptability. Rich learning materials will increase the quality of these environments.

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Comparing Social Network Analysis of Posts with Counting of Posts as a Measurement of Learners' Participation in Facebook Discussions

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ABSTRACT
With the currently growing interest in social network services, many college courses use social network services as platforms for discussions, and a number of studies have been conducted on the use of social network analysis to measure students' participation in online discussions. This study aims to demonstrate the difference between counting posts and social network analysis of posts as a form of learners' participation in online discussions. To accomplish the goal, the study analyzed students' participation in Facebook discussions using the two methods and compared their results with those of MANOVAs. The between-group difference was significant when participation was measured by closeness centrality, but it was not significant when participation was measured by the number of posts. Although whether participation was measured by closeness centrality or by the number of posts did not make a significant difference in terms of learners' self-regulated learning level, the observed power of the closeness centrality measurement was higher than that of the number of posts measurement. These findings imply that it is important for a relational analysis to consider participation in terms of, not only the interaction between actors, but also closeness centrality, by comparing the two measurement methods.
Keywords: Social network analysis, closeness centrality, social media, participation, online discussion

INTRODUCTION

There is a growing interest in social network services (SNSs), and accordingly, many college courses use SNSs as platforms for discussion. A number of studies have used social network analysis (SNA) to measure students' participation in online discussions (De Laat, Lally, Lipponen, & Simons, 2007; Lipponen, Rahikainen, Lallimo, & Hakkarainen, 2001; Lipponen, Rahikajnen, Hakkarainen, & Palonen, 2003; Stakias, Psoras, & Glykas, 2013; Tomsic, & Suthers, 2006). SNA aims to describe structural patterns of relationships among social actors, groups, and organizations and their implications (Hatala, 2006; Mitchell, 1969; Reffay & Chanier, 2003; Scott, 2013; Wasserman & Faust, 1995). It is an effective means for collecting, storing, and managing big data and analyzing and facilitating data visualization, which explains the relationship of exponential information (Sternitzke, Bartkowski, & Schramm, 2008; Suh & Shin, 2012). A number of previous studies have considered SNA to be a theory or analytic technique, or an interdisciplinary methodology for identifying social structural variables and properties. And Hoff, Raftery and Handcock (2002) said that SNA can demonstrate the relationships among interactive actors in an unobserved social space and provide more information such as actor's power, prestige and information authority in networks, which makes it a sophisticated statistical and useful research tool (Aviv, Erlich, Ravid, & Geva, 2003; Garton, Haythornwaite, & Wellman, 1997; Martinez, Dimitriadis, Rubia, Gomez, Garrachon, & Marcos, 2002; Wasserman & Faust, 1995).

As the importance about online discussion environment as new platforms for discussion has become more and more, there has been much empirical evidence of the usefulness of SNA methods for analyzing online networks, specifically, e-learning social awareness as well as evaluation technique in collaborative e-learning (Lambropoulos, Faulkner, & Culwin, 2012), the response relations among participants in asynchronous online discussions (Aviv et al, , 2003), and the participation in online-learning (Kim & Park, 2009; Park & Choi, 2011; Suh & Shin, 2012). Specifically, learner's participation- one of the factors predicting learners' achievements-, expressed as posts and/or comments in online discussion environment was influenced by learner's interactions (Moore & Marra, 2005; Jung, Choi, Lim, & Leem, 2002). So SNA method which is tools considering actors' interactions (including direct and indirect connections) can make it easy to comprehend the influence of each actor in networks. In this regard, it is highly possible that using SNA indexes can lead to conclude unprecedented implications which could not be revealed by using a simple count of meaningful posts because of SNA indexes demonstrating interactive relations between actors. Consequently, this study aims to demonstrate the difference between counting meaningful posts and SNA of posts as a form of learners' participation in online discussions by using the closeness centrality of posts to analyze authentic relations, interactions, and the position of actors.

Most research reported that SNA indexes(especially closeness centrality) are able to analyze and enhance the deeper understanding of research based on interaction, however, how deep and wide in the research is not definite. Therefore, research to identify the difference between traditional research method and SNA method are required, and the research question is, "Are counting of meaningful posts and SNA of posts as a form of learners' participation different in the analysis of online discussions?"

LITERATURE REVIEW

Social Network Analysis

SNA, a strategy for investigating social networks or relations, can be applied in many fields as a new approach (Borgatti, Mehra, Brass, & Labianca, 2009; Otte & Rousseau, 2002; Stakias et al., 2013; Wasserman & Galaskiewicz, 1994). Some researchers have examined SNA from various aspects, including theories, methods, software, and the research paradigm, from an alternative metaphor to an analytic approach (Scott & Carrington, 2011; Stakias et al, 2013), while others have perceived it as a methodology. Whereas research in past decades focused on theoretical assumptions, recent studies have regarded SNA as a research methodology for systematically analyzing complex social-structure properties originating from the interdependence underlying function of social relations among analytic objects (Galaskiewicz & Wasserman, 1993; Makagon, McCowan, & Mench, 2012; Perna, Marra, & Napolitano, 2008; Shim & Lee, 2008; Wasserman & Faust, 1995). By focusing on relationships among actors rather than on each actor, SNA can analyze an organizational topological structure and its diffusion progress (Scott, 2013; Wasserman & Faust, 1995). In other words, it can provide an understanding of the network's features through link patterns, the number of links, and the structural concentration, not with attribute variables, but with relational variables. Also, visualization with an informal or formal network structure is useful for people who conduct research on big data (Perna et al., 2008). Considering the environments, it is necessary to deal with both the numeric comparison and the visualization of data.

The elements of analysis include connection, centrality, cohesion, and equivalence. Researchers mainly use density of connection and centrality as analytic techniques (Abbasi, Hossain, Uddin, & Rasmussen, 2011; Enriquez, 2008; Hamulic & Bijedic, 2009; Hawe & Ghali, 2008; Rice, Tulbert, Cederbaum, Adhikari, & Milburn, 2012). A node's connection is the number of neighboring nodes; it is the primary index that describes the node's characteristic in the network. It is possible to analyze a connection using concepts such as degree, density, reciprocity, and shortest path, to analyze the fundamental relationships with nodes and links. SNA focuses on relational attributes and considers in-degree and out-degree. The number of in-degrees is the number of lines directed toward the node, and the number of out-degrees is the number of lines directed to other points. According to graph theory, an in-degree is placed in the column of a matrix, whereas an out-degree is placed in the row. Centrality is used to measure the basis of a degree (Scott, 2013), the structure of which depends on certain criteria not based on the median or a node attached to many links. The aim of centrality structure analysis is to identify one of the most important nodes in a network and to investigate critical nodes for determining the degree of centralization. The components of centrality include degree centrality, closeness centrality, and betweenness centrality. Generally, the shorter the distance to other nodes is, the higher the closeness centrality is. In addition, closeness centrality indicates multiplicative inverse proportionality to distance to other nodes. The concept of a high level of closeness centrality is applied to all other nearby actors, indicating easy and rapid accessibility to other actors with minimum efforts (Wasserman & Faust, 1995).

Participation in online discussion environment

Online environment as new platforms for discussion makes learners participate in discussion activity more and has a positive effect on high academic achievements, retention and transfer of learning. Besides, online discussion is beneficial for learners in that the learning environment is not influenced by time and location unlike traditional learning method. Therefore, previous studies (Berge, 1996; Dennen, 2001; Johnson & Johnson, 2000; Yellen, Winniford, & Sanford, 1995) suggested structure of groups, characteristics of learners, the role of tutor (or instructor) and strategies promoting discussion learning affect learner's participation in online discussion environment since that participation is closely associated with academic achievements. These research have been studied by quantitative and/or qualitative method, and also SNA indexes (Aviv et al, 2003; Lambropoulos et al, 2012; Moore & Marra, 2005; Jung et al, 2002).

Above all, since closeness centrality is measured by direct and indirect links among nodes found in an efficient organization (Shim & Lee, 2008), there have been a number of previous studies on the closeness centrality of participation in the online environment. Suh and Shin (2012) used closeness centrality providing a standardized value and a quantitative indication of concentration in online discussion activity, whose participation is an index that enables a multidimensional understanding of participation in learning as well as an analysis of interactions that take place among learners. Kim and Park (2009) used centrality of interaction on a Web bulletin board in order to analyze interdependency among learners in the Web environment. Interaction on a Web bulletin board is

represented by the instructor's feedback, and its centrality is an index that affects learning, which facilitates the assessment of interactions as well as with whom learners are exchanging opinions and whose opinions are influential. Park and Choi (2011) viewed centrality in the number of posts as representing the level of participation and argued that analyzing the relational attributes of the discussion environment, such as the relationships among central and surrounding individuals, can be helpful toward understanding learners' characteristics. Therefore, it is necessary to combine conventional statistical research methodology with SNA or content analysis in order to identify new findings with profound implications and to broaden the context of analysis (Park & Choi, 2011) and allows a better understanding of the evolution process in online communities (Bae, Seo, & Baek, 2010). Among social network indices, the centrality of participation also has a significant effect on quantitative achievements (Cheong & Corbitt, 2009; Cho, Gay, Davidson, & Ingraffea, 2007; Russo & Koesten, 2005), providing a perspective of actual relationships and interactions rather than quantified numerical data.

METHOD

Participants and Treatment

To illustrate the approach, this paper analyzes the data drawn from a previous study that examined the effects of learners' self-regulated learning (SRL) skills and the instructor's feedback on learners' achievement and participation in Facebook discussions (Park & Lee, 2013). The experiment was implemented in two classes, which were taught by the same instructor with the same contents. One class was a control group not provided with instructor feedback, and the other class was an experimental group that was provided with instructor feedback. Then, based on the measured levels of all the participants' SRL, each class was divided into two groups representing high and low SRL, respectively. Thus, the participants were assigned to four groups: (1) feedback–high SRL, (2) feedback–low SRL, (3) non feedback–high SRL, and (4) non feedback–low SRL. The study analyzed the data of 108 participants who completed a self-regulation survey and posted meaningful posts.

Measurement Instruments and Procedure

In the study, the learners' levels of SRL skills and achievement were drawn from Park and Lee's (2013) data. However, their participation level was newly measured. The number of meaningful posts was determined by the meaning unit technique, which was widely used in the message analysis. "Meaning unit," as the unit of analysis, is a unit of idea extracted from contents and contains a single item (Budd & Donohue, 1967). After dividing the data into units of analysis, the researchers measured the number of posts, excluding the number of extraneous posts related to contents. Together, they analyzed the meaning units to achieve reliability. When there were differences in opinion, the researchers discussed the analysis and made adjustments where necessary.

The researchers analyzed the participants' meaningful posts regardless of their length. Also, out-closeness centrality was calculated by the length of shortest paths that a specific actor posted meaningful posts to other actors. To measure out-closeness centrality, the meaningful posts' matrix of between participants was figured out at out-closeness centrality vector using NetMiner 3.0.

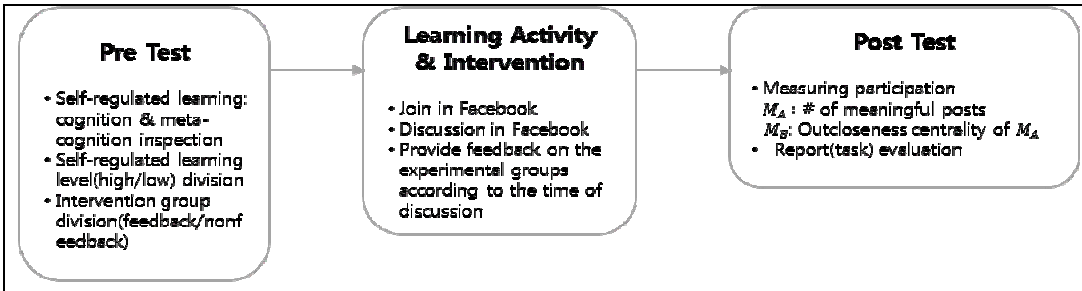

Figure 1: Revised from Park and Lee (2013). The Effects of Learners' Self-regulated Learning Skills and Instructor's Feedback on the Learners' Achievement and Participation in Facebook®-based Discussion of a Higher Education Setting. *The Journal of Educational Information and Media, 91*(2), 229–251.

Analysis

To investigate the difference between SNA of posts and counting of meaningful posts, data were analyzed using NetMiner 3.0 and SPSS Statistics 18. For each measurement method that used feedback and level of self-regulation as independent variables with participation and achievement as dependent variables, descriptive statistics and multivariate analysis of variance were performed. The results of MANOVA depending on the measurement method were compared. For all statistical analyses, a level of significance of .05 was chosen.

RESULTS

Result of counting and meaningful posts

Table 1 shows the descriptive statistics of the data regarding instructor feedback, learners' achievement according to level of SRL skills, logarithmic value of participation level, and number of cases. Measurement A is a semantic analysis of Park and Lee's data pertaining only to the meaningful comments on each post. The maximum level of achievement was set at 20, and the average level was 16.67.

Table 1: Descriptive Statistics of Measurement A

Feedback	SRL	n	Measurement A (counting of meaningful posts)				Achievement	
			Raw		Log			
			M	SD	M	SD	M	SD
Feedback	High	36	5.06	3.71	0.60	0.30	17.24	1.70
	Low	25	3.12	2.49	0.40	0.29	16.64	2.03
	Sum	61	4.26	3.38	0.52	0.31	16.99	1.85
No Feedback	High	21	6.38	5.29	0.66	0.38	16.96	1.96
	Low	26	4.08	2.26	0.55	0.25	15.65	1.56
	Sum	47	5.11	4.03	0.60	0.31	16.24	1.85
Sum		108	4.63	3.69	055	0.31	16.67	1.88

MANOVA was conducted to determine if the instructor feedback and level of SRL skills had an effect on learners' achievement and participation. In Measurement A, the result of Levene's homogeneity of variance test indicated that the difference in covariance between two dependent variables–achievement ($F = 1.201$, $p = .313$) and the logarithmic value of participation ($F = 1.992$, $p = .120$)–was not statistically significant at the significance level of .05, satisfying MANOVA assumptions. Furthermore, Box's M test on the covariance matrices of the dependent variables yielded Box's M of 7.282 ($F = .780$, $p = .635$), passing the homogeneity test. The results of MANOVA are shown in Table 2.

Table 2: MANOVA results of Measurement A

		Wilks's λ	**F**	**P**	**NCP**	**Observed Power**
Measurement A (counting of meaningful posts)	Feedback	.922	4.330*	.016	8.661	.740
	SRL	.902	5.626*	.005	11.251	.850
	Feedback *SRL	.979	1.124	.329	2.247	.243

*$p < .05$

Result of the closeness centrality of posts

Table 3 shows the descriptive statistics of the data regarding instructor feedback, learners' achievement according to the level of SRL skills, average and standard deviation of the closeness centrality vector value, and number of cases. Measurement B is the closeness centrality of Measurement A's out-degree. Measurement B includes the interaction between actors, which is different from Measurement A, as well as the concept of closeness centrality based on the geodesic distances among actors.

Among the closeness centralities associated with participation, the out-closeness centrality vector value was used for Measurement B. In a network with directionality, closeness centrality that represents status and influence among actors in networks can be categorized into in-closeness centrality and out-closeness centrality. In-closeness centrality signifies the shortest distance from other actors to a specific actor, whereas out-closeness centrality is the shortest distance from a specific actor to others. In other words, closeness centrality is the shortest distance between actors, and in-closeness and out-closeness are categorized based on their direction. The data used in this study involved the number of posts left by each participant for other participants in an online environment, which is associated with out-closeness centrality directed from a specific actor to others. This is because learners' participation level in the online discussion environment was influenced by the instructor's feedback and other learners' direct and indirect effects; therefore, this study used out-closeness centrality, which provided a standardized value to analyze multidimensionally in detail in the online discussion activity. As a result, the out-closeness centrality vector value of the number of posts written by participants was used to

indicate the level of participation in this study. The maximum level of achievement was identical with the scores used in the Measurement A analysis.

Table 3: Descriptive statistics of Measurement B

Feedback	SRL	n	Measurement B (closeness centrality)						Achievement	
			In-degree		Out-degree		Closeness centrality			
			M	SD	M	SD	M	SD	M	SD
Feedback	High	36	4.14	2.99	4.06	3.71	0.34	0.15	17.24	1.70
	Low	25	2.24	1.79	2.12	2.49	0.15	0.13	16.64	2.03
	Sum	61	3.36	2.71	3.26	3.38	0.27	0.17	16.99	1.85
No Feedback	High	21	5.43	3.88	5.38	5.29	0.41	0.20	16.96	1.96
	Low	26	3.23	2.29	3.08	2.26	0.28	0.15	15.65	1.56
	Sum	47	4.21	3.26	4.11	4.03	0.34	0.18	16.24	1.85
Sum		108	3.73	2.98	3.63	3.69	0.30	0.18	16.67	1.88

MANOVA was also conducted to determine if the instructor feedback and level of SRL skills had an effect on learners' achievement and participation. In Measurement B, the result of Levene's homogeneity of variance test indicated that the difference in covariance between two dependent variables—achievement (F = 1.201, p = .313) and the closeness centrality of participation (F = .738, p = .532)—was not statistically significant at the significance level of .05, satisfying the assumptions. Box's M test on the covariance matrices of the dependent variables yielded Box's M of 12.434 (F = 1.331, p = .214), passing the homogeneity test. The results of MANOVA are shown in Table 4.

Table 4: MANOVA results of Measurement B

		Wilks's λ	**F**	**P**	**NCP**	**Observed Power**
Measurement B (closeness centrality)	Feedback	.873	7.501*	.001	15.002	.938
	SRL	.776	14.895*	.000	29.790	.999
	Feedback *SRL	.975	1.346	.265	2.692	.285

*$p < .05$

Comparison of closeness centrality with counting of meaningful posts

Table 5 shows the comparison of two MANOVAs. There were statistical differences between Measurements A and B. First, MANOVA confirms that there was no significant difference in participation measured by the counting of meaningful posts (Measurement A) based on the provision of instructor feedback (F = 3.086, p = .082), but participation measured by closeness centrality (Measurement B) based on the provision of instructor feedback differed significantly (F = 10.014, p = .002). Second, Measurements A and B were significantly different in terms of participation based on learners' SRL level. However, the observed powers of Measurements A and B were .763 and .999, respectively.

Table 5: Comparison of univariate tests of closeness centrality with those of number of posts (n = 108)

			Type III SS	**df**	**MS**	**F**	**P**	**Partial η^2**	**Observed Power**
Measurement A (counting of meaningful posts)	Feedback	Achievement	10.388	1	10.388	3.196	.077	.030	.425
		Participation	.280	1	.280	3.086	.082	.029	.413
	SRL	Achievement	23.607	1	23.607	7.263*	.008	.065	.761
		Participation	.663	1	.663	7.297*	.008	.066	.763
	Feedback *SRL	Achievement	3.349	1	3.349	1.030	.312	.010	.171
		Participation	.056	1	.056	.611	.436	.006	.121
Measurement	Feedback	Achievement	10.388	1	10.388	3.196	.077	.030	.425

B (closeness centrality)		Closeness centrality	.244	1	.244	10.014*	.002	.088	.880
	SRL	Achievement	23.607	1	23.607	7.263*	.008	.065	.761
		Closeness centrality	.637	1	.637	26.153*	.000	.201	.999
	Feedback *SRL	Achievement	3.349	1	3.349	1.030	.312	.010	.171
		Closeness centrality	.032	1	.032	1.300	.257	.012	.204

*$p < .05$

In conclusion, it is important for relational analysis to consider participation in terms of, not only interaction between actors, but also closeness centrality, by comparing the two measurement methods. Because the closeness centrality of SNA focuses on relationships between actors instead of each individual actor and reflects social phenomena for analyzing the implications of relation, SNA should be widely applied in intra-organizational actors' positions as well as in inter-organizational network.

DISCUSSION

The major goal of quantitative research focused on variables is to test a theory and offer a broad explanation about the prediction. However, a variety of factor-control variables, measuring variables, intervention variables, and moderating variables that affect the experimental environment are attribute variables, which only consider the direct connection between variables. Research focusing on attribute variables can provide a solution to a problem, but it is not an effective method that takes relational attributes into account. In accordance with the state of complex society and environment, it is necessary to comprehend unseen things and conduct sophisticated analysis. Therefore, this study examined the difference between SNA of posts and counting meaningful posts as forms of learners' participation in online discussion.

The results of this study can be summarized in three parts.

First, the participation measured by closeness centrality based on the provision of instructor's feedback was significant, but measured counting of meaningful posts was not significant. Since the closeness centrality is associated with relationship between an individual and other members of the network directly and unmediatedly (Cho et al, 2007), in this regard, the result indicated that instructor's feedback have a positive effect on other participants who is 'indirectly' connected with a participant in whole network space That is, SNA indexes are able to avoid failing to consider influence of instructor's feedback in online environment unlike numerical value by counting of meaningful posts, the conclusion is that instructor's feedback in online environment widely promotes learner's participation as a whole.

Second, both participation measured by closeness centrality of posts and participation by counting meaningful posts were significantly different based on the level of learners' SRL; and participation measured by closeness centrality of posts was more significantly than that by counting posts simply. In addition, a number of previous studies have used the closeness centrality of participation to gain a better understanding of numerous social networks in the online environment (Bae et al., 2010; Suh & Shin, 2012; Park & Choi, 2011; Rice Doran, Doran, & Mazur, 2011). The level of learners' participation can vary according to diverse factors, such as gender, background, cultural traits, prior training and education, and prior experience (Gay & Howard, 2001), and the same can be said about the online learning environment (Wang, 2007). Taking these factors into account, Rice Doran et al (2011) suggested that SNA should be used to analyze the potential pattern of participation in the online learning environment. In conclusion, Rice Doran et al (2011) argued that when analyzing learners' participation in an online discussion and learning environment, researchers should take various potential elements into account by using the closeness centrality of the number of posts rather than simply looking at the number of posts, which is consistent with the results of this study.

Third, the difference between participation measured by closeness centrality and counting of meaningful posts was the observed power. According to Tables 2, 4, and 5, each MANOVA result and univariate test about feedback and SRL were statistically significant, but the observed power of the closeness centrality measurement was higher than that of the counting of meaningful posts measurement. This means that higher observed power implied lower type II error. In this way, SNA of posts is a credible and valid method compared with the general counting of meaningful posts, especially for the analysis of a complex and dimensional learning environment influenced by various factors.

Overall, these findings indicate that SNA measures can explain networked relationships more specifically in an online learning environment. Although counting meaningful posts can be used to analyze learners' participation in an online learning environment, it is more important how much each actor plays a central and critical role in online discussions. Given the traits of the online learning environment, analysis of the central role in the environment can be verified by SNA measures, namely regarding the counting of meaningful posts, as learners' participation does not include attributes of the online learning environment; however, SNA measures that consider various factors not overlooked can involve the traits of the online learning situation.

Going forward given the diversity, complexity, and massive scale of big data, network visualization will facilitate data analysis. This can also be useful in analyzing data stored in the Learning Management System (LMS), which includes nonstructural and large-scale data, such as the learning activity status, posts left by learners, log-on times, study duration, and participation in team projects. For example, in Moodle-based LMS, the instructor may use display replies in unthreaded form for SNA. Therefore, in analyzing the LMS environment with accumulated big data, it is necessary to use visualized images of the network in addition to the basic statistics data. Through this, the network's structure and characteristics in online discussions can be better understood.

ACKNOWLEGEMENTS

This research was supported by a 2014 Research Grant from Sangmyung University.

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Design of Open Content Social Learning that Increases Learning Efficiency and Engagement Based on Open Pedagogy

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ABSTRACT
Due to the rapid growth in Internet resources, mobile technologies and social media, teaching and learning are increasingly adapting to the notion that 'content is open; learners are social'. The learning materials are open but effective learning is challenging due to the explosion of unstructured content on the web. The effectiveness of learning on the web largely depends on the relevancy of the content and the learner's engagement. This paper's objective is to develop an Open Content Social Learning(OCSL) system, to compare different pedagogical strategies and algorithms on improving effective learning. This paper proposes an enhanced learner-centered online learning experience by matching the content based on learning goals, historical learning preferences and behaviors from other learners with similar goals to increase the learner interaction and engagement.

INTRODUCTION
Open Educational Resources (OERs) are teaching and learning materials that anyone can use and share freely, without charge. Since first being coined by UNESCO in 2002, the term Open Educational Resources has evolved to meet the fast pace of the change and the diverse contexts in which it has now been used (Bossu, Bull, & Brown, 2012). The worldwide OER movement is rooted in the idea of high quality education at no cost. The Cape Town Declaration (2007) states that “Educators worldwide are developing a vast pool of educational resources on the Internet, open and free for all to use. These educators are creating a world where each and every person on earth can access and contribute to the sum of all human knowledge. They are also planting the seeds of a new pedagogy where educators and learners create, shape and evolve knowledge together, deepening their skills and understanding as they go.”

Open learning enables learners to be self-determined and interest-guided. Stacey (2013) educators to “Go beyond open enrollments and use open pedagogies that leverage the entire web not just the specific content in the MOOC platform”. Learners are often unable identify which material is needed, useful, and required at their level. Hence, open content learning design must assimilate the material from various sources and provide a new pedagogy that is appropriate to the needs of today’s learners (Smyth, Bossu & Stagg, 2015). This paper explains the design for an Open Content Social Learning (OCSL) system that leverages Open Content to deliver an adaptive and personalized experience accounting for the pedagogical needs of the learners and similar learners

and the need to recommend learning activities in a pedagogically effective order.

RELATED RESEARCH

Learner's experiences with open learning do not always contribute to effective learning because some traditional pedagogical strategies are still being used. Over the past decade, researchers have investigated different pedagogical strategies for making the online learning environment effective. Sathiyamurthy & Geetha (2012) state that "The effectiveness of an e-learning system for distance education to a large extent depends on the relevancy and presentation of learning content to the learner". In a recent study, Kim & Reeves (2007) showed that the increase in online courses has definitely helped to reach millions of learners, but the educational effectiveness of online courses is a subject of debate. Learning must be personalized based on the learner's goals and style and compared with "learner-like" learners (individualized and collaborative) as well as adaptive learning resources (organized and filtered), while considering motivation and engagement tools (Cheung, Lam, Szeto, & Yau, 2008). The goal of the adaptive presentation is to adapt the content to the user's goals, knowledge, and other relevant information. The architecture for an Adaptive Hypermedia System adapts the content of a hypermedia page to the user's goals, knowledge, preferences, and other user information for each individual user who is interacting with the system (Stern & Woolf, 2000).

Another aspect of effective search and personalized results is consideration of the learner's profile. All learners are unique; no two will achieve the same learning outcomes across a range of subject areas. Clear guidance can be provided on the diverse learning needs of each student by collecting and continuously updating metadata that is stored for learners in user profiles. Chan (2000) describes that implicit profile creation based on observations of users actions has been used in more recent projects and describes the types of information that is available. This model considers the frequency of visits to a page, the amount of time spent on each page, how recently a page was visited, and whether the page was bookmarked. Paireekreng & Wong (2010) observe that prior knowledge of each learner's activity and an effective user profile is required for personalization. M.P. Cuéllar, M. Delgado, and M.C. Pegalajar (2011) have considered social networks to be a type of Learning Management System (LMS). Social Network Analysis (SNA) is conducted for teachers, learners, learning resources and their interactions. Vassileva, J. (2008) emphasizes that the two main goals of the design of social learning environments should be making them learner-centered and making learning more gratifying. In recent research, association rule-mining algorithms have been used to solve the problem of web page recommendations. A web usage log is used in adaptive association rule-based web mining, which attempts to personalize the results.

Research shows that effective learning requires the following:

1. Learner centric adaptive learning by personalizing with relevant content based on the learner's goals, style, habits and prior knowledge;
2. Learner centric social learning based on the goals, learning style and behavioral patterns of similar learners;

Current Open Content Learning systems include: OER Commons (Yoav Yair 2014, D'Antoni, S 2009), iseek.org (Bansal 2013), Project MERLOT (Malloy & Hanley 2001; Hanley 2015), OCW (Vahdati 2015) and mooc-list (Holotescu, Grosseck, Cretu & Naaji, 2014). Most of these systems are not personalized and do not provide adaptive content. Learners use these platforms as content viewers, and there is no engagement. They do not offer personalized content based on a learner's goals and prior knowledge. To overcome these limitations, the proposed work is to develop an Open Content Repository by consuming the OER content and personalizing the learning experience based on the learner's goals and activities and similar learners' learning activities.

Another aspect of effective search and personalized results is consideration of the learner's profile. All learners are unique; no two will achieve the same learning outcomes across a range of subject areas. Clear guidance can be provided on the diverse learning needs of each student by collecting and continuously updating metadata that is stored for learners in user profiles. Chan (2000) describes that implicit profile creation based on observations of users actions has been used in more recent projects and describes the types of information that is available. This model considers the frequency of visits to a page, the amount of time spent on each page, how recently a page was visited, and whether the page was bookmarked. The user's learning behavior is used to create user profiles in several systems. Paireekreng & Wong (2010) observe that prior knowledge of each learner's activity and an effective user profile is required for personalization. Open pedagogy could be considered to be a blend of personalized adaptive design, algorithms and technologies, and networking among learners, which makes the learning process effective and engaging.

OPEN PEDAGOGY AND LEARNER-CENTERED LEARNING

Some early MOOC experiments were based on a pedagogy of connectivist learning (Milligan, Littlejohn, & Margaryan, 2013), which connects many people in a loose online network that enables them to share their ideas and learn together. While this approach harnesses the power of many voices and technologies, it is difficult to manage at a large scale and requires learners to know how to navigate the web resources and engage with their peers (de Waard, Koutropoulos, Keskin, Abajian, Hogue, Rodriguez, & Gallagher, 2011). So which pedagogies actually improve with scale? Some effective methods of teaching, such as personal tutoring, cannot scale up to thousands of learners without enormous costs, even though researchers in artificial intelligence have been attempting for many years to develop computer-based tutors. In contrast, methods of direct instruction scale well – a good educational television program can inform a hundred people, or a million – but they are not very effective at engaging people in active and reflective learning. There is a general theory of scale that can be applied to education. The Network Effect proposes that the value of a networked product or service increases with the number of people who use it (Sharples, Adams, Ferguson, Gaved, McAndrew, Rienties, Weller & Whitelock, 2014). For example, a telephone system becomes more valuable when we connect millions or billions of phone users worldwide. The worldwide web benefits from interconnecting millions of people through their computers. But people are not solely points in a network; we have knowledge and perspectives to share. Thus, the Social Learning Effect can be stated as such: the value of a networked learning system increases as it enables people to learn easily and successfully from each other. Another difficulty experienced by many who have participated in connectivist MOOCs (Milligan, Littlejohn, & Margaryan, 2013) is the feeling of being 'lost in hyperspace,' of having too many options and possibilities and not knowing where they are in a learning activity, who to engage with, and where to go next.

Most existing e-learning platforms and tools focus on technology without rigorous investigation of the pedagogical issues or quality control of the e-learning material. The motivation to learn and engage with the e-Learning solution is key to its effectiveness, especially when the effectiveness is defined as the time spent using the product: 'Results suggest the importance of motivation to learn and workload in determining aggregate time spent in e-learning courses' (Brown, 2005). Open pedagogy could be considered to be a blend of personalized adaptive design, algorithms and technologies, and networking among learners, which makes the learning process effective and engaging.

OPEN CONTENT SOCIAL (OCSL) SYSTEM

This section summarizes the general overall system architecture and design of OCSL before discussing the individual modules in detail. OCSL is a personalized learning system represented in figure 1 uses complex algorithms to automatically learn a learner's interests with respect to learning activities. It then makes highly personalized content recommendations based on the goals, past activity and similar learners' activities.

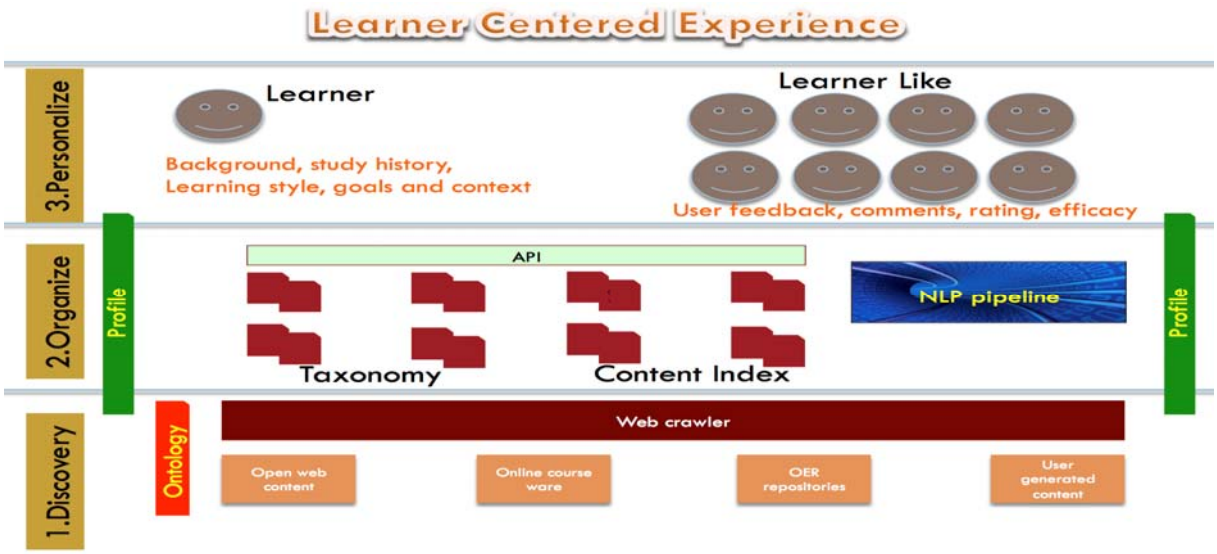

Figure 1. Overview of the Learner-Centered Learning Experience leveraging Open Content.

Research shows that most of the Open Content learning platforms currently use standard search techniques by combining conventional information retrieval techniques that are based on page content, such as word vector space (Salton, & McGill, 1983), with link analysis techniques based on the hypertext structure of the Web, such

as PageRank (Brin & Page, 1998) and HITS (Devi, Gupta, & Dixit, 2014). The PageRank algorithm (Brin & Page, 1998) attempts to provide an objective estimate of the Web page importance. However, the importance of the Web pages is subjective for different users. The true relevancy of a page depends on the interests, goals and existing knowledge of the individual users; a global ranking of a Web page might not necessarily capture the importance of a page for a given individual user. OCSL expands the scope of the search to generate more personalized results and greater learning engagement using the following two modules:

A. Offline Process:

1. The content manager reads the content (Crawling, API calls, Streaming API).
2. The content classification engine analyzes the content.
3. The system sends 20% of the content to the Natural Language Processing NLP API.
4. After categorization, the content is verified by Amazon Mechanical Turk through APIs.
5. The remaining 80% of the content is classified using the Naïve Bayes classifier (Patil & Pawar 2012) algorithm.
6. Once the content is classified with attributes (meta-data), it is loaded into the content index.

The content index indexes the attributes and stores it inside the Apache Solr container. This content index is updated periodically through an offline process.

2. Online Process:

1. The learner inputs his/her goals, learning style, and relevant content.
2. The pedagogy engine formulates the query to retrieve content in three ways, depending on the historical information and the learner's goals:
   a. Conventional search using an inverted index and page ranking algorithm.
   b. Improved results based on the Content Hierarchy and Learner attribute-based Matching (CHLAM) of the OCSL system.
   c. Superior results based on CHLAM and Similar Learners Attribute-based Matching (CHSLAM) of the OCSL system.
3. Filter the content results.
4. Implicitly capture the learner's activity and use it as a feedback loop to apply to the learner's profile attributes.

Each module performs its defined function and exchanges information with other modules, as shown in figure 2.

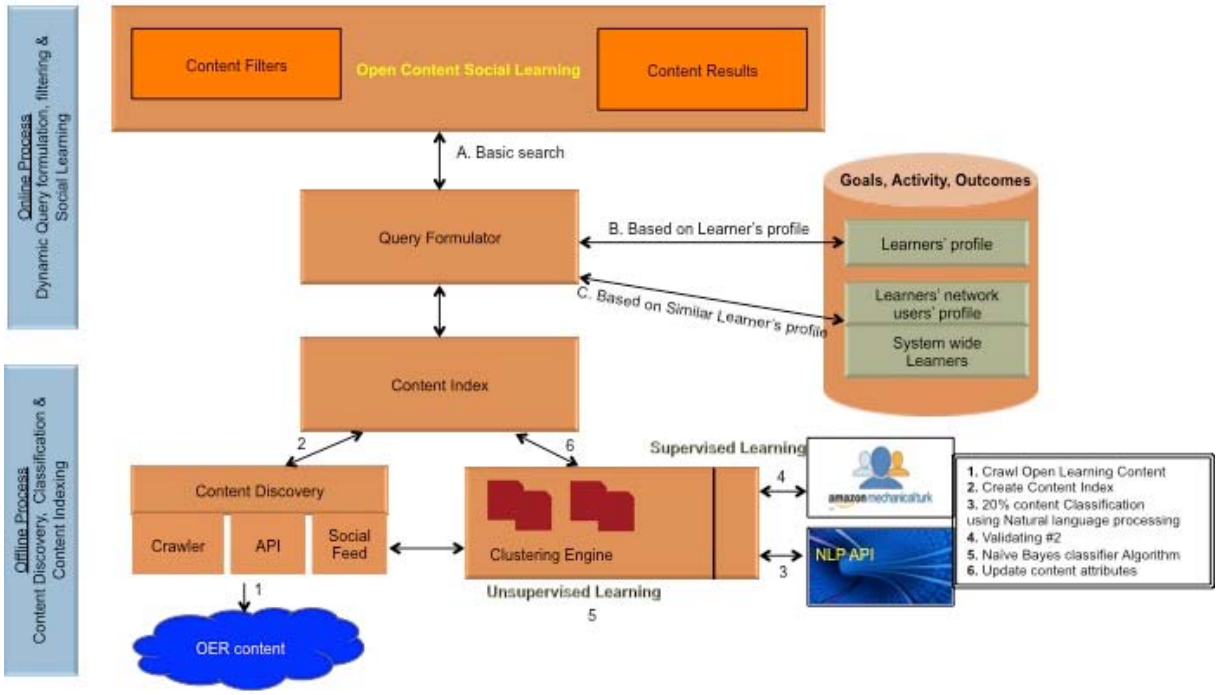

Figure 2. System Architecture of the OCSL Work

The role of content discovery is to crawl open content from the Internet, i.e.,, the World Wide Web and social media, and to locate content to present to the user. The content manager is configured to collect content from three sources: 1. Crawling OER content sites 2. Streaming API against social media platforms 3. API calls

against learning platforms such as MERLOT (Hanley, 2015), OER Commons, Gooru learning.

Content clustering entails grouping similar uncategorized documents together based on similarity measures. Content classification categorizes and organizes content by combining multiple methods of context-sensitive analysis. The clustering engine consumes content from multiple sources (Nutch Crawler, Federated API search, and Streaming API for social media feeds) and performs the following steps:
1. Alchemy's machine learning APIs (Quercia, Askham, & Crowcroft, 2012) are used for categorizing the content. OCSL uses the Taxonomy API to perform classification. The Entity API calls fetch the desired Internet web page, normalizes it, and extracst named entities, topics, and other content.
    a. http://www.alchemyapi.com/api/taxonomy_calls/urls.html
    b. http://www.alchemyapi.com/api/entity/urls.html#rurl
Using the Taxonomy and Entity API, content metadata is updated in the Solr content repository.
2. As recommended by Wang, Kraska, Franklin, & Feng (2012), OCSL leveraged a hybrid human-machine approach in which machines are used to perform an initial, coarse pass over all of the data, and people are used to verify only the most likely matching pairs. OCSL integrates with the Amazon Mechanical Turk API to verify the classified content.
3. Using the Apache Mahout framework and Naive Bayes classifier algorithm (Patil & Pawar 2012), OCSL automatically classifies documents using a training set developed from the previous two steps. The training set includes documents that are already associated with a category. Using this set, the classifier determines, for each word, the probability that it reflects a document that belongs to each of the considered categories. To compute the probability that a document belongs to a category, the classifier multiplies together the individual probabilities of having each of its words in this category. The category that has the highest probability is the category that the document is most likely to belong to.
4. OSCL updates the content index engine with all of the taxonomy attributes (URL, content category, content sub category, content type, last modified, and many more).

The Dynamic Query Formulator is the core component of the OCSL system design. Most conventional search engines function with a search query that is limited and not as good as searching by phrases. The pedagogical engine uses a dynamic query formulator algorithm that was developed through this research to navigate a learner's learning experience by analyzing his/her user interactions and prior learning knowledge on any given topic. The OCSL pedagogical engine also dynamically generates a query based on similar learners' learning experiences.

Learner Attribute-based Matching (LAM) enhances the conventional search experience by building a user profile to provide more personalized search results based on learning style, type of content, recent activity, content categories, or other interests of the users. To build an intelligent pedagogical learning engine based on attributes, this system ensures that both users and documents are tagged with the same types of attributes. We are implicitly and explicitly collecting information from learners about their learning behaviors, learning goals, and other criteria. Basically, the pedagogy engine is responsible for figuring out both the most appropriate way to construct the queries and which data to use in them to optimize the relevancy of the learner's learning experience. While a conventional search engine builds a sparse matrix of terms that are mapped to documents in the content index, OCSL enhances the design to map the user's behavior to those documents. The Learner Attribute-based Search enables the system to classify users and content into a hierarchy that goes from more general to more specific categories, but it is further possible to query this hierarchy and apply a stronger relevancy weight to more specific matches:
Learner_Profile:{
MostLikelyCategory:"engineering.computerscience.artificialintelligence",
2ndMostLikelyCategory:"engineering.computerscience.datastructures",
3rdMostLikelyCategory:"engineering.mathematics.algebra", ... }

First, each category from a learner's profile can be broken into three terms in the query, with each term corresponding to a level of specificity in the classification:
(engineering.computerscience.artificialintelligence vs. . engineering.computerscience.datastructures vs. engineering.mathematics.algebra).

Second, each term is assigned a different query weight, with higher weights assigned to more specific terms. This arrangement serves the purpose of boosting the more specific (and presumably better) matches higher in the search results. Third, there are three distinct sets of queries, which correspond to the three potential classifications that are listed on a learner's profile:

(engineering.computerscience.artificialintelligence, engineering.computerscience.datastructures, engineering.mathematics.algebra).

The end result is that by using query weights on terms that combine a measure of their probability (most likely to least likely) and their specificity (most descriptive to least descriptive), a fuzzy query can be constructed to match documents that match any of the criteria; at the same time, it boosts documents to the top of the search results that match the best combinations of those attributes within the hierarchy.

The query parameter also allows the author to weight the fields differently. This parameter can be used to make a query match in one field more significant than a query match in another field.

$$qf = field_1^{v1} + field_2^{v2} + \cdots + field_n^{vn}$$

where qf is the Query Fields, and v is the weight for each field, based on the learner's goals and interests as calculated and applied dynamically. In our approach, we personalize PageRank scores by assigning weights to the fields based on matched goals and activities based on the learner and similar learners. At the query time, the user's profile matches with the corresponding personalized values.

By mapping the learning behavior of users to documents, OCSL system is effectively creating links in the index between documents. Klašnja-Milićević, Vesin, Ivanović, & Budimac (2011) recommended that similar users learn similar content, which means that documents that are mapped to similar users are likely related. To make use of these relationships to recommend learning items to a new user, we find other similar users and recommend other items. OCSL provides a mechanism to form a social network among the learners who have similar learning interests, preferences, and learning experiences based on the data collected. A learning group in OCSL is a group of learners who share common learning goals and mutually recommend learning content that meet those goals. OCLS uses User-based Collaborative filtering and Item-based Collaborative filtering (Drachsler, Hummel & Koper, 2008) to filter the learning content and recommend learning activities in a pedagogically effective order.

To evaluate our design, we conducted a Web crawl against Open Educational Resources (OER) and implemented a dynamic query formulator engine. We performed an experimental study that focused on Science, Technology, Engineering, Mathematics (STEM) engineering students. Our study explored the results of the following three algorithms, to validate the idea of effective learning by personalizing the content results. The study lasted for almost three months. Learners were grouped into 15 groups.

1. Algorithm 1 – Basic search using inverted index and page ranking conventional algorithm
2. Algorithm 2 – Search based on the Content Hierarchy and Learner Attribute-based Matching (CHLAM) of the OCSL system
3. Algorithm 3 – Search based on CHLAM and Similar Learners Attribute-based Matching (CHSLAM) of the OCSL system

We asked each learner to use our OCSL system after they entered their goals and profiles into our system. We did not provide any information about the main goal of the system. The learners were expected to use the platform and learn based on their choice of preferences. A results page was shown with the recommended content based on the three different types of algorithms mentioned above. Figure 3 is a screen shot of the OCSL system.

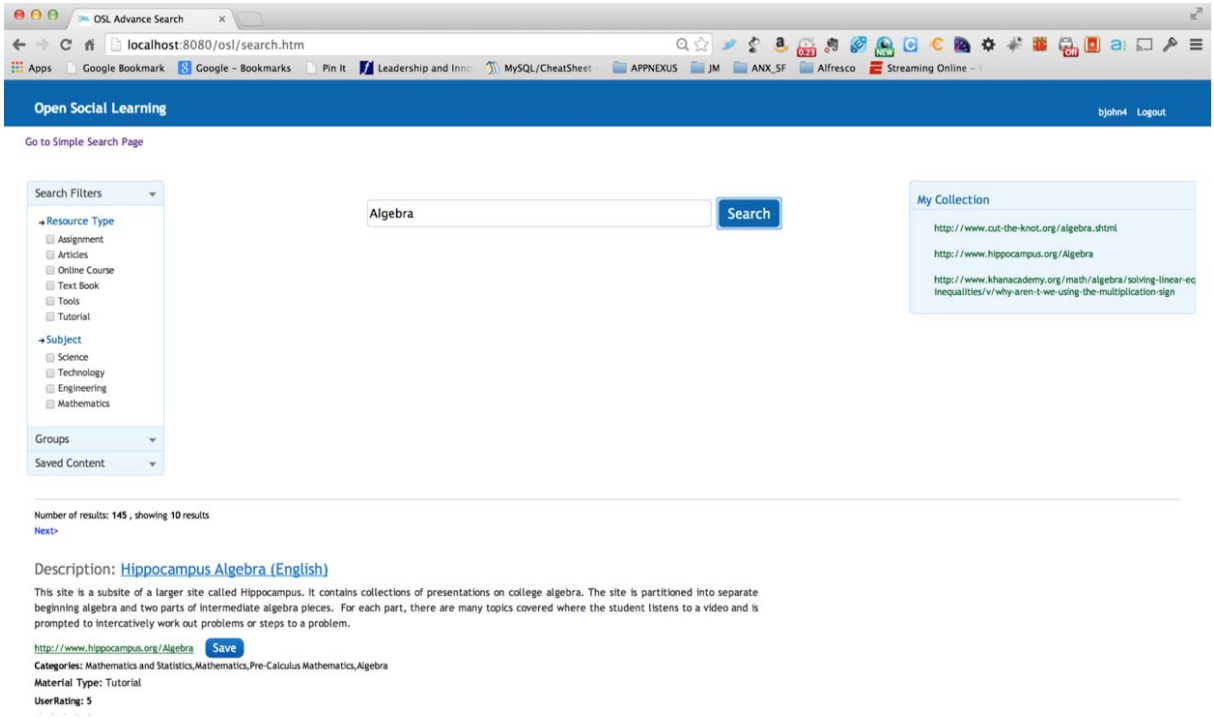

Figure 3. OCSL System screen shot

TESTING APPROACH AND RESULTS

Comparing search results and recommendation systems is difficult. The best way to experiment with different relevancy parameters is to run A/B experiments that randomly divide users into groups over the same time period, with each group interacting with a different algorithm. Another common method for measuring the relative performance of algorithms involves generating test data and performing comparative analysis using the generated log data (Khosla, & Bhojane, 2013). To experiment with learning activities in detail, behavioral patterns were extracted from the log files and user activity database table.

There are two aspects of a search result set that determine the quality of the results, the precision and recall, as Powers and David (Powers & David, 2011) suggest. Precision is the fraction of the retrieved documents that are relevant. A precision of 1.0 means that every result that is returned by the search is relevant, but there could be other relevant documents that were not a part of the search result.

$$precision = \frac{|\{relevant\ documents\} \cap \{retrieved\ documents\}|}{|\{retrieved\ documents\}|}$$

Recall is the fraction of the relevant documents that are retrieved. A recall of 1.0 means that all of the relevant documents were retrieved by the search, irrespective of the irrelevant documents also included in the result set.

$$recall = \frac{|\{relevant\ documents\} \cap \{retrieved\ documents\}|}{|\{relevant\ documents\}|}$$

If all of the documents are retrieved, then the recall is perfect but the precision may not be good. On the other hand, if the document set contains only a single relevant document and that relevant document is retrieved in the search, then the precision is perfect but again the result set may not be good. This relationship shows a trade-off between the precision and recall, in which they are inversely related.

The F-score is a measure of a test's accuracy. It considers both the precision p and the recall r of the test to compute the score:

$$F_1 = 2 \cdot \frac{precision \cdot recall}{precision + recall}$$

In this approach, we can take previously saved user behavior data from log files and test how well each of the candidate algorithms predicts the results that were previously acted on by the users. In the case of OCSL, we take the list of search results for every search or recommendation run for the user and plot them in aggregate on a precision versus recall graph, showing whether the algorithm made the correct prediction based on the user's

historical behavior. For example, the correct prediction might be defined in terms of which learning materials a user consumed, and thus, any query model that resulted in higher precision and recall for that learning content would be considered to be a better algorithm.

We analyzed the system logs and calculated the Precision, Recall and F-Score based on the learner's activity for each algorithm. In the following results table, each row indicates the aggregated result of a group of learners who interacted with the system. The Learning activity indicates the number of times each learner interacted with the system. The Total recommendations show the number of learning (retrieved) documents that were displayed to the learners, while the Total documents indicate the possible number of documents (relevant documents) that were related to the search.

Table 1. Conventional search using an inverted index and page ranking algorithm

Group #	# of interactions	# of recommendations	Total no. of documents	Precision	Recall	F-Score
1	12	510	17519	0.0235	0.0007	0.001368981
2	7	2939	15090	0.0024	0.0006	0.000927337
3	4	722	17307	0.0055	0.0002	0.000462127
4	9	560	17469	0.0161	0.0005	0.001029866
5	38	103	16993	0.0367	0.0024	0.004462451
6	35	146	17883	0.2397	0.002	0.003906686
7	99	172	17857	0.5756	0.0056	0.011026955
8	32	660	17369	0.0485	0.0019	0.00367795
9	4	459	17570	0.0087	0.0002	0.000455224
10	24	1609	16420	0.0149	0.0016	0.002918998
11	20	830	17199	0.0241	0.0012	0.002323015
12	77	876	17153	0.0879	0.0047	0.008937899
13	32	137	17892	0.2336	0.0018	0.003570632
14	30	168	16344	0.0178	0.002	0.003664306
15	51	80	17949	0.6375	0.0028	0.005666667

Table 2. Search based on the Content Hierarchical and Learner Attribute-based Matching (CHLAM) of OCSL

Group #	# of interactions	# of recommendations	Total no. of documents	Precision	Recall	F-Score
1	123	810	17219	0.1519	0.0074	0.014185215
2	160	616	17413	0.2597	0.0094	0.018209754
3	140	439	17590	0.3189	0.0081	0.015792442
4	120	218	17811	0.5505	0.0068	0.013384641
5	230	443	17586	0.5192	0.0132	0.025819488
6	230	266	17763	0.8647	0.013	0.025565498
7	211	612	17417	0.3448	0.0124	0.023939188
8	227	389	17640	0.5835	0.013	0.025409974
9	211	411	17618	0.5134	0.0121	0.023669303
10	220	409	17620	0.5379	0.0126	0.024663677
11	166	260	17769	0.6385	0.0094	0.018511291
12	121	120	16829	0.1008	0.0077	0.014277286
13	177	934	17095	0.1895	0.0108	0.0204956
14	156	303	17726	0.5149	0.0089	0.017447713
15	110	900	17129	0.1222	0.0067	0.012761761

Table 3. Search based on CHLAM and on Similar Learners Attribute-based Matching (CHSLAM)

Group #	# of interactions	# of recommendations	Total no. of documents	Precision	Recall	F-Score
1	298	330	17699	0.903	0.0169	0.033116631
2	199	260	17769	0.7654	0.0112	0.02215049
3	82	76	17953	1.0789	0.0046	0.009093429
4	120	140	17889	0.8571	0.0067	0.01332667
5	310	311	17718	0.9968	0.0175	0.034390947
6	215	217	17812	0.9908	0.0121	0.023853109
7	120	124	17905	0.9677	0.0067	0.01331484
8	307	330	17699	0.9303	0.0174	0.034099745
9	111	101	17928	1.099	0.0062	0.012306669
10	130	150	17879	0.8667	0.0073	0.014437226
11	144	166	17863	0.8675	0.0081	0.01599378
12	168	172	17857	0.9767	0.0094	0.018640777
13	141	146	17883	0.9658	0.0079	0.015645806
14	318	320	17709	0.9938	0.018	0.035280413
15	119	120	17909	0.9917	0.0066	0.013201686

The data in the table represents aggregate precision and recall calculations that are based on the learners in 15 different groups. Table 3 shows that the learning groups that used OCSL with the CHSLAM algorithm had an effective learning experience by interacting with the system more than the user groups that used the OCSL with the conventional and CHLAM algorithms. The precision is calculated as (# correct matches) / (# total results

returned), and the recall is calculated as (# correct matches) / (# correct matches + # missed matches). Although the precision and recall are not perfectly negatively correlated, there is a natural tension between the two in such a way that improvements in one often lead to declines in the other. The data from the table can be easily turned into a graph. All three tables are generated as graphs in Figure 4, Figure 5, and Figure 6, which show that the CHSLAM algorithm of OCSL generates improved results.

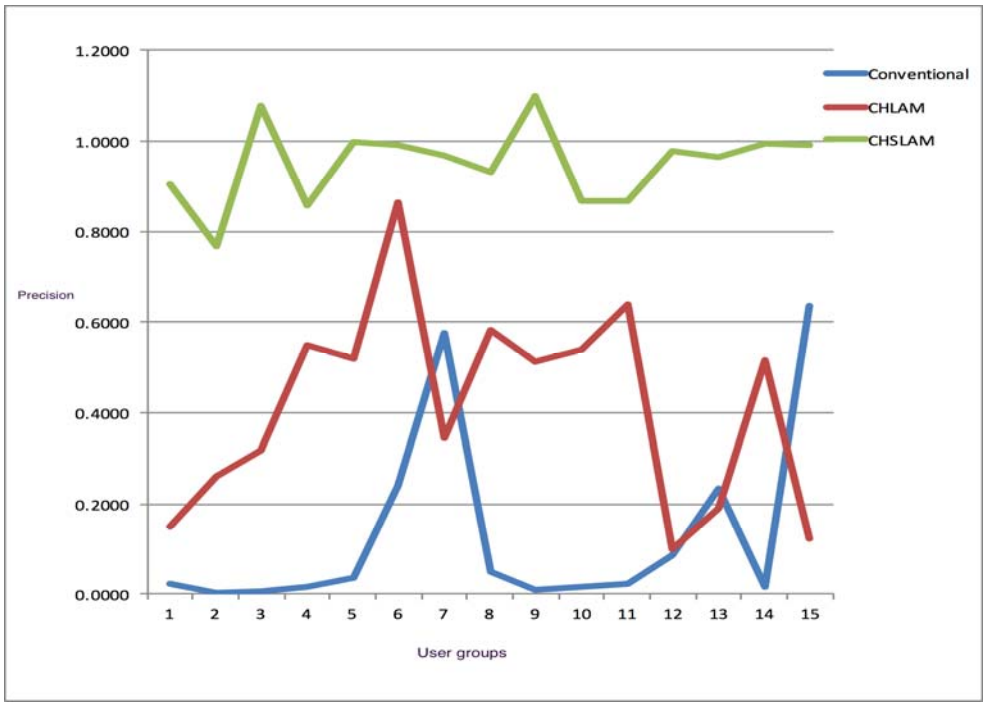

Figure 4. Precision values for Conventional, CHLAM and CHSLAM of OCSL algorithms

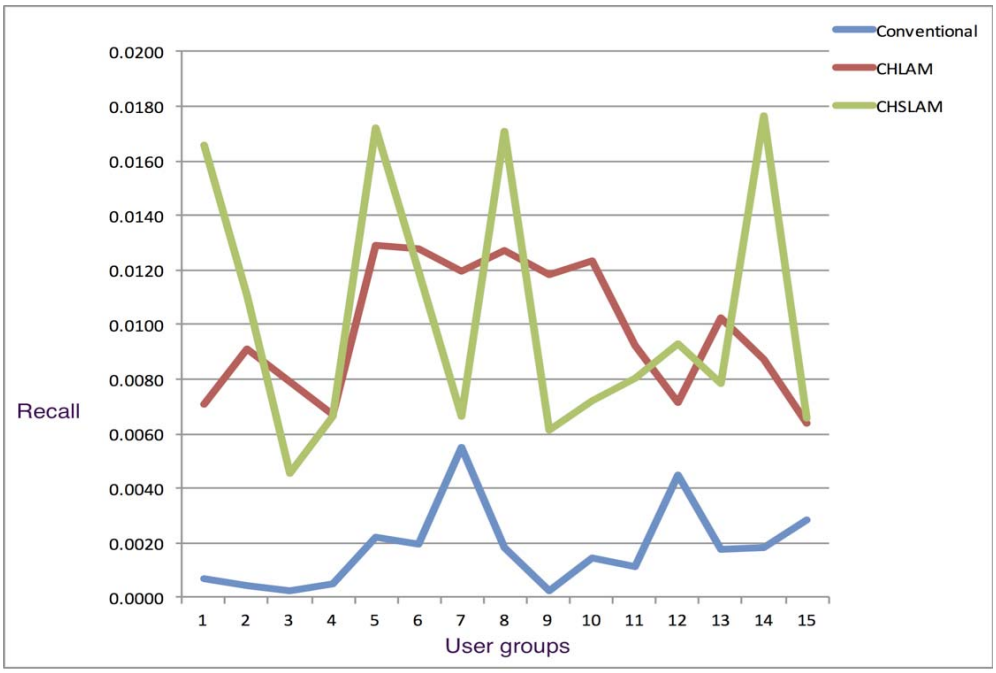

Figure 5. Recall values for Conventional, CHLAM and CHSLAM of OCSL algorithms

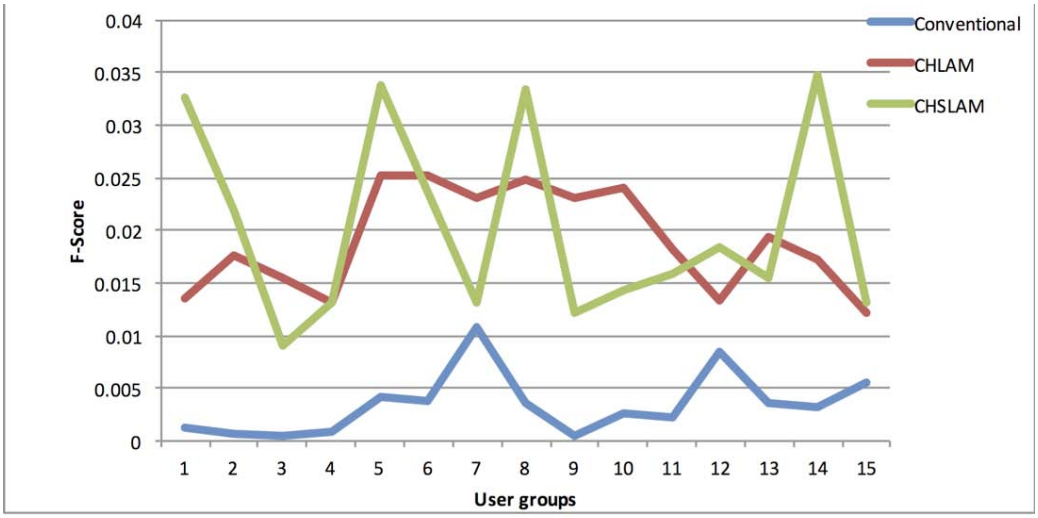

Figure 6. F-Score values for Conventional, CHLAM and CHSLAM of OCSL algorithms

The F-score shows an absolute score for an algorithm that strives for good balance between the precision and recall. Figure 6 shows that the learners engaged more successfully based on the CHSLAM algorithm compared to the CHLAM and conventional algorithms. The F-Score can be interpreted as a weighted average of the precision and recall, where an F-Score reaches its best value at 1 and worst at 0. The average F-Score value for conventional algorithm was 0.0034, and for CHLAM algorithm it was 0.0190 and for CHSLAM algorithm it was 0.0203. Based on the tests, CHSLAM algorithm yielded better F-Score results. To obtain a subjective evaluation of the OCSL system, we organized a non-mandatory questionnaire that collected information on learners with respect to the main features of the system. More than 65% of the learners reported that the system recommended personalized results and was able to focus on the correct content. Overall, the system showed remarkable improvement in self-learning. The learners were able to focus more time on studying the correct content and less time on searching for the content.

CONCLUSIONS

We presented a design and implementation of an end-to-end implementation model and conducted several experiments to test our system. Our system starts with a clustering engine that processes the content from various OER sources to properly map it to the taxonomy we built to support STEM (science, technology, engineering, and mathematics) content. It then generates personalized search results based on the content hierarchy (e.g., content type, content category) and learner attributes (e.g., learning style, recent activity). We took the learner experience from the logs and database and plotted them in aggregate on a precision versus recall graph, which showed whether the algorithm made the correct prediction based on the learner's historical behavior as well as similar learners' learning behaviors. Here, the precision and recall are not perfectly negatively correlated; there is a natural tension between the two in such a way that improvements in one often lead to declines in the other. We found that a search that was based on the historical learning of learners and similar learners' behaviors (CHSLAM of OCSL) yielded better F-Score results compared with the conventional search as well as a search based only on Content Hierarchical and Learning Attribute-based Learning (CHLAM). In the future, we plan to expand the system by creating peer groups with complex algorithms by leveraging similar learners' data from OCSL. We will explore extending the personalized mechanism and pedagogical aspects of OCSL to increase the engagement of learners by having the influencers and mentors interact with the peer group.

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Designing a Website to Support Students' Academic Writing Process

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ABSTRACT
Academic writing skills are crucial when students, e.g., in teacher education programs, write their undergraduate theses. A multi-modal web-based and self-regulated learning resource on academic writing was developed, using texts, hypertext, moving images, podcasts and templates. A study, using surveys and a focus group, showed that students used the learning resource on numerous occasions, a resource reachable outside in-person mentor sessions. Students declared that the resources had been important for finishing their degree projects. Mentors highlighted structure, multidisciplinary overview and linking possibilities. Using digital learning resources supporting students' academic writing is doubtless a developmental area in higher education.
Keywords: academic writing; undergraduate thesis; digital resources; higher education; multimodal design.

INTRODUCTION
This article draws on the project *Scientific process – Teacher education program, S-TEP*, which was undertaken at Stockholm University between 2012 and 2014. Three different departments at Stockholm University were involved in the project, the departments of Child and Youth Studies, Education and Special Education. Stockholm University has prioritized strengthening the social scientific quality of student teachers' undergraduate theses. It was in light of this priority that the *S-TEP* project was established, in order to further develop and improve digital resources and teaching support for students pursuing a teacher's degree generally, and, more specifically, to assist with the writing of undergraduate theses within the teacher education programs. Since 2001, writing an undergraduate thesis has become a constituent element of the teaching degree course. This has involved some important challenges during the implementation process of the reform. An important task has been to find the right balance between professional and social scientific perspectives. For its part, *S-TEP* took as its starting point the assumption of academic pluralism, namely that academic writing, in the context of different knowledge domains, is realized and transformed in multiple ways by particular students and mentors, all of whom are spread across a variety of learning environments. A website was developed, utilizing multiple modes and means; these were designed to complement the lectures, literature and supervision that traditionally serve as core parts in undergraduate thesis courses. The idea was to create digital learning tools which would enable students to work more independently in regard to both the structure and content of their undergraduate theses. In this article we will explore the following question:

- How do students and mentors perceive the learning resources on the website and their possibilities for supporting skills in academic writing?

Background
Academic writing is a genre within the larger field of academic literacy. Academic literacy is more than the ability to read and write effectively. It also includes the capacity to adapt smoothly to the cultural, linguistic and social milieu of academic departments and institutions (Gijbels, Donche, Richardson & Vermunt, 2014; Lee, 2013). Students bring a cultural code from their previous education, and there is cultural currency embedded in each one of us (Loughran, 2006). Furthermore, the idea of a traditional academic student has been replaced by multicultural and heterogeneous students who bring diverse experiences to universities (Entwistle, 2009). The introduction of computers in higher education has led to a qualitative change for all writing. Information and

communication techniques (ICTs) provide new tools, which may be used individually or with groups of students. Web-based learning platforms are increasingly used, not only for distance learning, but also as educational tools in campus based courses. Online support is thus looked upon as a complement to classroom teaching. Hansson and Moberg (2011) developed online support for students who were writing their theses. According to their findings, a new generation of students takes the Internet, smart phones and computers for granted. Universities have to readjust and develop new ways of organizing their educational practices. Numerous initiatives, such as recorded lectures, recorded questions and answers, and checklists as well as supportive administrative systems were introduced. Results showed that students came better prepared to their supervisory sessions, where time can then be focused on discussing the problems studied, rather than spending time on basic research methodology. In addition, Hansson and Moberg (2011) report that, with these changes made, mentors and administrators spent their time more efficiently when working with undergraduate theses.

Academic literacy

Developing academic literacy involves acquiring the discursive repertoire of the sciences: critical thinking, reasoning, reading, writing and behaving like a scientist, in the humanities as well as in the social and natural sciences. Academic literacy, therefore, is supported in and through established ideological positions and intersects issues of identity. The process of becoming academically literate, however, seems to lean on a paradox: those involved appear to be afraid of writing; yet they have chosen a career in which, by definition, writing is a necessity (Cameron, Nairn & Higgins, 2009). Many people think about writing as a linear process; academic writing can rather be described as recursive. Academic writing is not carried out from page A to Z in a continuous process. Instead there exist multiple drafts, where drafts are shown to critical readers and the advice given most often calls for serious revisions and restructuring of the text. Braine (2002) has defined the content of academic literacy to include, *inter alia*: knowledge of one‘s chosen field of study; research skills, good reading and writing techniques, as well as a continued adaptation to both the academic and social cultures of the university. In addition, Braine pointed out that the personalities and demands of the lecturers and academic mentors also vary considerably; the same can be said about the multicultural group of student peers. Academic literacy is generally acquired over an extended period of time, sometimes already starting in secondary schools. The input comes from various sources, such as teachers, mentors, peers, research, style guides, textbooks and handbooks. There are multiple systems prescribed for how best to organize the text as well as manuals specializing in referencing. Often different systems run parallel at a higher institution, and even at one department. Different disciplines develop their own framework and rules, as can easily be noticed between for instance the natural and social sciences. Vermunt (2005) described the importance of recognizing students’ individual learning patterns. A learning pattern is a complex result of a student‘s personal factors, conceptions and regulations of learning and motivation in relation to contextual factors. The different patterns are related to quality of outcome; i.e. unstructured and undirected patterns can easily lead to reproductive and repetitive writing, whereas possibilities to relate to previous experiences and to formulate meaning-making tasks were found to improve the overall quality of written text. An initial inventory of learning patterns and a continued focus on student participation and critical approaches are recommended (Gilbels et al., 2014; Vermunt, 2005). It has been suggested, by Cameron et al. (2009) that technical know-how be addressed in specific, optional workshops, addressing topics such as the outline, constructive alignment from aim and research questions to result and discussion, rhetoric, reference systems and so forth. Braine (2002) pointed out that shortcomings in academic literacy most often cannot be solved only by focusing on writing tasks alone. Data about the students has to be obtained from multiple sources for a more comprehensive understanding of the process by which academic literacy is acquired. Even with detailed, highly structured instructions, indicating that course instructors carefully controlled the assignments, students from other cultural backgrounds tended to misunderstand the assignments. There was a need on the students’ part to interpret the assignments so as to better understand the instructors’ expectations. Moreover, according to Braine (2002), a form of dialogical communication was found to be more productive than any relationship developed along hierarchical lines. Students seemed to become more receptive to a mentor when the latter assumed a co-worker and a co-learner role.

Writing degree papers

In order to be awarded a degree, by the end of their education, most undergraduate students have to undertake an independent study. This affords the students an opportunity to direct their own studies. Since the study constitutes a minor research project, it often involves the independent collection and analysis of data. Compared to other course assignments, such research projects are extended over time. During this period students need various kinds of support so as to be able to achieve the expected learning outcomes (Todd, Bannister & Clegg, 2004). The ability to work independently is an important outcome of undergraduate studies, but it is also a necessary precondition for such work to get done. Indeed, if students have not developed such an ability before writing their undergraduate theses, then the task of the academy must surely be to provide the tools and the

teaching support for students' to further develop their abilities to work more effectively and independently. Todd et al. (2004) argued that the key issue, when students write undergraduate theses, is to handle the balance between encouraging freedom and independence, on the one hand, and writing within the established tradition of the academy, on the other. Often, students struggle with formulating a practicable research question and thus run into difficulties with time-management, that is, *how*, *what* and *when* to do certain things. The research of Todd et al. (2004) showed that students "appreciate structure within the dissertation process as it helped them to manage their workload and remain motivated" (Todd et al., 2004, p. 344). An interesting question is then: is it possible to support the writing of an undergraduate degree paper as well as to develop the student's ability to work independently? The aim of developing the website was to create digital learning tools, which would enable students to work more independently on questions surrounding structure and form.

An additional demand for support for students is the increasing number of students entering into Swedish higher education with a different mother tongue than Swedish. This may be the result of migration but also of academic ambitions, i.e. to recruit a high number of exchange students as part of internationalization strategies. Büker (2003) stated that for most students academic writing becomes more difficult when it is done in a foreign language. However, it is not just language that creates a problem; cultural patterns in academic writing vary between disciplines, universities, languages and countries. International students are quickly supposed to adapt to the traditions at a specific institution (Vermunt, 2005). But there are other reasons for shortcomings in academic writing among international students. A lack of understanding of the writing process adds to the students' difficulties. There exists ignorance among mentors and teachers about process-related writing techniques, and even so about overall study techniques, which could be overcome by developing a practice that enables individual learning patterns (Entwistle, 2009; Vermunt, Bronkhorst, & Martínez-Fernández, 2014).

Degree papers in teacher education

The demand for a degree thesis in teacher education was introduced in Sweden in 1993, and today teaching is looked upon as an academic profession. The thesis is meant to have both an academic and a professional orientation. Researchers indicate that even if a dynamic balance between these would be preferable, it is in reality difficult to achieve. For instance the rigid scientific structure of the thesis can reduce the transferability of knowledge to the teaching profession (Gustafsson, 2008; Reis-Jorge, 2007; Wallace, 1997), while, conversely, the professional orientation may cause deficiencies in any critical approach adopted and may also harbour inadequacies with respect to documentary evidence (Mattson, 2008; Meeus et al., 2004). There is also a tendency toward academic focus becoming more prominent than professional perspectives (Calander, 2005). The academically-oriented approach has a strong support in official policy documents and studies have shown that this orientation has grown in recent times (Gustafsson, 2008). An academically-oriented approach advocates a teacher education that focuses on social scientific preparation, where research methodological skills and connection to research is important (Andersson, 2002; Feiman-Nemser, 1990). An academic thesis gives students the opportunity to learn about research, giving them a greater understanding of the genre of social science theses and dissertations (Ersoy & Cengelci, 2008). However, Gustafsson (2008) analyzed policy documents and research on student teachers' degree theses and found that neither academic nor professional training have a consistent impact on the quality of the theses. What seems to be happening is that those who advocate for the established tradition in academic writing hope to preserve the thesis as an academic phenomenon, instead of seeing it as a way to develop the profession and prepare students for the teaching (Gustafsson, 2008). A review of teacher education degree theses found these to be of lower academic quality than in other studied programs (The Swedish Agency for Higher Education, 2006). The survey was based on an evaluation model (Härnqvist, 1999) covering six aspects of quality: research links, formulation of problems, theoretical awareness, research methodology, implementation and conclusions, linguistic design and format. Problems highlighted were strong normativity, weak links to research, lack of critical thinking and a predominance of qualitative methods. These identified problems have inspired the design of the website and digital tools in the present study.

MATERIAL AND METODS

Scientific process S-TEP

The project *S-TEP* has a design-based research approach (Andersson & Shattuck, 2012) and utilizes design-theoretical and multimodal perspectives on learning and communication (Kress & Selander, 2011). A principal purpose was to design resources for students' self-directed and self-regulated learning. The aim of the *S-TEP* project was to design and improve significant learning resources for academic writing and to make these resources available on the Internet. These perspectives adopt an approach in which learning is understood as a dynamic process, involving both design *for* learning and design *in* learning (Selander, 2009; Selander & Kress, 2010). Design refers to how people make use of the resources that are available at a given moment in a specific communicational environment to realize their interests as makers of a message/text (Kress & Jewitt, 2008, p.

17). Multimodal perspectives acknowledge different resources, a complex fabric of modes that to some extent are used to shape students' possibilities in the representation of their learning. Within that complexity, the use of a variety of resources and modes (such as text, speech, images and moving images) offers different possibilities and constraints for meaning-making and learning, and different ways of learning and representing knowledge in the subject matter. According to Selander and Kress (2010), people orchestrate meaning through their choices of resources and configuration of modes.

These perspectives were applied within the *S-TEP* project as approaches for enabling and recognizing design possibilities for students to shape meaning and represent knowledge within academic writing, by using a variety of modes and resources from a website. New technologies and digital resources may challenge us and make our perception of a given text or subject matter expand. For example, what has been referred to as the "the visual turn" in theoretical discourse has changed approaches to truth and authority (Jewitt, 2008, p. 9-10). The possibilities for designing and expressing knowledge, for example by using moving images, speech and pictures instead of written text, have increased considerably during recent years. So if students use various modes and resources in their learning process and if all these modes and semiotic resources have different affordances, what modes and resources represent the most appreciated tools by students and mentors in supporting academic writing and what kind of interactivity do they provide? We may argue that different digital resources have different potentials and constraints as learning resources, and these resources lead to certain aspects being foregrounded (in accordance with the subject matter) during the learning process. Given the digital and multimodal landscape of today, it is crucial to understand the potentials and constraints of such resources as well as the costs and benefits of their use in academic writing.

Designing resources for the website

The *S-TEP* project's design experience arose out of the design *for* learning approach (Selander & Kress, 2010). This approach takes the perspective that designers construct and make available resources for learning with respect to epistemological and methodological considerations. On the website, different learning resources for academic writing were displayed in multiple media and modes, e.g. images, written texts, moving images and speeches which were distributed in templates, films and podcasts. The various modes and resources were set to perform different tasks in the students' design *for* learning process. This means that each mode or resource was designed with a particular meaning-making purpose in mind. The design of modes and resources also tells us something about how we as designers perceive the phenomena or issues being represented (Kress, 2003).

Within the *S-TEP* project, between 2012 and 2014, a collaborative design process took place involving a group of web designers, senior lecturers and teaching administrators. The aim was to come up with proposals for digital learning resources that would be supportive of students' academic writing. Within the design process, ideas, sketches and different multimodal learning resources were frequently discussed and evaluated in terms of their suitability for facilitating students' academic writing processes. During this process, professors and lecturers were invited to contribute with content, which could then be developed in the different modes and resources. Thus, the resources made available mirrored the variation of social scientific perspectives represented among faculty members. The design of the website was based on the assumptions that all modes have the potential to contribute to learning. The website was adapted to departmental concerns and placed on the three departments' home pages.

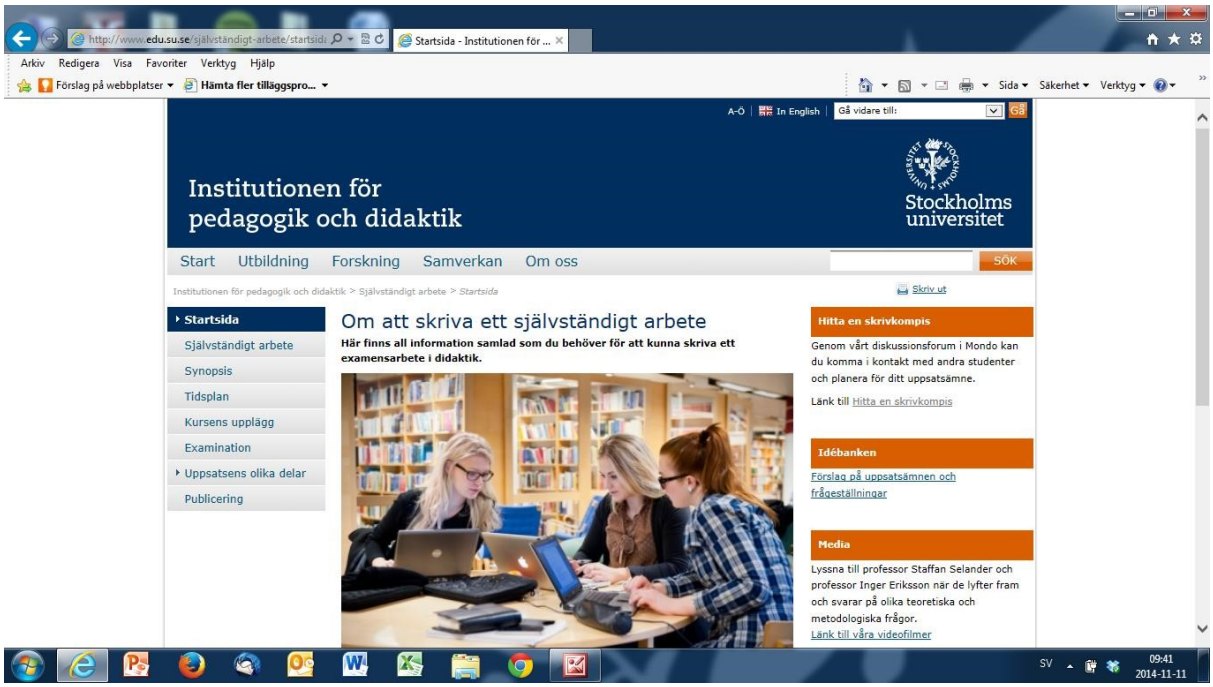

Figure 1: Example of the website designed within the project.

The website may be characterized as a work-through site, designed *for* learning, with chronologically arranged web links, constructed in relation to academic writing objectives and quality aspects (Härnqvist, 1999). These links were displayed on each of the sides on the homepage. Every link was adapted to display specific semiotic work related to the particular objectives of the academic writing course. For example, the design of the mode *written text* communicated meaning concerning objectives, time frames, how to write a synopsis, examination routines as well as advice about the oral defense of the thesis. Additionally, a further text advised students about the required organization of academic writing and provided links also to templates and other *formalia* related to the academic presentation of texts. In the mode written text, students could read via *hypertext* about aspects such as: How to select theoretical perspectives suitable for specific knowledge domains, and What important methodological issues ought to be considered in different academic approaches and in writing? The mode of *colour* was designed to enhance structure and readability. All the *images* on the website represented collaborative and active students engaged in work processes.

The images were meant to be eye-catching; the sight of students socially engaged serves both an emotive and pragmatic function. The images were coloured, centrally framed and designed to enhance inspiration and dedication to the website. *Films and pods* were also available through links on the website, representing academic work in other modes (moving images and speech). These modes provided different affordances for meaning-making and learning. Different modes hold particular potentials and constraints for meaning-making and, indeed, the meaning of some content may be better expressed in one mode than another. Speech combined with gestures may orchestrate variability of meanings through both sound and bodily movements, and these can be used to enhance both meaning-making and learning. On the website a number of short films (each one approximately two minutes long) and podcasts (no longer than fifteen minutes) were displayed to stimulate the students' interest in academic work and academic writing. The topics in these films and podcasts illustrated several essential and important issues within social scientific work in general, and within the academic writing process in particular. For instance: How to transform ideas into research questions? What does the concept "coherence" mean in academic writing? And, what does "distributed time" facilitate in an interview setting? The digital films were identified within the design process as useful and successful resources for meta-reflection. With support of the website, students have the opportunity to become their own designers *in* learning.

Data collections and analysis of the empirical data

To explore how students and mentors perceived the website, a trio of methods was adopted, including: (a) questionnaires to students; (b) a video-documented focus group with mentors and (c) questionnaires to mentors.

a) Questionnaires to students. All teacher students (n=157) who participated in the academic course for the undergraduate thesis during the spring and autumn semesters of 2013, across three different departments, received a questionnaire to fill in after their oral examination seminars. The learning outcomes of the

undergraduate thesis course are the same at the three departments. Of the total number of teacher students, 90 answered that they had used the website. Students not using the website indicated that the main reasons for not doing so was because it was unknown to them and/or that they received their help exclusively from their mentors. We asked the students in what ways and how often they used the learning resources, to rate how useful the different resources and modes were, and whether they deemed these resources as satisfactorily supportive for students' independent work. Responses were compiled partly by descriptive statistics concerning utilized resources, and partly through an analysis of those survey questions that solicited open-ended responses. The subsequent analysis focused on potential issues and prospects in using website resources as well as any further development opportunities.

b) A video-documented focus group with mentors. In order to gain an insight into mentors' opinions of the website resources, we arranged a focus group with four mentors at the Department of Education. They were instructed to use the website and then give their views. A research room with one prepared computer and a film camera documented their working process and discussions. We wanted to observe how they navigated through the website without any initial guidance or distractions. Conversations, body language and typing on the keyboard were all documented by the film camera. All conversations were transcribed. The analysis focused on issues and opportunities raised through website interaction. Particular attention was given to problems in orienting oneself on the site, comments about website content and opinions about possible improvements.

c) Questionnaires to mentors. To know more about how mentors from all three departments perceived the site, an open-ended questionnaire was constructed based on the analysis of the focus group. 14 mentors answered the questionnaire. A few of them hadn't used the website, but took the opportunity afforded them by the questionnaire and went through the website, answering most of the questions. We asked whether mentors used the site when supervising students and what they perceived as useful. The questionnaire also dealt with design and content, ambiguities and requests for development. The subsequent analysis focused on potential issues and prospects concerning the use and development of the website.

This study draws on an empirical sample of students, N=90, who answered (a) and mentors, N=18, who answered (b) or (c). The data does not allow us to assess the influence of website exposure on the written quality of undergraduate theses.

RESULTS

How do students and mentors perceive the learning resources at the website and its possibilities to support skills in academic writing?

The results of the survey show both the possibilities and constraints when using a website to support the writing of an undergraduate thesis. Examples of possibilities mentioned include the following. First, time is not a limiting factor when visiting the website, a student can visit the site as often and at whatever time s/he likes. Second, there are unlimited possibilities with respect to linkages students might make to different knowledge bases. Third, the site offers multiple modes for where and how knowledge can be sought. Moreover, according to informants, the layout of the website ensured easy access to knowledge. At the same time constraints were also reported. These drawbacks included that the information on the website is too limited, and that suggested templates can prove to be too inhibiting for students. Moreover, informants pointed out that a website is changeable, recognizing the modus operandi of web-based knowledge.

Students' usage of the Website

Initially we asked the students to what extent they had used the learning resources on the website. A significant number of students entered the website five times or more. Some used it even more frequently, returning to the website more than twenty times. It's clear that students experienced the information to be useful, returning repeatedly to the website to gather new information or to check that they had comprehended the information correctly.

Writing an undergraduate thesis is a major task, and one-third of the students said that the web-based resources contributed to their fulfilling the requirements of the degree paper. The results indicate that most of the students considered the information to be useful, especially in the initial phase of their working process. Concerning questions about what specific modes and parts of the website the students liked and used most, identified preferences included the text-based resources, such as different informative texts, descriptions of content, texts with focused explanations, and templates, etc. Students also liked the films, representing both visual and auditory modes. The clear and structured design was a further quality students appreciated.

While students seemingly used the traditional modes of learning most, they nonetheless gave appreciation to the information/knowledge given in the other modes. The variety of modes available was one of the qualities associated with the website. In the course of writing the degree thesis, the multimodal approach adopted by the website offered students semiotic potentials. The students were also asked to rate how useful they had found the resources to be in terms of improving skills in academic writing and strengthening possibilities for independent work. On these issues, students found the website particularly useful for their academic writing. Some students turned to the website for supervision rather than getting in touch with their mentor. This study did not investigate the connection between the mentors' knowledge of the website, and the students' usage of it. However there are indications that the mentors' attitudes affected student usage. Student requests for further development of the website included adding more information about technical know-how, and more information concerning their course. Some of the students' responses indicated a wish to get "the right answer" to dilemmas that occur during the writing process. This shows the central challenge facing academia. How can mentoring of students help to foster independence in the research process, that is, in finding knowledge, thinking and consequent decision-making?

Mentors' usage of the Website

Mentors were asked if and how they had used the website while mentoring teacher students' thesis writing, and why they chose to do so. They were also asked for their opinions about the website. Possibilities and constraints associated with using web-based learning resources were drawn from a content analysis of their answers. Around half of the mentors had referred the students to the website, especially at the beginning of the course. They found it to be a good starting point, giving the students an idea about the expected structure of the work. Most of the mentors had a positive attitude to the newly developed website. They described it as clear and accessible; particularly merit-worthy was the fact that it was specially adapted for student teachers. The mentors also mentioned that the visual presentation gave students an overview of the expectations of the course. Most of the mentors experienced the website as a complement both to their mentor tasks, and to textbook-based learning. Mentors have limited possibilities and resources to guide students; there is only a certain amount of time for group mentoring and supervising each individual student. The website is, on the other hand, accessible at any time and place. It is possible to go back and view the same information over and over again. The students' own working pace can thus be acknowledged. If the students get to know about the website at an early stage in the program, they also have the possibility to prepare in advance. A variety of information is gathered on the website. The texts on the site are compact and selective and, in that sense, when compared with what is presented in a textbook, information can be understood and assimilated more quickly. Mentors also encourage students to seek information by themselves, using other systems and databases that are presented via links on the website.

Some mentors raised the problem that the website and its templates can inhibit creative solutions, and this might be a hindrance, especially for students studying at an advanced level. Generally, a high variation between different media and modes was recommended. In many respects, the website offers unlimited resources, but, still, the fact remains that someone always decides which information is to be displayed. The ways to go about finding knowledge will therefore always be, to a greater or lesser extent, limited. Some mentors wanted to make more use of the different modes on the website. In particular, several mentors mentioned wanting to use more visual and auditory sources. In order to present a variety of research perspectives and traditions, more films were suggested. Several mentors also asked for films about the assessment procedures and seminars. The mentors wanted to use ICT as a communication tool for how they want students to work with their theses. Methodology books provide general information but this website is seen as tailored by the mentors' perceptions.

DISCUSSION AND CONCLUSIONS

This concluding section will point towards some possibilities as well as indicate some constraints that were perceived by both the students and the mentors interviewed about a website dedicated to the writing of undergraduate theses. It is hoped that these findings will be of importance in the continued development of this website initiative and others like it.

In the project *S-TEP*, multimodality was applied as an approach to enable and recognize design possibilities for students to shape meaning and present knowledge within academic writing, by using a variety of modes and resources. A website was designed for students to be able to use several resources for learning to write academic texts. Selander & Kress (2010) and Kress & van Leuween (2001, 2002) discuss the potentials of different modes and argue that all modes (e.g., written text, images, moving images) carry potential for meaning-making in different ways. As we see it, the modes and resources available at the website may realize different meanings, different usages and give different ideological or epistemological implications for the academic writing process. The design-theoretical and multimodal approach gives a dimension to understand the design *for* learning by

taking into account how students actively choose and use different modes and resources in the writing process. The perspective offered us a theoretical framework and notions for analyzing modes, resources and ideas of their respective roles of facilitating students' learning processes. The framework gave us, as designers-as-producers (Kress & Selander, 2011), a theoretical ground for discussing the design process and deepening our understanding of how a website can be designed to support academic writing. We were thus given the opportunity to reflect on the values and the perceptions of what is recognized as quality in academic writing. Our own cultures of recognition were scrutinized and critically discussed, e.g., interpretations of different resources and analyses of available prompts and their potential for meaning-making.

Drawing on the findings presented above, this section also summarizes a few of the gains some students made in taking this course with these web tools at their disposal. Finally, the mentors' perceptions of the website are also summarized. It is arguably still relatively new, in the context of teacher education, to introduce technology as a central part of the process of learning and mentoring academic writing. Writing a degree thesis is often considered an important milestone in any higher education program.

Multimodal design for independent learning

Traditionally, university students have received guidance from mentors whenever needs and problems crop up during their writing processes. Often, such guidance has been situational, contextual and problem-oriented, organized in face-to-face sessions between mentors and students on campus. Additionally, multiple e-mails go back and forth between student and mentor, a time-consuming but yet not always satisfying way to help students. The findings in this project, drawn from a specific website initiative, suggest that web-based resources may promote the utilization of resources which are both multimodal and of a wider range. These resources have been shown to support the possibility of "flipped" supervision and self-regulated learning (cf. Fulton, 2012). In the context of the *S-TEP* project, available resources influenced students' engagement and helped them to become more familiar, and more at ease, with academic writing traditions. The results indicate that a website offers multimodal design *for* learning in ways that help students become less dependent on their mentors. The resources presented on the website offer possibilities for different kinds of representations and communication. They also provide additional tools for students to investigate their own interests and particular meaning-making practices. Moreover these assembled resources allow new ways for mentors to support the students' ways of learning the techniques necessary for academic writing. Many other digital resources, e.g., databases for methodological approaches or for searching articles in online journals, have been characteristic elements of the writing process as well as being objects about which students and mentors have often communicated.

For some students the available website and its digital resources offer the possibility of viewing and re-interpreting the entire academic writing process, through utilizing the website as a virtual gallery for a constant design *in* learning (cf Kress, 2003; Kress & Selander, 2011). Overall, the students and mentors were satisfied with the existence of the website and some students even pointed out that their skills in academic writing had been developed by the use of these web-based resources. Expectations of learning objectives were communicated on the website in a clear way. The academic writing process also became more transparent via the informative texts, templates, films and podcasts (cf. Todd, Bannister & Clegg, 2004). Although the students often used monitory templates, these were to a large extent open for students to design their own learning, rather than to reproduce knowledge from others. Students chose different modes and resources based on their interests and level of engagement, in order to develop their understandings of topics and knowledge. These resources offered students a multimodal world of images, speech and printed text. These findings suggest that the website had the potential to support:

- Independence during the initial phase of the course
- Individual learning pathways and different ways of learning academic writing
- Multimodal variation and resources for flipped learning
- Around-the-clock online guidance
- Access to the knowledge and experience of many mentors
- Transparency regarding expected learning outcomes and academic criteria
- Students' ability to complete the degree thesis

Challenges in implementing new tools

The students', as well as the mentors', use of the website varied. For some students, the website became an appreciated and frequently utilized tool, for others it served as a complement to other means of learning. For a significant proportion of the students, though, the website was not utilized, and in some cases students were in fact unaware of it. Implementing new educational resources, such as the website discussed here, must be carefully planned over time. There is a need for systematic implementation efforts over an extended duration, so

as to reach and teach new ways of learning in an educational system of a larger size. As shown above, there were differences in understandings of the affordances of the website. There is, in constructing a new web-based resource, always a balancing act between providing correct and adequate information while not overwhelming students with too many details. Both students and mentors asked for more information concerning different aspects of writing a degree paper. Some of this information is easily found in textbooks dealing with academic writing and research. In a website, there are a variety of possibilities to link to other Internet sources, this was a point also suggested by some mentors. Both students and mentors have suggestions about what could be developed on the website, which may be interpreted, fundamentally, as a sign of appreciation of the website. There are different opinions about what to develop. Should there be more detailed and/or additional information? How many links to external websites should there be, e.g., compared to developing our own production of additional visual and auditory modes?

Another driver for the furtherance of this project is the question: What modes and semiotic resources are the most appreciated tools by (different groups of) students and mentors in supporting academic writing? These questions illustrate that the website affords multiple perspectives that may be further developed, as well as clear and framing formats for meaning-making. In this way, the web resources encompass both critical thinking and academic writing, since the students need to critically examine and choose the most relevant perspectives and methods, a process which underpins quality (Loughrain, 2006). Working with a website, like the presented one, gives opportunities for continuous development, which is not possible with published textbooks. This may also be realized during mentoring. Just as mentors need professional learning in order to deepen their fields of expertise, a website needs maintenance, up-dating and the incorporation of new knowledge, as well as the highlighting of aspects suggested by students and mentors. The process of updating would invite mentors to participate in an ongoing discussion about what students need to know and need have easy access to, in order to write an undergraduate thesis. Such an on-going discussion has been shown to strengthen the mentors in their work as well (Todd, Smith & Bannister, 2006). Web-based teaching offers a lot of unused possibilities, but the results from this study show that students and mentors have only started to realize the potential of web-based learning resources.

Drawing on the results from our study, the resource of a tailor-made website can actually constitute something analogous to a third party, mediating between the on-going dialogue between student and mentor, and thereby complementing the supervisee-supervisor interaction. Mentoring can be realized through a multimodal website. As a consequence, more faculty researchers become available, with each mentor potentially reaching more students. In the context of a website, each student could meet and benefit from the expertise of multiple researchers. The purpose would be to loosen the dyad of student-mentor, and to convert the relation into a triad; student-mentor-website. However, we would like to underline that implementing a website, such as ours, takes time and effort, and there is always a “takeoff-period” to take into account.

ACKNOWLEDGEMENT
This work was supported by the 2013 Future Learn project at Stockholm University.

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Further Classification and Methodological Considerations of Evaluations for Online Discussion in Instructional Settings

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ABSTRACT
With the rapid advancements of technology, online communication in both K-12 and post-secondary instruction has been widely implemented. Instructors as well as researchers have used various frameworks to evaluate different aspects of online discussions' quality. The online discussions take place synchronously or asynchronously in chat rooms, boards, and blogs, often using mobile applications and usually aimed at understanding course content and concepts. The current review follows up on Spatariu, Hartley, and Bendixen's (2004) classification that placed these frameworks in four categories based on what they were aimed at measuring (disagreement, argumentation, interaction, and content). The current review serves two main purposes. First, newer frameworks are categorized and described while addressing methodological considerations. Second, conclusions and recommendations for future research and instructional applications of online discussion evaluation are made.

INTRODUCTION
A report by two research groups that are tracking distance education yearly in the United States (Allen & Seaman, 2013) shows that there were 6.7 million students enrolled in higher education online courses in 2011. Straunsheim (2014) reported that about 2.6 million students were enrolled in fully online programs while the rest were taking some online courses. Graduate students are typically the ones who opt for completely online programs rather than undergraduate students (22% versus 11 %). While higher education has slowed its expansion in the last few years, K-12 education has been rapidly increasing. North American Council for Online Learning (2012) reports 26 states have state virtual schools, 31 states and Washington, DC have state-wide full-time virtual schools with an estimated total enrollment of 1.8 million students in 2009-2010. The delivery mode in K-12 education has also been summarized by NCES (2012) with 53% of public high schools reporting 1.3 million students enrolled in distance educations courses in 2010. Keeping these educational trends as well as the rapid progress of technology in mind, one can surmise all aspects of distance education have to be continuously researched and improved, including online discussions and communication.

Online discussions, also known as online discourse or computer mediated communication, can be synchronous (e.g., chat rooms) or asynchronous (e.g., discussion boards) and are common practice in many types of distance education courses. Online discourse is used for purposes such as understanding subject matter, enhancing communication, developing cooperative projects, and boosting critical thinking skills (Bonk & Dennen, 2007; Garrison, Anderson, & Archer, 2000, 2001; Kay 2006; Meyer 2003; Palloff & Pratt, 2001; Rourke & Anderson, 2002; Spatariu, Quinn, & Hartley 2007; Spatariu, Hartley, Schraw, Bendixen, & Quinn, 2007; Tu & McIsaac, 2002).

In order to evaluate the quality of online discourse when using either course-based online discussion tools (e.g., discussion boards, chat) or similar tools ancillary to the course (e.g., wikis, skype, mobile device applications) different frameworks have been employed. A framework is a grading rubric that allows the reader to score the discussion (e.g., interactivity patterns, strength of an argument). Spatariu, Hartley, and Bendixen (2004) classified and described a number of such frameworks, placing them in four categories based on the constructs

that were purportedly measured by the instructors. The categories were levels of disagreement, argument structure analysis, quality of interactions, and content analysis. These frameworks provide a foundation for researchers and practitioners interested in a systematic and purposeful way of evaluating the quality of course discussion as it relates to course objectives or goals.

The current review follows-up on the frameworks presented in Spatariu et al. (2004) and explores new frameworks. It also discusses methodological considerations and provides suggestions for future use. First, the conclusions of Spatariu et al. (2004) are reviewed to illustrate specific evaluation models. Second, new frameworks are reviewed that pertain to evaluation of argumentation, interaction, content, and qualitative analysis. Extensive literature searches were conducted to locate evaluations frameworks employed in research studies, especially those published in the past 5-6 years. Particular information, related to the type of study, theoretical framework, and reported reliability and validity undertakings, is included in three different tables. Many studies, even though recently published, were not included in this review as the overall focus was on number of instructor or student posts, replies, time, length, and other descriptive features of the generated discussions. While of possible value to research, this type of information was not considered to be particularly relevant to the quality of the actual discourse. The focus of this review was on studies that involved substantial analysis of the writing involved within discussions. Lastly, conclusions and recommendations for future research and practice for discourse in both post-secondary and K-12 instruction are presented.

EXISTING FRAMEWORKS

Levels of disagreement and argument structure analysis are approaches that have been used by different researchers (Golanics & Nussbaum, 2008; Spatariu et al. 2007) to evaluate the quality of arguments produced in online discourse. Although their coding schemes vary based on research needs, they all targeted agreements, disagreements, and evidence supplied in support of claims. At a basic level, argument and counter-arguments can be counted and recorded. At an advanced level, the type of claim and evidence would make an argument weak or strong, and would allow the reader to score it beyond simple categorization as agreement and/or opposition.

Interaction based coding has been used by other researchers such as Schaeffer, McGrady, Bhargava, and Engel (2002), Järvelä and Häkkinen (2002), and Nurmela, Lehtinen, and Palonen (1999). The main purpose of these methodologies is to identify particular message roles in the larger discussion. Message board posts are usually scored based on the relationships they establish with other posts, especially as related to perspective-taking, change of topic, and type of social interaction.

Spatariu et al.'s (2004) research included the last category, content analysis. Several studies (e.g., Hara, Bonk, & Angeli 2000; Henri, 1992; Peterson-Lewinson 2002) have developed frameworks that examine such learning aspects as cognitive and metacognitive skills and depth of processing, as well as social interaction and participation patterns.

NEW FRAMEWORK: ARGUMENTATION ANALYSIS

Researchers continue to further develop and use argument structure analysis frameworks. Clark and Sampson (2008) developed and employed an analytic framework for assessing argumentation in online science courses that examined levels of opposition, discourse patterns, use of evidence, and conceptual soundness. They have also reported on validity and reliability of the instrument. Salminen, Marttunen, and Laurinen (2010) have embedded argumentative discourse in chat discussions. This approach was quite different from other asynchronous argument analysis frameworks as students had the opportunity to construct argument diagrams with or without computer assistance. The diagrams produced were analyzed for different argument structures and inclusion of prior knowledge.

Other researchers such as Clark, Samson, Weinberger, and Erkens (2007) examined methodological aspects of existing frameworks for argument structure analysis. Their review looked at argument structure and conceptual quality, which exist in most frameworks presented. Their work explores aspects of previous argumentation analysis frameworks employed by Clark and Sampson (2008) in their study, which is included in the table below. Additionally, researchers have employed various evaluation schemes that included evaluation of arguments along with other types of post characteristics such as elicitation and integration (Tawfik, Sánchez, & Saova, 2014).

Table 1: Argumentation Analysis Frameworks

Author	Type of Framework	Theoretical Framework	Reliability	Validity
Clark & Sampson (2008)	Argumentation in asynchronous discussions	-Dialogic arguments to reach agreements on ill defined problems -Social collaboration	-Interrater reliability 94% (Cohen's k = 0.91)	-Framework scores the individual comments in terms of discourse moves, grounds quality, & conceptual quality -The framework is based on previous frameworks; each modification is discussed and justified
Salminen, et al. (2010)	Argumentation in synchronous chat discussions	Three theories were discussed as they pertain to the use of visual argument diagram construction: the theory of computational efficiency, the cognitive theory of multimedia learning, and the cognitive load theory	Not reported	-Framework is based on participants constructing visual argument diagrams -Participant-generated diagrams were compared and classified based on categories supported by previous research

NEW FRAMEWORK: INTERACTION ANALYSIS

Recently research has adopted and further developed a social interaction analysis framework. However, the social interaction framework is not mutually exclusive with the community of inquiry framework which suggests that there is overlap in what they propose to evaluate in the discourse.

Hull and Saxon (2009) evaluated the social interaction of education courses during asynchronous discussions. The evaluation instrument has been previously used and focused on the presence of thought process patterns in discussions, in addition to evaluation and explanation of social, cognitive, and metacognitive processes detected. Hull and Saxon (2009) detected higher mental processes and more sophisticated interaction patterns than previous frameworks, which may mean the evaluation framework they employed is more elaborated. Heo, Lim, and Kim (2010) employed both social network analysis and content analysis to evaluate levels of interaction and knowledge construction in project-based learning environments. The authors neglected to investigate methodological issues of the instrument most likely because it was based on a previously developed and tested framework. However, they concluded the tool needs further development to address emerging coding (qualitative analysis codes not previously classified, which surface while analyzing data). Likewise, Lang (2010) examined interaction in project-based learning environments at the high school level using asynchronous discussions. This evaluation of discourse focused on information exchange, knowledge construction and negotiation. The findings of Heo, et al. (2010) and Lang (2010) are based on the framework developed by Gunawardena, Lowe, and Anderson (1997) for measuring social interaction patterns. Although there is valuable information about turn taking and conversation patterns that these frameworks can provide, the overall trend is to develop evaluation tools that get more extensively into what is being discussed, what type of reasoning is involved, and how deeper thinking is manifested. The need for more complete understanding of participants' thinking and interactivity has led some researchers such as Heo et al. (2010) to employ two different frameworks, in their case both social interaction and content analysis.

Table 2: Interaction Analysis Frameworks

Author	Type of Framework	Theoretical Framework	Reliability	Validity
Hull & Saxon (2009)	Social interaction in asynchronous discussions	-Social construction of knowledge -Social collaboration	Inter-rater reliability (k=0.77)	-Framework is based on previously developed frameworks for social interaction and knowledge construction -Coding included the following categories: direct instruction, sharing new information, situated definition, inter-subjectivity, negotiation/co-

				construction, testing tentative construction, and reporting application of knowledge
Heo, et al. (2010)	-Social interaction analysis in asynchronous discussions -Content analysis in asynchronous discussions	-Social and situated learning -Social collaboration in project based learning	-Social network analysis was performed by quantifying 5 phases -Inter-rater reliability for content analysis at 86%	Framework based on previously developed framework and assessed sharing/comparing of information, discovery of dissonance, negotiation/co-construction, testing and modifications, and applications of newly-constructed meaning

NEW FRAMEWORK: CONTENT ANALYSIS

An important and fairly large body of research, that includes but is not limited to coding and analysis of discussion transcripts, has been initiated in the work of Garrison, Anderson and Archer (2000) who coined the term *community of inquiry*. Their work stems from Henri's (1992) content analysis work, but they created a comprehensive instrument for the description and analysis of the online-environment educational experience consisting of three main elements: social presence, cognitive presence, and teaching presence (Garrison et al. 2000). Numerous subsequent studies (Cleveland-Innes, Koole, & Kappelman, 2006; Garrison, et al., 2001; Garrison, Cleveland-Innes, & Fung, 2004; Gorsky, Caspi, Antonovsky, Blau, & Mansur 2010) have employed this model to evaluate the three components and their particular descriptors: social presence (i.e. expression, group cohesion), cognitive presence (i.e. resolution, integration) and teaching presence (i.e. type of instructor involvement, shifts in presence). This framework has been employed in a variety of courses for content transcript analysis to include problem-based learning in agriculture (Kenny, Bullen, & Loftus 2006), natural sciences and humanities (Gorsky, et al. 2010), teacher education (Koh, Herring, & Hew 2010); and English language (Ho & Swan 2007).

Other researchers have adopted the Garrison et al. (2004) community of inquiry framework explain the community of inquiry framework. Tirado, Hernando, and Aguaded (2012) and others have employed framework combinations; for instance, Tirado et al. (2012) used a combination of content analysis as initiated by Henri (1992) and social network analysis as used by Wang and Li (2007) and Reffay and Chanier (2002). These combination frameworks tend to be focused on social presence and cognitive presence factors.

Shea, et al., (2011) used both the community of inquiry framework and learning outcomes taxonomy to evaluate online asynchronous discourse. Aykol and Garrison (2011b) employed transcript analysis to assess cognitive presence in both online and blended communities of learning. Results revealed students achieved high levels of cognitive presence and learning outcomes. Aykol and Garrison (2011a) further developed content analysis into a metacognition evaluation instrument. The community of inquiry theoretical framework served as a conceptual base for metacognitive constructs, operationalization, and evaluation. The use of content analysis, just like many other frameworks, has been employed in chat discourse analysis (Hou & Wu 2011). Another social analysis framework, discourse analysis, was employed by Dennen and Wieland (2007) and by Herring (2004). Discourse analysis consisted of scoring social engagements, acknowledgments, peer questioning, and perspective taking. There are many overlaps of this framework with both argumentation and interaction frameworks, which have already been discussed. Jorczak and Bart (2009) also employed a framework that evaluates both cognitive structures, through content analysis, and argumentation patterns in asynchronous discussions.

Kay (2006) presented a comprehensive framework for analyzing the quality of online discussions. This framework stems from content analysis (Hara et al. 2000) and the social aspects of learning (Vygotsky 1978). Some of the variables measured included aspects of social learning, cognitive involvement, discussion structure, instructor role, discourse challenges, learner attitudes, and learning performance. Putman, Ford, and Tancock (2012) developed their own framework for collaboration and cognitive engagement based on students' discourse data.

Another approach for cognitive presence evaluation is based on Bloom's taxonomy (Valcke, De Wever, Zhu, & Deed, 2009). A unique aspect of this study is that the authors did not use a learning management system designed for online courses; instead they utilized social media (i.e., Facebook) as the interaction space for a

project-based learning activity. Their instruments detected both low level cognition (i.e., understanding and comprehension) and metacognitive processes. Higher order thinking skills were examined by Xie and Bradshaw (2008) as well in an experimental study on the effects of questioning prompts on solving ill-structured problems. The authors developed their own coding scheme that was essentially a rubric for detecting identification and possible solutions of the various problems presented for discussion. Problem identification and solution each contained four criteria related to number of problems, justification of problem, number of solutions, justification of solution, quality of solution, etc. Two raters scored the students' posts to ensure reliability. A similar rubric was designed to evaluate problem-solving abilities in a study byDu, Yu, and Olinzock (2011). They looked at the effects of instructor prompts on different types of discourse from chat rooms to discussion boards, and evaluated the assignments using rubrics that yielded significant differences on problem construction, needs assessment, and argument construction.

Table 3: Content Analysis Frameworks

Author	Type of Framework	Theoretical Framework	Reliability	Validity
Gorsky, et al. (2010)	Teaching, cognitive, and social presence in asynchronous discussions; content analysis	Community of inquiry	Inter-rater reliability at 92% (Cohen's k= 0.89)	Validity is discussed based on validity reported for previously developed framework upon which the current one is based
Koh, et al. (2010)	Teaching, cognitive, and social presence in project-based learning asynchronous discussions; content analysis	-Community of inquiry -Knowledge construction and social interaction	Inter-rater reliability (k=0.75)	Framework based on previously developed codes related to knowledge construction, teaching, social interaction, and logistics
Tirado, et al. (2012)	Social interaction and cognitive presence in asynchronous discussions	Community of inquiry	Triangulation of data used for reliability	Validity is discussed based on existing content and social network analysis frameworks
Shea, et al. (2011)	- Teaching, cognitive, and social presence -Learning outcomes taxonomy	Community of inquiry	Inter-rater reliability using Holsti's Coefficient of Reliability	Validity is discussed based on existing frameworks
Aykol & Garrison (2011b)	-Cognitive presence -Learning outcomes -Content analysis	Community of inquiry	Inter-rater reliability at 75%	Validity is discussed based on collection and analysis of different types of data
Hou &Wu (2011)	-Content analysis -Lag sequential analysis in synchronous discussions	Social learning	Inter-rater reliability (k=0.67)	Validity is discussed based on existing frameworks
Aykol & Garrison (2011a)	Metacognition in asynchronous discussions	Community of inquiry	Not reported but discussed	Discussed based on existing metacognition constructs and instruments
Valcke, et al. (2009)	- Cognitive processing categories in Bloom's taxonomy - Cognitive, affective, and	Social interaction	Inter-rater reliability reported for both instruments (and sections of the instruments) ranging from K=0.87 to 0.95	Not explicitly discussed but instruments are based on existing constructs that are discussed

	metacognitive learning			
Xie & Bradshaw (2008)	Solving ill-structured problems, critical thinking	-Collaborative inquiry -Social learning	Inter-rater reliability represented by Pearson correlation reported on problem representation 1 ($r = .856$, $p < .001$), representation 2 ($r = .745$, $p < .001$), representation 3 ($r = .738$, $p < .001$), and representation 4 ($r = .821$, $p < .001$). And on problem solution 1 ($r = .698$, $p < .001$), solution 2 ($r = .756$, $p < .001$), solution 3 ($r = .781$, $p < .001$), and solution 4 ($r = .811$, $p < .001$).	Scoring rubric is based on an existing instrument; additionally two experts in the field of educational psychology reviewed the rubrics prior to implementation in scoring.

NEW FRAMEWORK: QUALITATIVE ANALYSIS

Some researchers use qualitative approaches to evaluate online discourse. An advantage of a qualitative approach is the possibility of exploring new aspects of discourse that may not be captured in a previously constructed framework. For example, Rourke and Kanuka (2007) incorporated a unique approach to online discussion evaluation in which they conducted post-qualitative analysis and interviewed students about their interactions and writing experiences. Other researchers examined the level of critical thinking and involvement of students in asynchronous discussions (Lim, Cheung, & Hew 2011; Vonderwell, Liang, & Alderman 2007). This approache yielded information on student exchange of information that may not have been adequately captured by an existing framework that quantified the information of messages.

Arend (2009) used a mixed methods approach to explore critical thinking patterns in online asynchronous discussions. The emphasis of this particular study was on qualitative analysis that revealed many subtle aspects of advanced critical thinking when instructor involvement is more purposeful and less prevalent. Baran and Correia (2009) employed basic quantitative approaches (number of posts, type of posts) and qualitative approaches (discourse evaluation) in mini case studies to analyze students' discussions in education classes. They also used triangulation of discourse data, course materials and instructor guidelines to strengthen the study's trustworthiness. Findings of the study suggest student-led discussions can be very instrumental in boosting motivation to participate in discussions, generation of new ideas, and the creation of an environment conducive to overall learning.

In summation, qualitative approaches allow for exploration of new discourse aspects that may not be otherwise captured when employing an evaluation tool already in use. However, in some cases, constructs purportedly being explored in these qualitative studies have many similarities with existing frameworks previously described and that would have to be investigated by the researcher before using in online discussion analysis.

RECOMMENDATIONS

The current paper updates Spatariu et al.'s (2004) review to provide an overview and evaluation of the newer frameworks for evaluating different aspects of quality in online discussions. Studies were placed in four categories of analysis: argumentation, interaction, content, and qualitative. The classification is primarily for the ease of understanding the concepts targeted for measurement, although there are areas of overlap. An important aspect of choosing one approach over another for research or practical reasons involves considering both discussion implementation (i.e. accomplishing course goals) and the evaluation of the discourse (i.e., grading, instrument validation).

METHODOLOGICAL CONSIDERATIONS

Below we discuss a few methodological aspects that can help in advancing research in this field. It is important to note that some of the instruments presented need additional testing for validity and reliability. There is a substantial amount of research moving in this direction for some of the frameworks presented, while others are

isolated studies that cannot claim sound generalizability based on quality measurement. For example, community of inquiry has received a lot of attention in the literature and some articles examined validity and reliability evidence (Garrison, 2007; Garrison et al. 2004; Garrison et al. 2006). Further, DeWever, Schellens, Vackle, and Keer (2006) examined 15 content analysis frameworks for evaluating online discourse. They paid particular attention to the theoretical base, validity and reliability reporting, and the choice of the unit of analysis. As the three tables illustrate, some of the newer frameworks provide the reader with information on validity and reliability (Aykol & Garrison, 2011b; Heo et al., 2010; Hou & Wu, 2011; Hull & Saxon, 2009; Shea et al., 2011) while others suggest more studies need to be conducted (Aykol & Garrison, 2011a; Salminem et al., 2010). It appears as though newer analytical frameworks are grounded in particular learning theories.

Penny and Murphy (2009) took a different, more practical approach; they collected, compared, and analyzed 50 rubrics being utilized for college level asynchronous discussion evaluation. They studied the commonalities among these rubrics and placed them in the following categories: cognitive, mechanical, procedural and interactive. This type of research and analysis can be useful for practical applications; however, we encourage more in-depth exploration of each instrument's methodological issues. For example, Rourke and Kanuka (2009) conducted a comprehensive literature search of over 250 articles that involve community of inquiry and reported that only five of them included a concrete measure of student learning. This means that no validity evidence was advanced indicating the method accurately and consistently measured student learning outcomes.

It is important that future research considers other salient aspects when examining online discussion quality, for example, accuracy, time requirements, and trainer scoring issues (Meyer, 2003). We suggest further work should be done in automated computerized assessment systems based on these frameworks. Some researchers have already developed tools along these lines such as the discussion analysis tool (Jeong 2003; Jeong, Clark, Sampson, & Menekse 2011). However, more research is needed to improve the operation, functionality and performance of computerized assessment systems, as they can be difficult to learn how to use.

Lastly, more research needs to be conducted to determine how the current constructs measured by these frameworks correspond to other learner characteristics such as motivation (Zhang, Koheler, & Spatariu, 2009), metacognition (Hou & Wu, 2011), and epistemology (Nussbaum, Sinatra, &Poliquin, 2008). One way to show evidence of construct validity is through looking at other constructs (convergence) to see how they are related to discourse frameworks. Zhang et al. used a unique approach to identify some of the more outlying learner characteristics by developing and validating an instrument for motivation for critical reasoning in online discourse. This type of instrumentation can provide data on how motivation for reasoning is related to argumentative aspects of online discussions or higher levels of critical thinking as exhibited in online discourse. Hartnett (2012) conducted research that reveals the importance and complexity of relationships between motivation, participation, and achievement of pre-service teachers in online asynchronous discussions. Both holistic learner approaches as well as particular constructs related to learning approaches have to be further developed and explored to further the field's understanding of ways to analyze online discussions quality.

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Generic Assessment Rubrics for Computer Programming Courses

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ABSTRACT
In programming, one problem can usually be solved using different logics and constructs but still producing the same output. Sometimes students get marked down inappropriately if their solutions do not follow the answer scheme. In addition, lab exercises and programming assignments are not necessary graded by the instructors but most of the time by the teaching assistants or lab demonstrators. This results in grading inconsistencies in terms of the marks awarded when the same solution is being graded by different person. To address this issue, a set of assessment rubric is necessary in order to provide flexibility for critical and creative solutions among students as well as to improve grading consistencies among instructors and teaching assistants or demonstrators. This paper reports the development of assessment rubric for each domain in computer programming courses; cognitive, psychomotor, and affective. The rubrics were then implemented for one academic semester consisting of 14 weeks. An interrater reliability analysis based on Kappa statistic was performed to determine the consistency in using the rubrics among instructors The weighted kappa is 0.810, therefore, the strength of agreement or the reliability of the rubric can be considered to be 'very good'. This indicates that the scoring categories in the rubrics are well-defined and the differences between the score categories are clear.
Keywords: Scoring, assessment rubric, computer programming, cognitive, psychomotor, affective, Kappa statistics.

INTRODUCTION

Grading programming assignments and projects are similar to grading traditional assignments such as written essays. The primary distinctions between them are the unique keywords or constructs across different programming languages and the diverse possible solutions associated with a particular problem solving techniques. Traditional assessment for computer programming assignments and projects usually depends on an answer scheme that includes the source code as a model answer with marks allocated to specific lines of code. This model answer is then used by the instructors to allocate marks to the students' programs based on the provided source code in the answer scheme.

The problem with the traditional schema-based approach of awarding marks according to a "point-per-correct-statement" is that students are being graded based similarity of their solution to the answer scheme. This leads to little or no consideration given to creativity and originality in the student solutions. In programming, the same problem can usually be solved using different constructs but still producing the same output. Students often get marked down inappropriately if their solution is not exactly the same as the instructor's solution or alternatively marked up if their solution is similar to the provided solution. In addition, lab exercises and programming assignments are not necessary being graded by the instructors but most of the time by the teaching assistants or lab demonstrators. This results in grading inconsistencies in terms of the marks awarded when the same solution is being graded by different person. Instructors, for example, may emphasize on the design of the solutions. Demonstrators, on the other hand, may emphasize on the programming syntax.

To address this issue, a set of assessment rubric is necessary in order to provide flexibility for critical and creative solutions among students as well as to improve grading consistencies among instructors and teaching assistants or demonstrators. The literature has revealed that strategies used to grade programming assessments has evolved from grading students based on an answer scheme where marks are allocated to individual programming statements to a more holistic and inclusive methodology using rubrics. A rubric is a set of ordered categories to which a given piece of work can be compared. Scoring rubrics specify the qualities or processes that must be exhibited in order to assign a particular evaluative rating for a performance (McDaniel, 1993). As a grading tool, rubrics have successfully enable the instructors to assess the student's understanding and creativity to produce a solution in programming courses (Becker, 2003; Ahoniemi and Karavirta, 2009; Payne et al., 2012) as well as evaluating research skills in strategic management (Whitesell and Helms, 2013), ethical behavior (Carlin et al., 2011), critical thinking in engineering (Ralston and Bays, 2010; Loon and Lao, 2014), and reflective writing in medicine (Wald et al., 2012).

This study hypothesizes that rubrics provide the necessary structure and guidance that enable instructors to award marks as a whole for students' ability in problem solving, creativity, and aesthetics of any graphical user interface as well as the use of good programming practice and standards. The central focus of this research will be on creating a set of rubrics as a benchmark to measure student learning outcomes in introductory computer programming courses offered by the Faculty of Computer Science and Information Technology (FCSIT) at Universiti Tun Hussein Onn Malaysia (UTHM). At present, UTHM has to cope with very large first year classes with average of 70 students per section with multiple sections to cater four specializations of undergraduate Computer Science programs: Software Engineering, Information Security, Web Technology, and Multimedia Computing. This necessitates for more than one instructor and teaching assistants for lab sessions in each program. Due to the high number of student enrollment and diverse background of the instructors or demonstrators, grading lab assignments and group projects is particularly a challenge especially in ensuring fair delivery to all students.

The main goal for this study is to promote critical and creative thinking skills and to improve grading consistencies in programming subjects by introducing a generalized programming rubric to be used across all programming languages such as C, C++, and Java. The outcome of this research is able to increase the effectiveness in teaching and learning activities in terms of consistent assessment of the course learning outcomes. The rubric developed in this study is presented in the section following the related works. Next, the research methodology is detailed out to explain the validation process of the developed rubrics followed by the findings. Finally, the paper is concluded with some indication for future research.

RELATED WORK

The Outcome-based Education (OBE) system emphasizes the importance of a curriculum content to be driven by learning outcomes (Spady, 1994). In OBE, the learning outcomes are expressed as statements of knowledge and skills individual students should possess at the end of the course they enrolled. An OBE system offers a comprehensive approach to organize and operates an education system that is focused on successful demonstration of learning sought from students at the end of the learning cycle (Murphy and Duncan, 2007).

The OBE system has been introduced to the Faculty of Computer Science and Information Technology (FCSIT) at Universiti Tun Hussein Onn Malaysia (UTHM) since 2004. The learning outcomes of a program are set by various level of academic management team at FCSIT. There are three primary components of the OBE system; Program Educational Outcome (PEO), Program Learning Outcome (PLO), and Course Learning Outcome (CLO). The PEO expresses statements of long term objectives that describe what a Computer Science should be able to demonstrate as a result of attending its program. Clearly, the achievement of the PEO at faculty level is geared to the achievement of the vison and mission of UTHM. Table 1 shows the PEO for one of the Computer Science undergraduate program offered at FCSIT, which is the Bachelor of Computer Science (Software Engineering).

Table 1: Program Educational Outcome (PEO).

PEO 1	Apply basic knowledge, principles and skills in the field of Computer Science to meet the job specification. (Knowledge / Practical Skills)
PEO 2	Implement the responsibility for solving problems analytically, critically, effective, innovative and market-oriented. (Critical Thinking and Problem Solving / Life-long Learning and Information Management / Enterpreneurship Skills)
PEO 3	Acts effectively as an individual or in a group to convey information within the organization and community. (Team Working Skills / Communication Skills)
PEO 4	Practicing good values and ethics in a professional manner in the community and able to act as a leader. (Profesional, Social, Ethics, and Humanity / Leadership Skills)

The PEO statements are further refined to establish PLO. The PLOs highlight individual student's abilities that reflect their learning experiences at FCSIT. In addition, the management team of FCSIT is also required to consider the general learning objectives set by the Malaysian Qualifications Agency (MQA, 2008) and the Ministry of Higher Education (MOHE) in expressing the PLO. As a result, the PLO are expressed to satisfy components of MQA standards which include knowledge, practical skills, communication, critical thinking and problem solving, teamwork, life-long learning and information management, entrepreneurship, moral, professional and ethics and finally leadership. Students of the undergraduate programs at FCSIT are expected to

acquire the PLO upon completion of their studies. The implementation of the PLO is he PLO is then distributed across individual courses in the undergraduate programs. Table 2 shows the PLO for Computer Science programs at FCSIT.

Table 2: Program Learning Outcome (PLO).

PLO 1	Applying knowledge and understanding of essential facts, concepts, principles and theories in the field of Computer Science Software Engineering. (Knowledge – K)
PLO 2	Implementing Software Engineering knowledge in analyzing, modeling, designing, developing and evaluating effective computing solutions. (Practical Skill – PS)
PLO 3	Communicate in spoken and written form in order to convey information, problems and solutions to the problems effectively. (Communication – CS)
PLO 4	Analyze the appropriate techniques in the field of Software Engineering to solve problems using analytical skills and critical thinking. (Critical Thinking, Problem Solving – CTPS)
PLO 5	Demonstrate teamwork skills, interpersonal and social effectively and confidently. (Team Work – TS)
PLO 6	Using the skills and principles of lifelong learning in academic and career development. (Life Learning and Information Management – LL)
PLO 7	Fostering entrepreneurship in career development. (Enterpreneurship – ES)
PLO 8	Adopt values, attitudes and responsibilities in a professional manner from ths aspects of sosial, ethics and humanity. (Moral, Professional and Ethics – EM)
PLO 9	Effectively carry out the responsibilities of leadership. (Leadership – LS)

The PLOs serve as the basis of determining the course learning outcomes (CLO) for every course offered. Each set of programming CLO in the course syllabus is mapped to the PLO of FCSIT. The mapping is known as CLO-PLO matrix. The CLO shall be constructed in such a way to accommodate the PLO. The establishment of the CLO in programming courses applies principles of Bloom's Taxonomy which covers three learning domains outlined by MQA standard: cognitive, affective, and psychomotor (Bloom et al., 1994). Table 3 presents the complete set of levels in each domain.

Table 3: Levels in cognitive, psychomotor, and affective domain based on Bloom's taxonomy.

Level	Cognitive Domain
C1	Knowledge (KN)
C2	Comprehension (CO)
C3	Application (AP)
C4	Analysis (AN)
C5	Synthesis (SY)
C6	Evaluation (EV)

Level	Psychomotor Domain
P1	Perception
P2	Set
P3	Guided response
P4	Mechanism
P5	Complex overt response
P6	Adaptation
P7	Origination

Level	Affective Domain
A1	Receiving phenomena
A2	Responding to phenomena
A3	Valuing
A4	Organizing values
A5	Internalizing values

Eventually, to measure the achievement of cognitive, psychomotor, and affective domain in each CLO, a student is evaluated using one to five assessment tools: quiz, test, laboratory assignments, project, and final exam. Each of the assessment tool is assigned to ensure positive achievement for the courses. Indeed, such information has implication on the achievement of CLO and PLO that are usually evaluated at the end of the learning process. Table 4 shows a sample of specification table to evaluate the cognitive domain in an object-oriented programming course. The specification table is designed to plan the distribution of marks based on taxonomy level mapping. Such constructive mapping is valuable to evaluate how the CLO and PLO are evaluated and related and finally implies the PEO.

Table 4: A specification table for an object-oriented programming course.

Question No.	Course Content/ Topic	Marks Distribution based on Bloom's Taxonomy						Subtotal
		KN	CO	AP	AN	SY	EV	
		Level 1		Level 2		Level 3		
Q1 (a)	Chapter 2: Primitive data types	3						24
Q1 (b)	Chapter 3: Fundamental of OO	6						
Q1 (c)	Chapter 3: Fundamental of OO	6						
Q1 (d)	Chapter 4: Object and classes					9		
Q2 (a)	Chapter 3: Fundamental of OO				12			27
Q2 b)	Chapter 3: Fundamental of OO				15			
Q3 (a)	Chapter 5: Inheritance and polymorphism		5					25
Q3 (b)	Chapter 5: Inheritance and polymorphism			20				
Q4 (a)	Chapter 4: Object and classes				5			24
Q4 (b)	Chapter 4: Object and classes					10		
Q4 (c)	Chapter 4: Object and classes					9		
Subtotal based on taxonomy (Marks)		15	5	20	32	28	0	100
Subtotal for each level (Marks)		20		52		28		40%
Cognitive level (%)		20%		52%		28%		100%
Distribution of cognitive level (%)		5%		35%		60%		100%

At FCSIT, the specification table is used to assess only the cognitive domain via quizzes, tests, and final exams. The assessment method is still using the answer scheme. However, assessments for lab assignments and projects are not necessary being graded by the instructors but most of the time by the teaching assistants or lab demonstrators. This calls for the need of a generalized rubric to cover all continuous learning assessments other than tests and final exams.

RESEARCH METHODOLOGY

A rubric is a set of categories developed based on a specific set of performance criteria. As an assessment tool, a rubric should cover all learning domains offered in computer programming courses. The purpose of such classification is to categorize different objectives that educators set for the students because educators have to focus on all three domains to create a more holistic form of delivery. In order to develop the rubric, the first step is to identify the learning outcomes at the program level followed by the course level before the types of assessments could be determined. The rubric can then be developed for a specific type of assessment such as lab assignments or group projects. In this study, the rubric development and validation process are founded on the principle of continuous feedback and improvement involving the following steps:

Step 1: Identify Program Learning Outcomes (PLO) and Course Learning Outcomes (CLO)

From the curricula, all programming courses are selected involving different languages (i.e. C, C++, Java). The PLOs and CLOs for each course were tabulated and compared. At FCSIT, UTHM, each course has three CLOs in average. Next, the assessment types were determined across all the courses and the percentage of each assessment type according to the PLO and CLO were distributed. Again, the types of assessment include tests, assignment, practical/lab, group project and final examination. Table 5 shows the mapping of PLOs and CLOs across all programming courses. The types of assessments are also indicated for each learning objective.

From the list of assessment methods provided in the table, quiz, test, and final examinations in CLO1 are graded based on traditional schema-based approach because the tools are only assessing the cognitive learning domain in computer programming. Lab assignments (CLO2) and projects (CLO2, CLO3), however, are designed to assess all three learning domains; cognitive, psychomotor, and affective. Because each CLO assess only one learning domain, the rubrics developed will be categorized according to the CLO. For each CLO, the level of domain for cognitive, psychomotor, affective are also assigned.

Table 5: Mapping of course learning outcomes to program learning outcomes across all programming courses.

		Program Learning Outcome (PLO)									
		Knowledge	Knowledge & Practical	Communication Skills	Critical Thinking & Problem Solving	Team Working Skills	Life-long Learning	Entrepreneurship Skills	Professionalism, Social, Ethics and	Leadership Skills	
Course Learning Outcomes (CLO)		PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	Assessment
CLO 1	Design problem solving process based on object oriented concept.				C5						Quiz, Test, Lab, Project, Final Examination
CLO 2	Construct an object oriented computer application using Java programming language.		P4								Lab, Project
CLO 3	Demonstrate the implementation of object oriented concept using any high level programming language.						A3				Project Presentation

Step 2: Formulate the rubric

In formulating the rubric, one or more dimensions that serve as the basis for judging the student work were determined. Each CLO was broken into one or more objectively measurable performance criteria along with its sub-criteria. The basic dimension in the rubric is the assessment type, whether delivered by the students in the form of written reports or via presentation. Next, for each dimension, a scale of values from 1 to 5 on which to rate each dimension is assigned; 1 is being very poor, 2 is poor, 3 is fair, 4 is good, and 5 is excellent. Finally, within each scale, the standards of excellence for specified performance levels accompanied were provided. Table 6 to Table 8 show the rubric for CLO1 (cognitive), CLO2 (psychomotor), and CLO3 (affective), respectively.

Table 6: Rubric for CLO1. Design problem solving process using algorithm/object-oriented concepts (Cognitive – C5, PLO4 – CTPS).

Assessment	Criteria	Sub-criteria	Level	1	2	3	4	5
Report	Ability to analyze problem and identify requirements	Identify correct input/ output	C2	Unable to identify any input and output	Able to identify only one input or output	Able to identify correctly some input and output	Able to identify correctly all input and output	Able to identify correctly all input and output and provide alternative
	Ability to	Construct	C3	Unable	Able to	Able to	Able to	Able to

	demonstrate design solution	correct flowchart or pseudocode		to construct	construct but mistake on symbol	construct correctly	construct correctly and use proper elements	construct correctly, use proper elements and documentation

Table 7: Rubric for CLO2. Construct a computer application/object oriented computer application using object:-oriented concepts (Psychomotor – P4, PLO2 – Practical Skill)

Assessment	Criteria	Sub-criteria	Level	1	2	3	4	5
Report	Ability to apply required data type or data structure	Appropriate choice of variable names or data structure (i.e. array/ linked list)	P3	Unable to identify required data type or data structure	Able to identify required data type or data structure but does apply correctly	Able to apply required data type or data structure but does not produce correct results	Able to apply required data type or data structure and produce partially correct results	Able to apply required data type or data structure and produce correct results
	Ability to apply required control structure	Correct choice of sequential, selection or repetition control structure	P4	Unable to identify required control structure	Able to identify required control but does apply correctly	Able to apply required control structure but does not produce correct results	Able to apply required control structure and produce partially correct results	Able to apply required control structure and produce correct results
	Ability to run/debug	Free from syntax, logic, and runtime errors	P3	Unable to run program	Able to run program but have logic error	Able to run program correctly without any logic error	Able to run program correctly without any logic error and display inappropriate output	Able to run program correctly without any logic error and display appropriate output
	Ability to perform input validation	Validate input for errors and out-of-range data	P3	The program produces incorrect results	The program produces correct results but does not display correctly Does not check for errors and out-of- range data	The program produces correct results but does not display correctly. Does little check for errors and out-of- range data	The program works and meets all specifications. Does some checking for errors and out-of- range data	The program works and meets all specifications. Does exceptional checking for errors and out-of- range data
Presentatio	Ability to	Comment /	P1	No	Docume	Docume	Document	Document

n	produce readable program	Description		documentation	ntation is simple comment in code	ntation is simple comments embedded in code with header separating the codes	ation is simple comments and header that useful in understanding the code	ation is well-written and clearly explains what the code is accomplishing
		Indentation / Naming Convention	P2	Unable to organize the code	The code is poorly organized and very difficult to read	The code is readable only by a person who already knows its purpose	The code is fairly easy to read	The code is extremely well organized and easy to follow

Table 8: Rubric for CLO3. Demonstrate the implementation of problem solving process/object-oriented concepts using high-level programming language (Affective – A3, PLO6 – Lifelong Learning)

Assessment	Criteria	Sub-criteria	Level	1	2	3	4	5
Presentation	Ability to demonstrate program in group	Demonstrate understanding on program design	A3	Unable to explain program design	Able to explain a little program design	Able to explain some program design	Able to explain entire program design correctly as it is	Able to explain program design correctly and provide alternative solutions
		Organization of group presentation	A4	Materials are not organized with missing information	Materials are partially organized with missing information	Materials are partially organized with required information	Materials are highly organized with required information	Materials are highly organized with additional information
		Cooperation from all members	A2	Unable to cooperate in a group	Forced cooperation through intervention	Demonstrate cooperation after intervention	Demonstrate cooperation through personal dominance	Demonstrate cooperation through group hierarchy

The rubrics have been developed as a 2D grid in Microsoft Excel sheet, where each row describes one evaluation criteria and the columns indicate the level of achievement. Since the rubric is already in an Excel form, the instructors simply fill in the student performance according to the desired column and the form will add up the corresponding values to produce a final score.

Step 3: Test the reliability of the rubric

Reliability refers to the consistency of assessment scores. On a reliable test, a student would expect to attain the same score regardless of when the student completed the assessment, when the assessment was scored, and who

scored the assessment. In order to measure the reliability of the rubrics, the rater reliability in the form of reliability coefficient is measured. Raters reliability refers to the consistency of scores that are assigned by two independent raters (inter-rater reliability) and that are assigned by the same rater at different points in time (intra-rater reliability) (Moskal and Leydens, 2000). According to Jonsson and Svingby (2007), the consensus agreement among raters depends on the number of levels in the rubric, whereby fewer levels lead to higher chance of agreement.

This study adopted the measurement of inter-rater reliability based on Kappa statistics (Cohen, 1960). In Cohen's kappa, values between 0.4 and 0.75 represent fair agreement beyond chance. Values ≤ 0 as indicating no agreement and 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41– 0.60 as moderate, 0.61–0.80 as substantial, and 0.81–1.00 as almost perfect agreement (McHugh, 2012).

EVALUATIONS

The rubrics developed in this study was implemented in three programming courses are offered during the First Semester of 2015/2016. The courses were Computer Programming (BIT10303) using C programming language, Object-Oriented Programming (BIT20603) using C++ programming language, and Java Programming (BIT33803). The rubrics were consistently used for grading lab assignments and group projects throughout the 14-week period of the semester. All the assignments and projects were graded independently by two random instructor or lab demonstrator using the same rubric. Table 9 shows the total number of students works/artifacts being compiled and graded based on the rubrics.

Table 9: Summary of total written artifacts graded using the rubrics. The artifacts for lab assignments and groups projects are in the form of source codes.

Course	No. of Students (a)	No. of Instructors/ Demonstrators (b)	No. of Lab (c)	No. of Assignments (d)	No. of Projects (e)	Total Artifacts (a * (c + d + e))
BIT10303	60 (S1) + 37 (S2) = 97	2	9	1	1	1,067
BIT20603	73 (S1) + 37 (S2) = 110	2	7	1	1	990
BIT33803	76 (S1) = 76	1	5	0	1	456
					Total	2,513

*S*i* indicate section number.

Based on Table 9, all sets of scores (i.e. four sets for BIT10303, two sets each for BIT20603 and BIT33803) are then statistically analyzed for inter-rater reliability using the Cohen's Kappa (Cohen, 1960). According to this metric, a Kappa of 1 indicates a perfect agreement, whereas a kappa of 0 indicates agreement equivalent to chance. The analysis was performed using the program Statistical Package for the Social Sciences (SPSS), version 20.0. Note that the instructors or demonstrators are referred as raters in calculating the kappa values. Two raters were randomly picked to evaluate the each artifact. Table 10 presents the results for both raters on every artifact.

Table 10: Assessment results for 2,513 artifacts by two independent raters.

	Rater #2					
Rater #1	1 (very poor)	2 (poor)	3 (fair)	4 (good)	5 (excellent)	Total
1 (very poor)	364	207	0	0	0	571
2 (poor)	161	349	55	1	0	566
3 (fair)	0	6	295	108	2	411
4 (good)	0	1	18	312	109	440
5 (excellent)	0	0	3	107	415	525
	525	563	371	528	526	2,513

Based on Table 10, the total number of observed agreements is 735, which constitutes 69.04% of the observations. The number of agreements expected by chance is 509.1, which is 20.26% of the observations. The kappa value is 0.612 with 95% confidence interval from 0.589 to 0.634. Based on the kappa value, the reliability of the rubrics is considered to be 'good' based on the strength of agreement between the two raters.

However, this calculation only considered exact matches between the two raters. Since the scale of dimensions

(very poor, poor, fair, good, excellent) are ordered, close matches were also being considered. This means if the first rater assessed an artifact as fair and the other as good, this is closer than if the rater assessed the artifact as poor and the other excellent. The calculation of weighted kappa assumes the categories are ordered and accounts for how far apart the two raters are. The weighted kappa is 0.810, therefore, using this approach the strength of agreement or the reliability of the rubric can be considered to be 'very good'. This indicates that the scoring categories in the rubrics are well-defined and the differences between the score categories are clear.

CONCLUSIONS

A generic programming rubric is proposed to be used across all programming courses offered by FCSIT at UTHM involving a variety of high-level programming languages such as C, C++, and Java. The rubrics are shared with the students every time a lab exercise or assignment is assigned to help them better understand the balance of the different activities in their final grade. From the rubrics, students are able to estimate the amount of effort that are required to achieve the perfect score. In this way, students are also playing active role of becoming independent in determining their own learning objectives. In the future, the rubrics will be used in establishing benchmarks for the programming courses and analyzing student performance to improve the learning and learning process including making adjustments to the curriculum.

ACKNOWLEDGEMENT

This project is sponsored by the Contract Research Grant from the Centre for Academic Development and Training (CAD) at Universiti Tun Hussein Onn Malaysia (UTHM).

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Modeling Behavior of Students in E-Learning Courses on the Basis of Use Interactive Animations

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ABSTRACT
Authors in their contribution deal with modeling the behavior of user in e-learning course based on the use of interactive animations. Nowadays, E-learning courses form a standard part of educational process. However, it is not so easy to determine the way students work with study material, whether they make use of it in order to increase didactic effectiveness of e-course. In the contribution authors point to the non-traditional method of recording students´ activities and reverse transition to previous lessons using interactive animations, which have been implemented into the study material. The method of recording students´ activities was implemented in the academic years 2009/2010 through 2013/2014. Students were divided into two groups – experimental and reference ones. The reference group did not use interactive animations, while in the experimental group interactive animations were implemented into the study material.
Keywords: behavior of students, interactive animations, interactive matrix, transition of e-learning course.

INTRODUCTION
Computer (interactive) animations may help concretise abstract, complex concepts and phenomena in science education, thus helping students to learn more easily and more effectively (Akpinar, 2013). The questions arises as to what the reasons are which have made interactive animations a vital part of modern ecurricula, and whether there is empirical evidence to support claims that using multimedia and interactivity in e-curriculum has positive impact to cognitive development and academic achievement at students (Pinter et al., 2012). Part of study of Informatics and Information technologies in higher education, in addition to programming is eg. graphics, theory of formal languages and automata and often the different subjects with a focus on the area of computer hardware. For understand the mutual action of the individual components PC must students handle basic physical principles. This specific area of hardware is called Logical systems of computers and the students applied their knowledge not only from mathematics but also physics, acquired his studies at secondary school. Abstract and complex concepts are especially difficult for students to grasp in the traditional learning environment using traditional teaching methods. As a result, learners at different levels and ages have difficulty understanding science concepts (Chiu et al. 2002). The reasons for these difficulties have some common features such as the students' varying levels of comprehension for science concepts. This variability is true for many fundamental concepts in all branches of science such as physics, chemistry and biology (Akpinar, 2013). The thorough investigation by Sekular and Blake (1990) into how students take in information, how they learn pointed out that the learning process takes place primarily by way of sight, and since it is the most vital of our senses, it is also the most highly-developed one. It enables a person to gather information from one's surroundings, analyze these and then decide how to process based on the deduced data. Graphical representations are defined as visual aids that act as supplement to any other textual information and will concentrate learners' attention (Mayer, 1989). Such representations will have maximum effect when accompanying some learning material that is (relatively) new to the learner (Mayer and Gallini, 1990). This is especially the case with computer animation that is designed to aid long-term learning in the form of focusing learners on certain objects in the beginning (Pinter et al., 2012).

METHODOLOGY OF RESEARCH
This study investigates the effects of using interactive animations based on predict-observe-explain as a presentation tool on students' (University students) understanding of the static electricity and concepts of electronic circuits (area of computer hardware). A quasi-experimental pre-test/post-test control group design was utilized in this study. This Experiment was realized in the academic years 2009-2014 (Winter semester). The

experiment group consisted of 20 students, and the control group also of 20 students. The control group worked by normal instruction in which the teacher provided instruction by means of lecture, discussion and homework. Whereas in the experiment group, dynamic and interactive animations based on predict-observe-explain were used as a presentation tool.

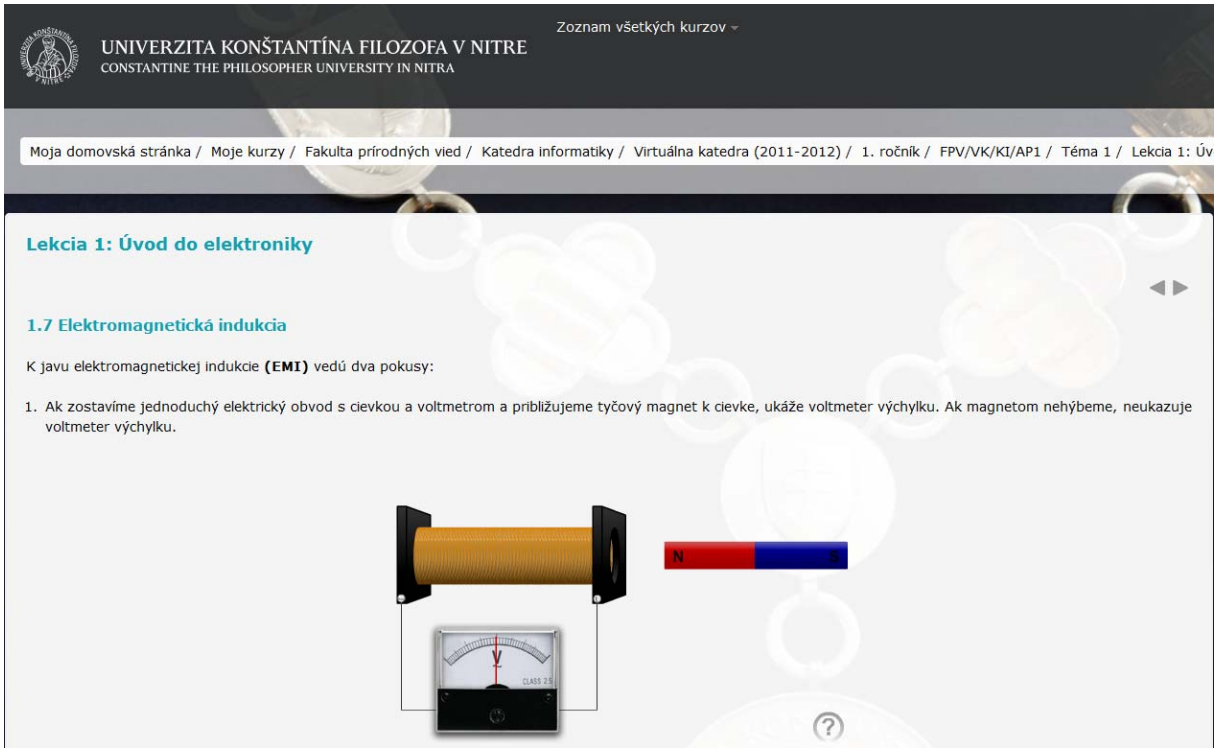

Figure 1: Example of interactive animation (changing the position of the magnet occurs misalignment of pointer the device).

Information on activities the student carried out in the e-learning course can be obtained from the records (Configuration module).
Observation of work can be divided into four main parts:

- Live signing from the last lesson,
- A report on activities,
- Records on participants,
- Statistics.

For the sake of acquisition of an idea of the real transition of all students through an e-learning course, methods of frequency and sequential analysis are mostly used. By means of these methods it is possible to set up the so-called interactive matrix (Chráska, 2007). Based on the found patterns of users´ behaviour, which are represented by sequence rules, it is possible to modify and improve the course (Munk et al, 2010). However, in order to be able to set up such type of matrix it is inevitable to filter out from the access statistics those data, which are connected with the side-show of students and they thus do not impact directly (or in a minimum possible degree) the method of acquisition of knowledge and skills. For us, such methods are for example (Nagyová, 2011):

- Initial course page view,
- Communication within the course,
- Profiles scanning.

RESULTS OF RESEARCH

Interactive matrix marked M represents a two-dimensional array of type n x n, where the number n is the number of overall activities realized by students in the course. It is possible to access the data in the matrix by means of the line number (variable i) and the column number (variable j). The matrix cells correspond to frequencies of incidence of variable j (of the given activity) after the activity i.

The creation of interactive matrix is influenced mainly by the selection of individual activities, which form header of the matrix. Activities depicted by the interactive matrix can represent, for example, the transition through individual chapters identically arrayed in line I and column j. In the following tables we present

activities of students representing transitions between individual chapters of the study material in the e-learning course Architecture of computers in the academic years 2009/2010 (Winter semester) until 2013/2014 (Winter semester).

Table 1: Interactive matrix of transitions between individual lessons in the academic year 2009/2010 (control group).

	Start study	L1	L2	L3	L4	L5	L6	L7	L8	L9	End study
Start study	0	2450	852	356	124	258	689	346	734	428	45
L1	892	0	1987	556	87	219	324	222	318	110	23
L2	634	554	0	2041	918	796	369	567	216	257	51
L3	176	652	347	0	1321	821	221	705	599	375	74
L4	841	869	490	1458	0	1878	478	756	311	338	36
L5	654	512	591	428	998	0	2887	568	850	151	111
L6	317	974	627	898	370	350	0	1655	347	185	34
L7	268	498	623	495	580	915	1331	0	1201	100	174
L8	954	825	829	461	613	558	471	434	0	1637	190
L9	438	604	268	947	864	466	420	623	350	0	1255
End study	526	249	315	185	277	216	265	170	57	46	0

Table 2: Interactive matrix of transitions between individual lessons in the academic year 2009/2010 (experimental group).

	Start study	L1	L2	L3	L4	L5	L6	L7	L8	L9	End study
Start study	0	1629	360	847	356	785	147	324	897	489	121
L1	980	0	1322	123	784	324	472	246	146	732	13
L2	999	2401	0	1325	258	753	159	456	321	798	27
L3	589	125	1324	0	2471	125	245	587	523	348	11
L4	359	547	125	756	0	687	225	586	152	245	58
L5	458	365	852	456	1247	0	122	111	252	584	98
L6	221	456	247	247	328	122	0	122	212	523	102
L7	556	128	258	258	654	122	125	0	578	236	54
L8	768	745	265	136	369	356	578	1125	0	1456	24
L9	452	257	132	458	147	369	785	145	1184	0	1471
End study	321	253	457	563	235	236	227	123	115	111	0

Table 3: Interactive matrix of transitions between individual lessons in the academic year 2010/2011 (control group).

	Start study	L1	L2	L3	L4	L5	L6	L7	L8	L9	End study
Start study	0	1005	123	241	235	632	568	512	122	145	11
L1	23	0	1247	220	215	666	553	596	215	233	123
L2	57	1147	0	2343	512	213	621	232	232	515	12
L3	123	111	1238	0	1247	233	258	223	562	923	45
L4	357	254	233	266	0	3568	222	465	212	232	95
L5	159	475	253	156	556	0	1247	213	113	952	78
L6	654	44	452	696	321	265	0	2582	875	213	68
L7	789	458	563	668	545	546	1024	0	2562	565	65
L8	257	754	126	160	456	546	546	555	0	1220	23
L9	369	351	165	161	516	815	566	546	872	0	1235
End study	57	123	124	245	264	214	235	11	63	24	0

Table 4: Interactive matrix of transitions between individual lessons in the academic year 2010/2011 (experimental group).

	Start study	L1	L2	L3	L4	L5	L6	L7	L8	L9	End study
Start study	0	1609	720	662	792	558	822	521	880	830	43
L1	955	0	1595	435	849	874	729	912	420	218	62
L2	949	1674	0	1455	896	411	862	325	930	538	30
L3	958	449	1674	0	1355	297	808	375	358	994	42
L4	221	706	667	1721	0	1279	831	480	814	266	53
L5	551	656	742	505	378	0	1004	458	609	292	20
L6	156	795	302	804	928	1429	0	1108	351	203	175

L7	663	694	251	846	956	892	676	0	1184	161	42
L8	982	356	826	703	629	710	615	1123	0	1523	262
L9	519	546	334	590	495	554	863	294	187	0	1358
End study	259	177	142	236	112	190	127	90	134	217	0

Table 5: Interactive matrix of transitions between individual lessons in the academic year 2011/2012 (control group).

	Start study	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**End study**
Start study	0	2687	235	214	268	235	789	124	125	247	13
L1	74	0	1987	234	157	547	249	652	735	621	56
L2	147	2410	0	2343	457	652	234	475	578	256	14
L3	478	245	235	0	1247	145	125	221	154	152	16
L4	245	592	265	263	0	3568	262	215	262	110	24
L5	212	812	256	124	454	0	1247	512	155	823	48
L6	142	323	262	296	265	265	0	2582	652	854	78
L7	25	548	546	556	263	215	256	0	2562	158	98
L8	57	485	152	152	125	287	152	158	0	1220	91
L9	21	156	145	458	542	225	486	267	225	0	2347
End study	47	4	15	215	25	50	54	52	87	12	0

Table 6: Interactive matrix of transitions between individual lessons in the academic year 2011/2012 (experimental group).

	Start study	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**End study**
Start study	0	1578	258	152	785	225	211	125	125	215	65
L1	125	0	2145	15	158	524	223	215	152	185	23
L2	325	1360	0	2254	254	258	258	872	155	375	25
L3	252	154	2451	0	1524	151	284	582	152	815	15
L4	152	522	145	1545	0	1552	216	415	562	812	12
L5	58	528	485	458	3542	0	5222	132	521	217	244
L6	158	785	212	556	569	511	0	2725	215	25	552
L7	548	542	252	541	965	232	51	0	1247	223	54
L8	215	85	895	961	215	548	514	4325	0	2251	85
L9	85	57	12	23	514	584	145	12	2152	0	3332
End study	485	595	95	558	45	54	82	48	48	21	0

Table 7: Interactive matrix of transitions between individual lessons in the academic year 2012/2013 (control group).

	Start study	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**End study**
Start study	0	3564	52	562	596	592	114	596	325	147	45
L1	256	0	1045	51	155	214	124	154	128	875	5
L2	784	256	0	1384	135	357	158	152	258	761	26
L3	136	863	4578	0	2004	201	741	357	258	208	45
L4	789	853	121	182	0	3007	257	722	225	167	56
L5	568	259	158	637	475	0	1367	277	248	365	45
L6	14	972	223	951	430	457	0	1473	256	152	15
L7	26	782	182	892	942	211	247	0	4236	255	54
L8	189	784	253	261	885	555	445	115	0	2544	25
L9	288	123	127	357	226	168	496	957	5687	0	2347
End study	12	256	213	686	145	556	562	215	25	4368	0

Table 8: Interactive matrix of transitions between individual lessons in the academic year 2012/2013 (experimental group).

	Start study	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**End study**
Start study	0	1032	152	56	545	589	325	591	102	147	22
L1	874	0	2567	256	262	258	894	255	235	482	56
L2	852	2223	0	1078	251	487	365	811	254	278	21
L3	472	152	157	0	1125	963	578	215	754	221	32
L4	465	254	271	1472	0	5687	145	878	241	811	247
L5	863	505	562	255	1254	0	2354	922	152	158	82

L6	552	225	522	364	125	3587	0	2235	751	235	12
L7	124	526	821	482	142	122	6211	0	4210	257	54
L8	989	222	121	212	224	127	752	1235	0	1247	25
L9	222	121	474	125	758	223	352	121	2225	0	1985
End study	22	25	48	25	58	52	23	48	16	21	0

Table 9: Interactive matrix of transitions between individual lessons in the academic year 2013/2014 (control group).

	Start study	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**End study**
Start study	0	1027	258	245	215	122	171	825	150	147	15
L1	452	0	2522	148	847	512	152	821	122	215	82
L2	256	1270	0	7511	253	895	122	148	152	472	47
L3	548	472	4851	0	2233	223	872	335	522	417	42
L4	582	415	845	581	0	3231	485	512	145	213	23
L5	852	481	485	527	535	0	1233	222	852	354	51
L6	562	212	485	215	415	147	0	1845	152	212	32
L7	851	151	562	561	185	758	669	0	4154	512	21
L8	75	123	213	357	152	152	154	585	0	1522	15
L9	125	145	21	478	84	15	128	482	1223	0	4844
End study	25	58	15	21	72	15	54	14	54	4122	0

Table 10: Interactive matrix of transitions between individual lessons in the academic year 2013/2014 (experimental group).

	Start study	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**End study**
Start study	0	1984	245	275	365	956	214	482	147	120	32
L1	84	0	5458	523	182	482	145	124	142	754	12
L2	145	1223	0	4235	458	125	215	582	287	122	21
L3	752	123	255	0	4203	523	581	152	851	522	35
L4	635	154	452	553	0	2536	152	845	485	235	89
L5	545	152	472	851	1234	0	2347	582	215	215	12
L6	375	512	152	152	123	152	0	1208	264	823	45
L7	754	123	158	254	502	123	5145	0	1369	556	52
L8	421	215	852	125	258	921	122	1522	0	2049	59
L9	215	145	495	528	555	145	552	142	3547	0	2102
End study	69	72	125	57	82	15	56	15	82	75	0

Based on interactive matrices we can observe the frequency of incidence of j- sequentiality (activity) after the activity depicted in line i. Values, which are highlighted in colours, represent maximum values within the line and column, and at the same time, in both interactive matrices are highlighted those values, which significantly influence the transition of one activity into another (all numbers in cells above the value 1000). Maximum value in the column expresses the fact that students realized the given activity most frequently and then they proceeded in another activity with the highest maximum value situated in the nearest column. In case that in the column of the interactive matrix appears more than one maximum value, it means that student during his study returned to this activity after a while. This phenomenon can be observed in both interactive matrices (each academic year).

DISCUSSION

By modelling the behaviour of users based on their activity we succeeded in defining the real transition through the e-learning course using interactive matrices. Experiment, which was carried out in academic years 2009/2010 through 2013/2014, was focusing on defining the effectiveness of utilization of interactive animations in the e-learning course. The method we used can be considered an indirect one. Based on the results of interactive matrices in individual academic years it is clear that the experimental group, which kept the e-learning course with implemented interactive animations at their disposal for the whole period of study, kept returning to the previous study lessons at any time. This fact proves our presumption that by implementing interactive animations into the e-learning course its didactic effectiveness as well as the one of its utilization were increased. That is the following rule of proportion applies: the more frequently the students used the back transition, the more frequently they employed interactive animations and the e-learning course itself. High figures ranging between 3000 and 5000 presented in interactive matrices represent places to which the students returned based on the written test announced in advance and also the places, to which the students returned after completing the test in order to verify the correctness of what they had written into the test. It is interesting that the students in the reference group, who did not use the implemented interactive animations, employed the previous lessons only in

a minimum way, despite the announced written tests. When using a questionnaire, as a research and evaluation pedagogic tool for finding information on the knowledge, opinions or attitudes of students we found that students of the reference group were frequently frustrated and irresponsible and took the study slovenly. Since the students, who were divided into both the experimental and reference groups were offered commonly and in the same form realized lectures, the only reason for their failure can be seen just in the distinct provision of the study material.

CONCLUSIONS

The results show evidence that interactive simulation contents can be very effective tools in the learning process. It can deliver information in a very attractive way, which also can be advantageous in assembling curricula for the students who have different skill levels and learning styles. Besides that, it can help learners to understand scientific topics, with presenting important conceptual relationships (Pinter et al., 2012).

In case of implementing interactive animations into the study material we obtain not only attractive form of providing the knowledge to the students, but also the possibility to determine the way the students use to work with this material. However, in the contribution we pointed also to another fact in case of using interactive animations, which is returning to previous lessons. This step is very important within the educational process, since by means of it there comes to the confirmation and stabilization of the contents of lessons. In case of the experimental group, which employed the implemented study materials, there came to the reverse transition and thus there is a presumption that the students attempted at putting the concepts acquired by means of interactive animations into context with the concepts previously taken within the study material. In the contribution we focused only on determining the activity of the students when using interactive animations and modelling the transition through the e-learning course. Study results of both the reference and experimental groups were not evaluated in this contribution. However, based on the partial evaluation we can state that differences between the experimental and the reference groups were marginal.

Similarly, as we do, Pinter came to the conclusion: However, results also show that there is a tendency of decreasing the difference between those learners who had used the animation and those who had not. Is this because there is an increasing number of such and similar e-curricula available to students, and this kind of attractive multimedia presentations are no longer motivate students as they used to before. However according to the Felder–Silverman (Richar and Rebeca, 2005) learning style model, the animations containing a lot of visual elements, such as pictures, diagrams, flow charts etc. are preferred for the visual learning profile, while written and auditory explanations are effective with the verbal type of student. And to mention another example: students with an active profile prefer the simulation (interactive animation) which allows experimenting with the system parameters. (Pinter et al., 2012).

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Predicting Virtual Learning Environment Adoption: A Case Study

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ABSTRACT
This study investigates the significance of Rogers' Diffusion of Innovations (DOI) theory with regard to the use of a Virtual Learning Environment (VLE) at the Royal University of Bhutan (RUB). The focus is on different adoption types and characteristics of users. Rogers' DOI theory is applied to investigate the influence of five predictors (relative advantage, complexity, compatibility, trialability and observability) and their significance in the perception of academic staff at the RUB in relation to the probability of VLE adoption. These predictors are attributes of the VLE that determine the rate of adoption by various adopter group memberships (Innovators, Early Adopters, Early Majority, Late Majority, Laggards). Descriptive statistics and regression analysis were deployed to analyse adopter group memberships and predictor significance in VLE adoption and use. The results revealed varying attitudes towards VLE adoption by academic staff at RUB. Few predictors were consistent with previous research on VLE adoption. There were also significant differences from previous research on predictors such as the deviation in adopter frequency from that predicted by Rogers DOI theory. Therefore, it can be concluded that it is misleading to rely on the DOI theory in the way it is currently operationalised for predicting VLE use.

INTRODUCTION
The diffusion and adoption of Information and Communication Technologies (ICT) have created an opportunity for universities to complement traditional face-to-face classroom teaching. Moreover, adoption and effective utilisation of ICT in education have become an acknowledged issue of strategic importance in educational institutions around the world (Jebeile &Reeve, 2003).The diffusion of innovations is happening across the globe, and has resulted in adoption or rejection, depending upon the users' perception of the innovations.

The adoption of innovations in higher education can be explained through Rogers' theory of the Diffusion of Innovations (sometimes DOI) (Rogers, 2003). Rogers's theory is widely used as a framework for technology adoption and is composed by a number of factors that influence the motivation of users to facilitate the rate of adoption (Sahin, 2006). For instance, VLEs (Virtual Learning Environments), which are the focus of this paper is a technology which practitioners need to advertise, internally promote and disseminate, and Rogers' DOI theory can be very helpful in this regard. Rogers (2003) states that the rate of adoption by various adopters (teaching faculty) depends on the factors or characteristics of a given innovation, which in our case is VLEs. Jebeile & Reeve (2008) outlined that after the evaluation of those factors/characteristics, it enables education administrators to plan and design educational technology and infrastructures. This adds strategic importance to the evaluation by practitioners of various types of faculty, to determine their readiness, adoption powers and DOI factors in order to provide institutional management with knowledge and adequate monitoring instruments, supporting improved planning. This can be highly useful for targeting training, addressing characteristics of ICT tools, etc.

Previous research (e.g. Al-Ali, 2007; Keesee & Shepard, 2011;Kilmon & Fagan, 2007; Zayim et al., 2006; Naveh, Tubin & Pliskin, 2006) has studied VLE adoption from a DOI perspective, but still as isolated case studies. Graham, Woodfield& Harrison (2013) use DOI for VLEs, but concentrate not on the predictors, but on the process. By providing comparative results of Keesee & Shepard's instrument for educational technology, the present study strengthens the area of knowledge of Diffusion and Innovation in this specific context. Generally, research has placed quite low value on replication compared to reporting novel findings. However, this need to be moderated with the recent results of Open Science Collaboration (2015), showing that less than 40% of established findings in psychology can be replicated. This study addresses this need in the context of Diffusion of Innovations, and in particular within Virtual Learning Environments. However, it is not a study that merely verifies earlier literature; rather, it demonstrates that for VLE, DOI theory may still be precarious. Furthermore, none of the aforementioned case studies were carried out in a developing country. This study contributes to this research area by analysing an interesting case, Royal University of Bhutan. It is the only major university of the country, and its activities are widely dispersed.

In the following sections, the academic staff (henceforth, staff) characteristics and the current adoption status are reported, which allows for a logistic regression analysis of these variables. This can be used for the prediction of adoption, and our results indicate that there is more opportunity for prediction than previous literature has found. There are also large variations within the university and between universities in the domain of VLEs, which has significant consequences for other tertiary educational institutes that rely on the DOI literature.

CURRENT SITUATION OF ROYAL UNIVERSITY OF BHUTAN

This section describes the research context. RUB is a federated public type University with 10 member colleges distributed across the country. At the time of writing, it has 483 staff and approximately 10,000 students (RUB Statistics, 2013). The RUB ICT strategic plan (Reid& Cano, 2005) has outlined clearly the needs and strategy to setup VLE as one of the components at RUB which can fulfil the expectations at the university of a high level of student involvement and self-learning. This has formed the platform for the integration of technology for teaching and learning. A Wide Area Network (WAN) that connects all the member colleges and server rooms provides the infrastructure for the VLE. It has power backup in order to cope with electricity shortages and malfunctions. The Moodle open source software has been adopted by RUB as its VLE, and has been installed and configured in each college location. RUB formally launched e-learning in Bhutan in May 2011, although Samtse College of Education had been using it since 2004. RUB has adopted a hybrid or blended learning method (Rennie& Mason, 2007), and the VLE facilitates both face-to-face and pure online learning. It provides opportunities for the students to spend less time in a class and engage more in self-directed learning online. Although all the member colleges are connected, RUB is unable to fully support the information exchange on the current bandwidth, which is limited and still lacks consistency to allow full reliance on university-wide solutions (Rennie& Mason, 2007). This is a common state of affairs in developing countries today. Thus, the campus-based setup of VLEs in each individual location was accepted to reduce the pressure on university-wide bandwidth.

Teaching staff at RUB have a great degree of influence on the students, since students relocate to the college and teachers teach their chosen subjects (Rennie& Mason, 2007). For this reason, they are considered to be the ultimate stakeholder group for the future sustenance of the VLE, by encouraging and motivating students to adopt and utilize it until student adoption is total. Even after three years of formal introduction of the VLE facilities, it has been observed that the rate of VLE adoption is very low among the colleges/institutions within the university. Hence, it was found to be necessary to evaluate the level of VLE utilization by staff around the colleges. Despite the training provided to around sixty percent of staff, the number of modules integrated into the VLE is far lower than modules taught only face-to-face. It has become very important to investigate predictors that influence the staff attitude towards the utilization and adoption of e-learning in order to use these to determine the sustenance of VLE.

DIFFUSION OF INNOVATION

The probability of new ideas being adopted or abandoned by members of a given culture in the social system is explained by Rogers' (2003) Diffusion of Innovations (DOI) theory. An innovation is defined as an idea, practice, behaviour or object that is perceived by the individual to be “new” (Rogers, 2003). Diffusion is *“the process to communicate an innovation through certain communication channels over time among the members of a social system”* (ibid, p. 5). In the context of the present research, the innovation in question is VLEs, which at this stage is a commonly known acronym at all the Colleges. The diffusion of an innovation is a continuous process that can be examined, facilitated, decided and promoted (Keesee & Shepard, 2011). The rate of adoption of innovations varies, depending upon the innovation types, opinion leaders and types of adopters. Therefore, the DOI theory provides the framework to analyse patterns of staff technology adoption in higher education (Zayim et al., 2006). It states that the technology is not adopted by individuals in the social system at the same time, but this depends on the attitude of the population that has been divided into five categories. The details of these five categories are illustrated in Figure 1.

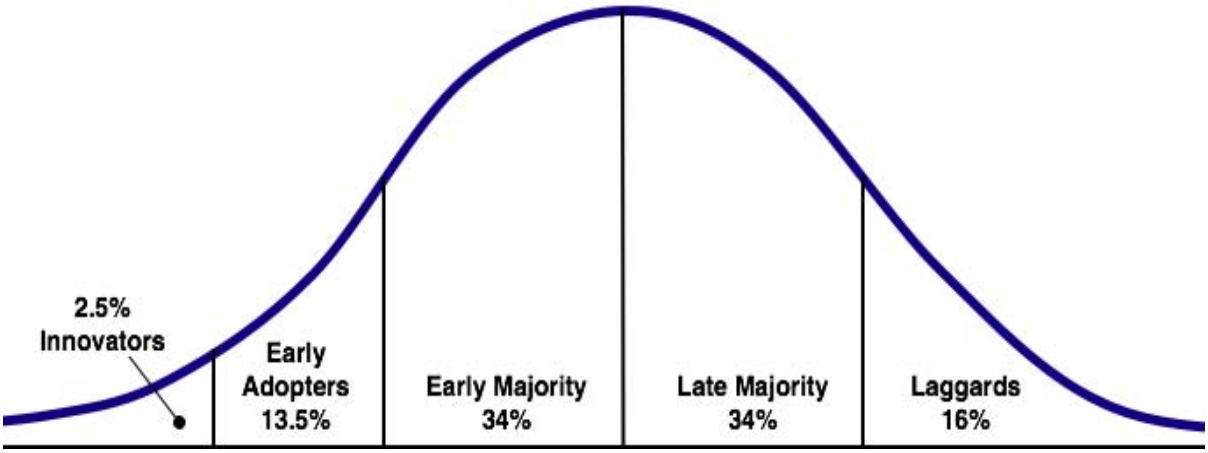

Figure 1: Various Adopters (Rogers, 2003, p. 655)

The following segments detail the various adopters as per Rogers (2003):

Innovators are the venturesome who are interested in the technical aspects, and are risk takers.

Early Adopters are respected and considered as change agents with the greatest degree of opinion about the new ideas. They examine the innovation as regards its benefits and are willing to try it out, provide help and advice to other adopters.

The *Early Majority* is deliberate and more concerned with professionalism. They are willing to adopt the innovation once the majority in society has adopted it.

The *Late Majority* is sceptical and believes less in new ideas and always makes sure that there are people ready to solve their problems before adoption.

Laggards are most likely to stick to the "old and traditional" ways. They are very critical towards adopting new ideas, and innovation is accepted only if it becomes tradition.

As Rogers is sometimes misread to contain very simplistic notions of human and social reality, some reservations are warranted here. Rogers' theory becomes more credible if these segment traits are treated notas general personality features, but as occurring in the context of the innovation in question, in this case instructional technology and pedagogy. A person can be quick to adopt new customs generally, but a laggard at work; religiously conservative, but an innovator of pedagogy, etc. Drawing the boundary between the adopter categories is an arbitrary act, which is useful to create a common frame of reference for the discussion of diffusion, but the bell-shaped distribution is reported to be a stable empirical finding (Rogers, 2003). It is also important to bear in mind that this is a model which simplifies much more complex patterns in which agency and stakeholdership are distributed in ways that do not fit into the DOI theory. While the basis for this paper is the DOI theory, it is not implying that this can serve as the master frame within all technological-pedagogical innovation, nor has this paper aimed to discuss the merits and limitations of the explanatory power of Rogers' DOI theory in general. The specific aim for this research is to refine a model (based on Keesee &Shepard's work) with predictive power for VLE adoption and diffusion and to investigate how this fits in with previous applications. Sometimes predictive models are very useful.

Rogers (2003) identified five attributes that influence attitudes or decisions of an individual during the innovation adoption process. He also claims that those attributes are derived from maximum generality and succinctness and based on past writings and research; they are conceptually distinct, but somewhat interrelated empirically. They influence the likelihood that teachers use the VLE for their daily teaching/learning practice (Askar et al., 2006). The five attributes are relative advantage, compatibility, complexity, trialability and observability:

Relative advantage: The individual considers the current practice and to what degree the innovation would provide advantage. This entails costs and benefits in terms of quality, efficiency, reliability and economic viability – will the adoption of the innovation lead to exceeding the status quo?

Compatibility: Degree of accordance with the existing values, past experiences and requirements of potential users. The innovation should be compatible with the organisational or professional norms or compatible to user needs, social values, standard and ways of working.

Complexity: Degree of difficulty in understanding or using the innovation. The more effort and considerable timeit requires, the more unlikely it is that users may adopt it.

Trialability: The perceived possibility to experiment and test the innovation on a limited basis to allow users to understand the benefits of it. If new ideas can be experimented with, this provides ways to the innovators of gaining more understanding of its functionalities on their own terms.

Observability: Degree of visibility to others of results of an innovation. This allows users to observe results and disseminate them to others. The more difficult it is to observe and describe an innovation, the higher is the risk of hindering its adoption. The results can be used to show the effectiveness of using the VLE.

Rogers (2003,p. 298;ibid, p. 316) claims that generally, relative advantage and compatibility are the most important predictors. The perceived attributes or characteristics of innovation predict the rate of adoption among the five group memberships (Rogers, 2003), and the adoption rate is measured as the number of individuals who adopt a new idea in a specified period. Some work is being done on the diffusion of VLEs at the organisational level, but not much at the individual staff member level. With little empirically based research on VLE adoption, assumption was made with regard to adoption, the staff distribution largely corresponds to the general distribution that Rogers described (later, our analysis shows that this cannot be safely assumed). Zayim et al. (2006) claim that predictors for early VLE adoption (an important user category, since it is key to attaining critical mass) include "non-professorhood" and a high level of self-efficacy. Rogers (1975) has also made a smaller study on instructional innovation in tertiary education, showing (again) that relative advantage is important, as well as observability and trialability, but not compatibility or complexity. He did not study this at adopter category level, which is one of our major foci in this paper.

Table 1: Predictors for the adopter category of VLEs (Keesee & Shepard, 2011)

Category	**Predictor**
Innovators	Compatibility and Complexity
Early Adopter	Relative Advantage, Complexity and Observability
Early Majority	Complexity
Late Majority	Compatibility, Complexity, Trialability and Observability
Laggards	Relative Advantage, Compatibility, Complexity and Organisational Support

When the VLE or new features are rolled out, it is important to know which users are innovators and early adopters, since these will diffuse the innovation to the remaining social system. Keesee & Shepard (2011) have developed a predictive model (Table 1) specifically for VLEs. Later, the paper examines the stability of this model closely by focusing on this research case organization.

METHOD

The research method was based on quantitative study collecting demographic information and user perceptions, with minor qualitative supplements (not reported directly in this paper).The intended participants were teaching staff of the Royal University of Bhutan.

Statistical analysis was carried out by using the SPSS package. Descriptive statistics were used to provide patterns of adoption, and logistic regression was deployed to predict the types of staff under various adopter categories.

PARTICIPANTS

The targeted participants were the full-time as well as visiting staff at various colleges under the Royal University of Bhutan. The study also targeted colleges that offer courses through local language instruction as they also offer programs through the VLE. This selection was expected to result in acceptable response rates from all major categories of respondents.

Around sixty percent of the total staff have been trained in producing courses with good usability, and in the administration and management of the VLE. However, colleges such as Samtse College of Education (SCE) had prior knowledge on its use as the majority of its faculty members have been providing distance education programs to in-service candidates. Participants in this survey were focussed on teaching staff since they are the ultimate users creating and enabling a platform for their own subject by adding materials and learning activities to be offered for the continuous use of their students. Thus, adequate faculty participation is clearly a critical success factor of the VLE.This is expected to match the requirements outlined in the criteria specified in this study. The specific criteria requirements for participants are illustrated below:

- Full-time teaching staff VLE administrators (they are either teaching staff or members of staff responsible for the VLE)
- Adjunct staff who have the same access rights as regular staff, although they are less exposed to training and less familiar with the ICT facilities.

INSTRUMENTS

The quantitative instruments providing the demographic information were developed from the Diffusion of Innovation theory (Rogers, 2003) and in particular Keesee and Shepard (2011). Samples were thoroughly discussed with the Directors, Deans of Academic Affairs and non-IT personal to match the level of understanding of RUB staff as VLE users.All questionnaires were in English (all staff have competency in English to read and write) and divided into three parts, Part 1, Part 2 and Part 3. Part 1 focused on the demographics of respondents, training and experience in VLE, frequency of using VLE, number of modules uploaded and VLE features used for their uploaded online module. Part 2 was based on the 4-point Likert-type scale with a scale range of 1 to 4 to rate their perceptions between two extremities:1 (*Strongly Agree*)and4 (*Strongly Disagree*). This is a small improvement of the original Keesee & Shepard instrument, developed in order to force choice (see also Clason & Dormody, 1994). Part 3 contained open-ended questions to enable the respondents to provide their suggestions and comments for future improvements.

Cronbach's alpha test was applied to assess the internal reliability of instruments. The individual predictors' internal reliability values were as follows:

Relative Advantage: 0.770
Compatibility: 0.975
Trialability: 0.890
Observability: 0.792
Complexity: 0.682

The reliability analysis of the overall instruments showed a Cronbach's Alpha of 0.934.A validity test was not conducted as all dependent and independent samples were adopted from Keesee and Shepard (2011) who already deployed it.

DATA COLLECTION

Data were collected from January 2013 to 30 August 2013, both online and by hardcopy questionnaires. The online questionnaire was developed using Google apps and was distributed by email to the following Colleges:

1. Sherubtse College (SC)
2. Samtse College of Education (SCE)
3. Paro College of Education (PCE)
4. Gaeddu College of Business Studies (GCBS)
5. College of Science and Technology (CST)
6. College of Natural Resources (CNR)

At the same time, printed copies were distributed to Jigme Namgyel Polytechnic (JNP) – 30 copies, Institute of Language and Culture Studies (ILCS)– 25 copies, Royal Institute of Health Sciences (RIHS) – 20 copies, National Institute of Traditional Medicine (NITM) – 10 copies, College of Science and Technology (CST) – 30 copies, 20 and 30 copies to Paro College of Education (PCE) and Sherubtse College Education (SCE) respectively. Out of these, 58 stakeholders (GCBS – 33, CNR – 19 and Sherubtse College – 6) responded online and, 143 (PCE – 25, NITM – 9,RIHS – 17,Sherubtse College – 20 and JNP – 14)were received by post.

RESULTS AND ANALYSIS

In total, 201 staff members participated from all Colleges of RUB, resulting in a response rate of 41.61% out of 483 staff, including expatriates. Thus, the sample collected was considered sufficiently

Table 2: Demographic distribution (N = 201)

Items	Group	Frequency	Percentage (%)
Gender	Female	46	22.9
	Male	155	77.1
Age	20 to 25 years	11	5.5
	26 to 30 years	43	21.4
	31 to 35 years	45	22.4
	36 to 40 years	40	19.9
	41 and above	62	30.8
College	SC	25	12.4
	CST	33	16.4
	JNP	14	7.0
	CNR	11	5.5
	ILCS	18	9.0
	RIHS	17	8.5
	NITM	6	3.0
	PCE	25	12.4
	SCE	19	9.5
	GCBS	33	16.4
Training	No	69	34.3
	Yes	132	65.7
Duration	No training	69	36.3
	1 to 3 days	95	45.3
	4 to 6 days	10	5.0
	One week and above	27	13.4

representative for this research study. Out of the 201 respondents, 46 (22.9 %) were female and 155 (77.1%) were male. The age group '41 years and above' is the single largest group with 62 (30.8%) respondents. CST and GCBS had the highest response rate (33 or 16.4%), followed by SC and PCE 25 (both on 12.4%).The response rate at SCE was 19 (9.5%), at ILCS 18 or 9.0%, at RIHS 17 or 8.5%, at JNP 14 or 7.0 % and at NITM 6 or 3.0%.

It was found that a total of 132 or 65.7 % of participants have been trained in administration and the management of Moodle. Training was conducted at the respective college premises with varying duration from 3 days to more than a week. 27 participants received training for more than a week, and 10 attended 4 to 6-day courses. Table 2 shows the demographic backgrounds of the participants in detail:

FREQUENCY OF USAGE BY STAFF MEMBERS

Table 3 shows the frequency of VLE use in daily teaching and learning.

Table 3: Frequency of using VLE

College	How often do you use VLE for your teaching and learning?							
	Missing	**Daily**	**Once a week**	**Once a month**	**Once a semester**	**Only once**	**Never**	**Total**
SC	2	3	9	6	2	2	1	25
CST	2	4	13	7	3	4	0	33
JNP	0	1	6	2	0	1	4	14
CNR	0	2	2	3	1	1	2	11
ILCS	2	1	8	2	0	3	2	18
RIHS	4	1	5	4	1	1	1	17
NITM	1	0	1	4	0	0	0	6
PCE	2	2	12	5	0	2	2	25
SCE	0	8	8	1	1	1	0	19
GCBS	0	0	3	6	0	9	15	33
Total	13	22	67	40	8	24	27	201

The above indicates that around 22 participants have used the VLE only once, and around 27 (12.9%) have not used it at all in teaching and learning. There are missing values (around 7.4 % of respondents) and some apply to system administrators in the colleges, since these do not fall under the teaching category. However, the interpretation of the work of Choeda et al (2014, p. 214), which uses a different data set, largely corroborates the distribution on the RUB level as a whole.

UTILISATION OF VLE FUNCTIONALITIES

Different Moodle functionality is used for the delivery of different teaching contents such as materials, audio visuals, online assignments, grading, forums, online surveys, interactive courses and resources developed using multimedia tools (including more interactive content). Table 4 shows the various existing functionality deployed on courses in the respective colleges. Uploading documents (MS Word, PDF, etc.) has been adopted most widely at CST.

Table 4: Moodle features deployed

College	Material (Word, Pdf, etc)	Audio/ Videos	Assignments	Online Grading	Forums or Chats	Surveys	Multi-media tools (more interactive)
SC	21	2	17	1	8	2	1
CST	31	1	24	13	4	4	0
GCBS	12	4	10	1	2	2	1
PCE	22	4	12	6	10	1	1
SCE	17	11	19	13	11	3	3
ILCS	12	3	13	4	1	0	0
RIHS	11	1	8	3	4	0	0
NITM	4	0	4	1	2	0	0
JNP	14	1	13	4	1	0	0
CNR	8	3	6	3	3	0	0

Online assignment is becoming common in the colleges. However, RUB staff is less prone to use interactive contents involving multimedia tools, even though these are used by a few colleges (SC PCE, SCE and GCBS). Other features such as Forums, online grading and audio/video are also used by most of the Colleges. Figure 2 illustrates the overall usage of Moodle activity for the delivery. The uploading of simple teaching/learning material(word, PDF, etc.) features is the most commonly implemented at all the colleges (29.93%), followed b

online assignments with 36.10 %.The lowest usage is interactive contents using 'multimedia tools' (1.43%), followed by online Surveys (2.85%). Other functionalities have

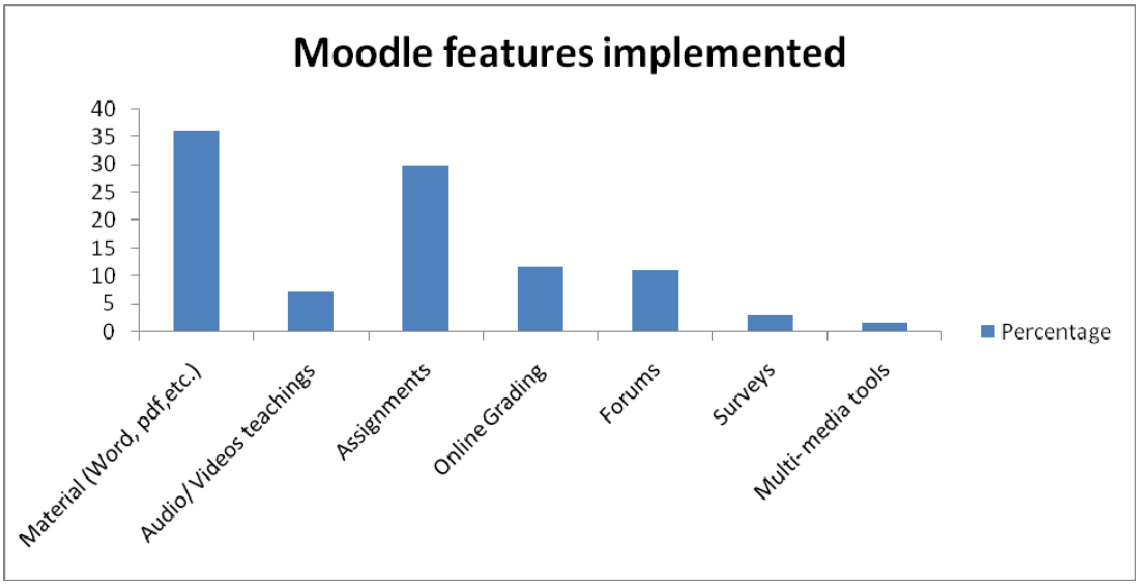

Figure 2: Overall percentage of features used

Some what similar rates; Audio/Video Teaching (7.13 %), Online Grading (11.64%) and Forums/Chats (10.93%). These data shows that while the VLE will be treated as a whole in the later logistic regression analysis, it is a simplification; a VLE is actually adopted in parts. Overall, these data do not indicate successful complete adoption of the VLE, but only partial adoption, with some colleges having significantly lower levels of use.

PREDICTORS FOR ADOPTION

Table 5 (next page) lists some of the instruments derived from Keesee &Shepard (2011) to assist researchers in identifying actual learning activities deployed by academic staff. These instruments were also used to calculate the adopters' status at ten RUB colleges. The right column in the Table 5 was used to categorize the adopter's group by assignment of dichotomous variables (0, if it does not belong, and 1, if it falls under that particular category). The respondent was asked 3-4 questions with dichotomous answers. The respondents were categorized as the adopter group with the highest resemblance to the

Table 5: Instruments for verifying the categories of staff

Instruments	**Adopter Type**
I try new available features of VLE on my own.	Innovators
I try new VLE features with the aim of improving teaching and learning.	
I share my experience of VLE with my colleagues.	Early Adopters
My colleagues often ask me for help to solve VLE problems.	
I am using VLE after evaluating its value.	
I make sure that the VLE for my module is free of problems.	Early Majority
I make sure that I have the necessary technical support to use VLE.	
I am not convinced about the value of VLE in my teaching.	Late Majority
I started using VLE when the majority of the staff started using it.	
I use VLE only when it is necessary.	
I do not use VLE for my teaching.	Laggards
I am not interested in using VLE for my teaching.	
I think VLE will make my teaching worse.	
I do not use VLE as my teaching works well without.	

stereotype (i.e. agreeing to all statements for that category). Respondents had to rate their attitudes based on the statements related to the predictors. These were later subjected to analysis, in which the attitudes were matched

with Rogers' predictor categories. The concept was derived from Keesee & Shepard (2011).The overall distribution of staff categories across the colleges is given below:

Table 6: Distribution of adopters

College	Innovators		Early Adopters		Early Majority		Late Majority		Laggards	
	Total	%	Total	%	Total	%	Total	%	Total	%
SC	3	12	6	16	8	16	4	16	4	16
CST	5	15.15	8	24.24	12	36.36	7	21.21	1	3.03
JNP	3	21.43	1	7.14	3	21.43	2	14.29	5	35.71
CNR	4	36.36	3	27.27			3	27.27	1	9.09
ILCS	2	10.53	7	36.84	4	21.05	4	21.05	2	10.53
RIHS			1	5.88	7	41.18	5	29.41	4	23.53
NITM	1	16.67			4	66.67			1	16.67
PCE	2	8	7	28	9	36	4	16	3	12
SCE	2	10.53	10	52.63	6	31.58	1	5.26		
GCBS	1	3.03	1	3.03	11	33.33	5	15.15	15	45.45
Total	23	11.39	44	21.78	64	31.68	35	17.33	36	17.82

The Early Majority consisted of 64 staff followed by Early Adopters (44). Late Majority and Laggards had almost the same numbers, with 35 and 36 staff respectively. The Innovators category comprised the lowest, with only 23staff.

The mean and standard deviations of the attributes or predictors are:

Table 7: Mean and standard deviations (Stdev) of predictors

Predictors	**Mean**	**Stdev**
Relative Advantage	3.11	0.89
Complexity	2.90	0.84
Compatibility	2.79	0.89
Trialability	2.63	0.88
Observability	2.80	0.83

Table 7 shows the predictors (independent variables) with the mean and standard deviation calculated. These were considered for the logistic regression to predict the probability of staff categories. The logistic regression analysis was applied to calculate the odds and odds ratio (Exp (B)). The significant predictors (significant value considered was less than 0.05) can predict the likelihood of category membership as provided by Rogers. The predictors are Relative Advantage, Complexity, Compatibility, Trialability and Observability.

Table 8: Results of the significant predictors for RUB Staff Categories

RUB Staff Categories	**Relative Advantage**	**Complexity**	**Compatibility**	**Trialability**	**Observability**
Innovators	Exp(B): 1.624	Exp(B):0.340 Significant	Exp(B):0.531	Exp(B): 2.711 Significant	Exp(B): 9.105 Significant
Early Adopters	Exp(B):1.680	Exp(B): 2.467 Significant	Exp(B): 1.174	Exp(B):0.947	Exp(B): 0.739
Early Majority	Exp(B):0.698	Exp(B): 1.537	Exp(B): 2.224 Significant	Exp(B): 0.781	Exp(B): 1.041
Late Majority	Exp(B): 0.970	Exp(B): 0.294 Significant	Exp(B):1.123	Exp(B): 1.168	Exp(B): 1.091
Laggards	Exp(B): 0.945	Exp(B): 1.298	Exp(B): 0.320 Significant	Exp(B):0.977	Exp(B): 0.228 Significant

Table 8 reflects the odds ratio (Exp (B)) that determines the likelihood to accurately predict an adopter category. If an odds ratio is more than 1, this signifies that perceived predictors amongst staff are more likely to belong to that category. However, if it is less than 1, this signifies that perceived predictors amongst staff are less likely to belong to a given category. Space restricts a full explication of how to derive probabilities and other characteristics; but an example of how to translate these results regards the odds for innovators, using the natural logarithm of the standard logistic regression model (see Grimm &Yarnold, 1995). Table 8 shows that the participant perceptions Relative Advantage, Trialability and Observability will result in the odds 1.624, 2.711 and 9.105 to 1 that a VLE user belongs to the innovators category. However, if Complexity (0.340) and Compatibility (0.531) are indicated, the odds of being an innovator are low – and so on for the rest of the items in the table. However, only the significant predictors can be used for our final purposes.

As indicated in Table 8 shows that the significant predictors are Compatibility for Early Majority and Laggards, Complexity for Innovators, Early Adopters, Early Majority and Late Majority, Trialability for Innovators, and Observability for Innovators and Laggards.

DISCUSSION

In relation to previous research by Keesee & Shepard these findings can be summed up as follows (Table 9). Table 9 indicates that the predictors are quite different in local contexts. General models for predicting adoption should be used with caution. However, some commonalities were also found. An interesting feature of Keesee & Shepard is that all groups find complexity important. Hence, this is not useful for

Table 9: Our verified predictors as compared with previous research

Membership group	Predictor found in both studies	Keesee & Shephard only	Our Present study only
Innovators	Complexity	Compatibility	Trialability and Observability
Early Adopters	Complexity	Relative Advantage and Observability	No category
Early Majority	No category	Complexity	Compatibility
Late Majority	Complexity,	Compatibility, Trialability, and Observability	No category
Laggards	Compatibility	Relative Advantage, and Complexity	Observability

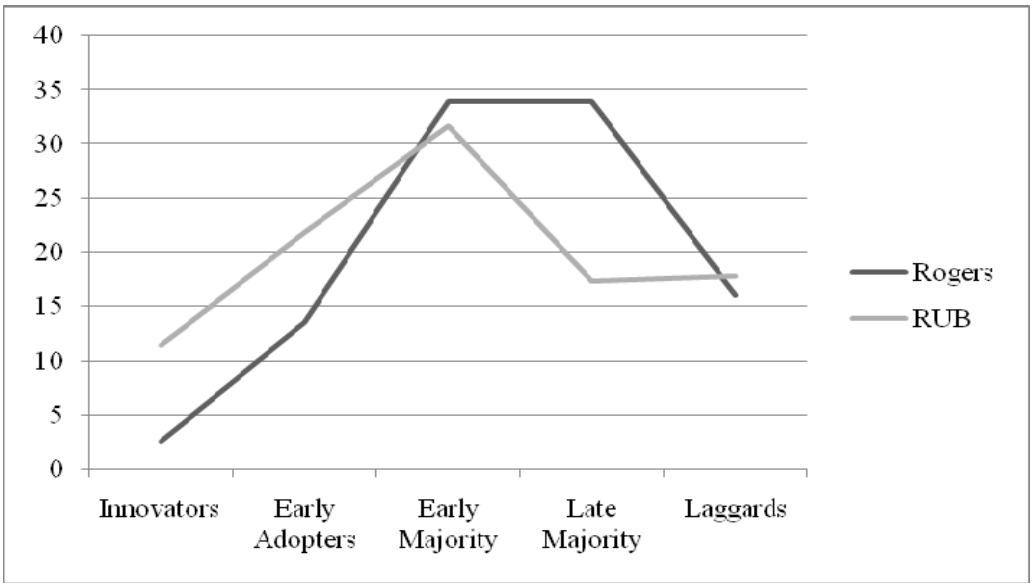

Figure 3: Variations in adopter categories

Table 10*:* Variation of adopter categories

	Innovators	Early Adopters	Early Majority	Late Majority	Laggards
Rogers (standard Bell curve)	2.5	13.5	34	34	16
RUB	11.4	21.8	31.7	17.3	17.8

predicting adopter category, as "complexity" attention of a user cannot be used as a differentiating attribute. In this model, however, the Early Majority and Laggards can be ruled out. There are significant variations between the graph illustrated by the distribution of RUB Adopters and Rogers' bell curve (Figure 3). Deviation in the innovator part of the curves can be observed. However, while this result may be important, the careful drawing of conclusions from it was taken into consideration. The distance between the curves is large, but the RUB curve is based on very few innovator-respondents, so there is a risk of a respondent bias.

Table 10 shows that the distributions of adopters at RUB were compared with Rogers, signifying a clear distinction in variations in distribution patterns. It shows that the distribution is more favourable at RUB. The percentage of Innovator and Early adopters is higher than in Rogers, that of Early Major and Laggards is almost equivalent to Rogers, that of Late adopters is lower than Rogers as compared to the predicted power of adoption from Rogers' population distribution. What is more interesting is that a majority of the population (staff around 65%) belonged to the categories of Innovators, Early Adopters and Early Majority at RUB, as compared to 50% in the case of Rogers. This would normally indicate (ceteri paribus) that the organisation easily adopts innovations that they are exposed to, yet it is not the case here, despite training and management support. It is the policy of RUB for each College to upload at least 10 to20 % modules of the programs (Author, 2011) although no specific encouragement has been given in terms of using interactive modules. (Choeda et al, 2014; Author, ibid) state that most of the teachers and students at RUB perceived VLE as useful as it saves a significant amount of their time and resources and was used to share benefits with other users. It can be inferred from Table 2 that many of the staff who used document uploading haven't implemented the more interactive/"advanced" features. The VLE does not appear more complex than comparable Moodle installations (although this study has not formally investigated this). Does lack of training account for the reluctance to adopt VLE? Rogers (2003) explains that the adoption rate depends on the individual's perception and the extent of the 'promotion efforts', and training will naturally change perceptions. Around 40% of the staff have not been trained and, moreover, new staff members are recruited at the beginning of every year. It takes time for them to get accustomed with the educational technology although they have been informed by their college on the VLE. It is difficult to find studies that benchmark VLE training across institutions, but it is reasonable to assume that some other universities have managed richer and higher adoption rates with less training. Indeed, other studies of VLE use at RUB show that uptake is slow despite training (Kinley, 2010). Rogers (1983, p. 233) gives three other factors of importance:

1. Type of innovation-decision, where 'authoritative decisions' are the fastest. RUB's adoption of the VLE is championed by the top management and is a kind of authoritative decision, yet it has not assisted the process.
2. Communication channels. The study lacked the data in this regard; this *remains a possible explanation to the slow adoption process*.
3. Nature of the Social system. This is *also a possible explanation*. RUB's existing norms, degree of interconnectedness, etc., may be impeding the processes.

This shows that adopter frequency and perceptions do not show the full picture of adoption, as Rogers concedes (but sometimes the other factors above are overlooked in the model; Keesee & Shepard is an example of this). It also shows that adoption in the VLE case is not an issue of adopting the *whole* of an innovation (which is also briefly mentioned in Rogers (1975)).If the VLE is considered as a tool for the distribution of PDFs to the students for their course, then Rogers' model has more (but still not good) explanatory power.

There are alternatives to Rogers' explanation, such as Moore and Benbasat's refined instrument (1991). Another intellectual option is to abandon the attempt to establish general models. Some studies go for in-depth studies of VLE adoption (Nyvang, 2008), and typically find additional case-specific variables, rather than the 'universal' predictors. In-depth studies also reveal whether the VLE is a non-changing unit of analysis, or if users gradually start to perceive it not as one VLE-object, but as several, or in a qualitatively new way. It is not the objective of this paper to show the merits of the alternative sex emplified above, but further research may fruitfully compare them in the area of VLEs.

CONCLUSION

The findings of the study reveal that perceptions of predictors by academic staff determine the likelihood of belonging to a certain group of VLE adopter, e.g. Early or Late Majority. RUB has implemented VLE to enhance the current traditional types of learning. The study reflected that the utilization of VLE is not particularly satisfactory in terms of deploying the interactive contents. The regression analysis shows that RUB diverges from previous research in terms of the prediction as to which adoption type staff belongs to. This means that to generalizing findings across institutions and innovations within the area in question will be ill-founded. Rogers was also painfully aware of the limitations of his own approach (see Rogers, 1983, p. 130ff). This research work has provided empirical ground for the many conceptual critiques (Schön, 1973; Lundblad, 2003; see Denning (2010) for a good introduction) of Rogers. Nevertheless, our study also shows that it is possible to build a local theory of adoption of VLEs that can be useful for RUB itself. Accordingly, it may be fruitful for other institutions to apply the instrument from this article, and to derive an equivalent model, based on their own data. Another route is to make the instrument more comprehensive in order to achieve cross-institutional generalizability. Keesee & Shepard do not take all factors of rate of innovation into account. It could be interesting to add these (innovation decision, communication channels, and the nature of the social system) to the instrument, or to investigate which complementary research tools would cover these factors satisfactorily.

Furthermore, universities should be aware of the fact that the adoption distribution is far from uniform within the organisation, and that it may not predict the adoption very well at college-level. Some colleges have large bases of early adopters. A diversified strategy for broadening the user base seems important, as the case of RUB shows. In some colleges, the majority of adopter groups are under the category of Late Majority and Laggards, which signifies that the college management or RUB need to offer more assistance to them and add more importance to the significant predictors that can help them force as the adoption of VLE amongst academic staff, as well as group memberships. This applies in particular to Late Majority and Laggards to make sure that they do not remain undetected.

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Predicting Virtual Learning Environment Adoption: A Case Study

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ABSTRACT
This study investigates the significance of Rogers' Diffusion of Innovations (DOI) theory with regard to the use of a Virtual Learning Environment (VLE) at the Royal University of Bhutan (RUB). The focus is on different adoption types and characteristics of users. Rogers' DOI theory is applied to investigate the influence of five predictors (relative advantage, complexity, compatibility, trialability and observability) and their significance in the perception of academic staff at the RUB in relation to the probability of VLE adoption. These predictors are attributes of the VLE that determine the rate of adoption by various adopter group memberships (Innovators, Early Adopters, Early Majority, Late Majority, Laggards). Descriptive statistics and regression analysis were deployed to analyse adopter group memberships and predictor significance in VLE adoption and use. The results revealed varying attitudes towards VLE adoption by academic staff at RUB. Few predictors were consistent with previous research on VLE adoption. There were also significant differences from previous research on predictors such as the deviation in adopter frequency from that predicted by Rogers DOI theory. Therefore, it can be concluded that it is misleading to rely on the DOI theory in the way it is currently operationalised for predicting VLE use.

INTRODUCTION
The diffusion and adoption of Information and Communication Technologies (ICT) have created an opportunity for universities to complement traditional face-to-face classroom teaching. Moreover, adoption and effective utilisation of ICT in education have become an acknowledged issue of strategic importance in educational institutions around the world (Jebeile &Reeve, 2003).The diffusion of innovations is happening across the globe, and has resulted in adoption or rejection, depending upon the users' perception of the innovations.

The adoption of innovations in higher education can be explained through Rogers' theory of the Diffusion of Innovations (sometimes DOI) (Rogers, 2003). Rogers's theory is widely used as a framework for technology adoption and is composed by a number of factors that influence the motivation of users to facilitate the rate of adoption (Sahin, 2006). For instance, VLEs (Virtual Learning Environments), which are the focus of this paper is a technology which practitioners need to advertise, internally promote and disseminate, and Rogers' DOI theory can be very helpful in this regard. Rogers (2003) states that the rate of adoption by various adopters (teaching faculty) depends on the factors or characteristics of a given innovation, which in our case is VLEs. Jebeile & Reeve (2008) outlined that after the evaluation of those factors/characteristics, it enables education administrators to plan and design educational technology and infrastructures. This adds strategic importance to the evaluation by practitioners of various types of faculty, to determine their readiness, adoption powers and DOI factors in order to provide institutional management with knowledge and adequate monitoring instruments, supporting improved planning. This can be highly useful for targeting training, addressing characteristics of ICT tools, etc.

Previous research (e.g. Al-Ali, 2007; Keesee & Shepard, 2011;Kilmon & Fagan, 2007; Zayim et al., 2006; Naveh, Tubin & Pliskin, 2006) has studied VLE adoption from a DOI perspective, but still as isolated case studies. Graham, Woodfield& Harrison (2013) use DOI for VLEs, but concentrate not on the predictors, but on the process. By providing comparative results of Keesee & Shepard's instrument for educational technology, the present study strengthens the area of knowledge of Diffusion and Innovation in this specific context. Generally, research has placed quite low value on replication compared to reporting novel findings. However, this need to be moderated with the recent results of Open Science Collaboration (2015), showing that less than 40% of established findings in psychology can be replicated. This study addresses this need in the context of Diffusion of Innovations, and in particular within Virtual Learning Environments. However, it is not a study that merely verifies earlier literature; rather, it demonstrates that for VLE, DOI theory may still be precarious. Furthermore, none of the aforementioned case studies were carried out in a developing country. This study contributes to this research area by analysing an interesting case, Royal University of Bhutan. It is the only major university of the country, and its activities are widely dispersed.

In the following sections, the academic staff (henceforth, staff) characteristics and the current adoption status are reported, which allows for a logistic regression analysis of these variables. This can be used for the prediction of adoption, and our results indicate that there is more opportunity for prediction than previous literature has found. There are also large variations within the university and between universities in the domain of VLEs, which has significant consequences for other tertiary educational institutes that rely on the DOI literature.

CURRENT SITUATION OF ROYAL UNIVERSITY OF BHUTAN

This section describes the research context. RUB is a federated public type University with 10 member colleges distributed across the country. At the time of writing, it has 483 staff and approximately 10,000 students (RUB Statistics, 2013). The RUB ICT strategic plan (Reid& Cano, 2005) has outlined clearly the needs and strategy to setup VLE as one of the components at RUB which can fulfil the expectations at the university of a high level of student involvement and self-learning. This has formed the platform for the integration of technology for teaching and learning. A Wide Area Network (WAN) that connects all the member colleges and server rooms provides the infrastructure for the VLE. It has power backup in order to cope with electricity shortages and malfunctions. The Moodle open source software has been adopted by RUB as its VLE, and has been installed and configured in each college location. RUB formally launched e-learning in Bhutan in May 2011, although Samtse College of Education had been using it since 2004. RUB has adopted a hybrid or blended learning method (Rennie& Mason, 2007), and the VLE facilitates both face-to-face and pure online learning. It provides opportunities for the students to spend less time in a class and engage more in self-directed learning online. Although all the member colleges are connected, RUB is unable to fully support the information exchange on the current bandwidth, which is limited and still lacks consistency to allow full reliance on university-wide solutions (Rennie& Mason, 2007). This is a common state of affairs in developing countries today. Thus, the campus-based setup of VLEs in each individual location was accepted to reduce the pressure on university-wide bandwidth.

Teaching staff at RUB have a great degree of influence on the students, since students relocate to the college and teachers teach their chosen subjects (Rennie& Mason, 2007). For this reason, they are considered to be the ultimate stakeholder group for the future sustenance of the VLE, by encouraging and motivating students to adopt and utilize it until student adoption is total. Even after three years of formal introduction of the VLE facilities, it has been observed that the rate of VLE adoption is very low among the colleges/institutions within the university. Hence, it was found to be necessary to evaluate the level of VLE utilization by staff around the colleges. Despite the training provided to around sixty percent of staff, the number of modules integrated into the VLE is far lower than modules taught only face-to-face. It has become very important to investigate predictors that influence the staff attitude towards the utilization and adoption of e-learning in order to use these to determine the sustenance of VLE.

DIFFUSION OF INNOVATION

The probability of new ideas being adopted or abandoned by members of a given culture in the social system is explained by Rogers' (2003) Diffusion of Innovations (DOI) theory. An innovation is defined as an idea, practice, behaviour or object that is perceived by the individual to be “new” (Rogers, 2003). Diffusion is *“the process to communicate an innovation through certain communication channels over time among the members of a social system”* (ibid, p. 5). In the context of the present research, the innovation in question is VLEs, which at this stage is a commonly known acronym at all the Colleges. The diffusion of an innovation is a continuous process that can be examined, facilitated, decided and promoted (Keesee & Shepard, 2011). The rate of adoption of innovations varies, depending upon the innovation types, opinion leaders and types of adopters. Therefore, the DOI theory provides the framework to analyse patterns of staff technology adoption in higher education (Zayim et al., 2006). It states that the technology is not adopted by individuals in the social system at the same time, but this depends on the attitude of the population that has been divided into five categories. The details of these five categories are illustrated in Figure 1.

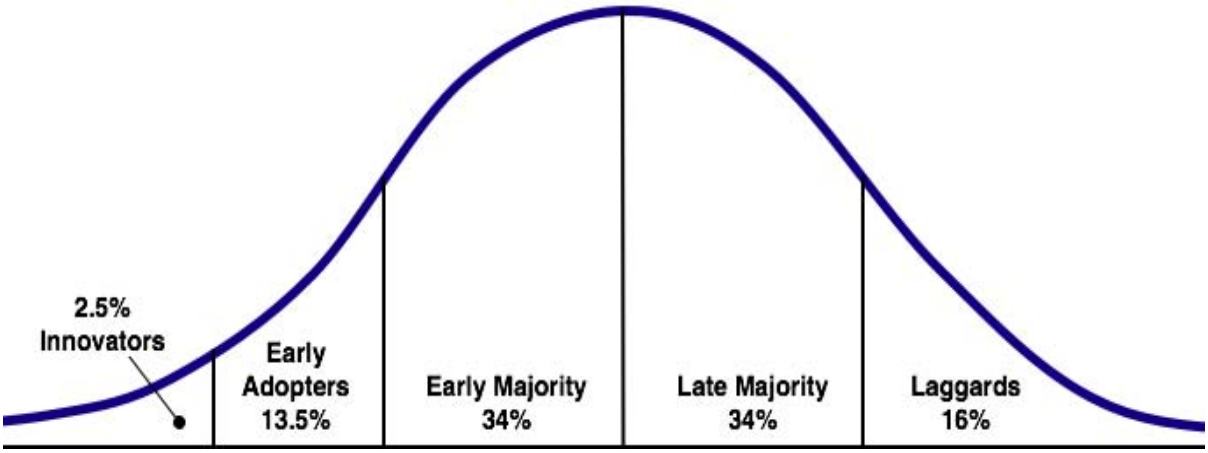

Figure 1: Various Adopters (Rogers, 2003, p. 655)

The following segments detail the various adopters as per Rogers (2003):

Innovators are the venturesome who are interested in the technical aspects, and are risk takers.

Early Adopters are respected and considered as change agents with the greatest degree of opinion about the new ideas. They examine the innovation as regards its benefits and are willing to try it out, provide help and advice to other adopters.

The *Early Majority* is deliberate and more concerned with professionalism. They are willing to adopt the innovation once the majority in society has adopted it.

The *Late Majority* is sceptical and believes less in new ideas and always makes sure that there are people ready to solve their problems before adoption.

Laggards are most likely to stick to the "old and traditional" ways. They are very critical towards adopting new ideas, and innovation is accepted only if it becomes tradition.

As Rogers is sometimes misread to contain very simplistic notions of human and social reality, some reservations are warranted here. Rogers' theory becomes more credible if these segment traits are treated notas general personality features, but as occurring in the context of the innovation in question, in this case instructional technology and pedagogy. A person can be quick to adopt new customs generally, but a laggard at work; religiously conservative, but an innovator of pedagogy, etc. Drawing the boundary between the adopter categories is an arbitrary act, which is useful to create a common frame of reference for the discussion of diffusion, but the bell-shaped distribution is reported to be a stable empirical finding (Rogers, 2003). It is also important to bear in mind that this is a model which simplifies much more complex patterns in which agency and stakeholdership are distributed in ways that do not fit into the DOI theory. While the basis for this paper is the DOI theory, it is not implying that this can serve as the master frame within all technological-pedagogical innovation, nor has this paper aimed to discuss the merits and limitations of the explanatory power of Rogers' DOI theory in general. The specific aim for this research is to refine a model (based on Keesee &Shepard's work) with predictive power for VLE adoption and diffusion and to investigate how this fits in with previous applications. Sometimes predictive models are very useful.

Rogers (2003) identified five attributes that influence attitudes or decisions of an individual during the innovation adoption process. He also claims that those attributes are derived from maximum generality and succinctness and based on past writings and research; they are conceptually distinct, but somewhat interrelated empirically. They influence the likelihood that teachers use the VLE for their daily teaching/learning practice (Askar et al., 2006). The five attributes are relative advantage, compatibility, complexity, trialability and observability:

Relative advantage: The individual considers the current practice and to what degree the innovation would provide advantage. This entails costs and benefits in terms of quality, efficiency, reliability and economic viability – will the adoption of the innovation lead to exceeding the status quo?

Compatibility: Degree of accordance with the existing values, past experiences and requirements of potential users. The innovation should be compatible with the organisational or professional norms or compatible to user needs, social values, standard and ways of working.

Complexity: Degree of difficulty in understanding or using the innovation. The more effort and considerable timeit requires, the more unlikely it is that users may adopt it.

Trialability: The perceived possibility to experiment and test the innovation on a limited basis to allow users to understand the benefits of it. If new ideas can be experimented with, this provides ways to the innovators of gaining more understanding of its functionalities on their own terms.

Observability: Degree of visibility to others of results of an innovation. This allows users to observe results and disseminate them to others. The more difficult it is to observe and describe an innovation, the higher is the risk of hindering its adoption. The results can be used to show the effectiveness of using the VLE.

Rogers (2003,p. 298;ibid, p. 316) claims that generally, relative advantage and compatibility are the most important predictors. The perceived attributes or characteristics of innovation predict the rate of adoption among the five group memberships (Rogers, 2003), and the adoption rate is measured as the number of individuals who adopt a new idea in a specified period. Some work is being done on the diffusion of VLEs at the organisational level, but not much at the individual staff member level. With little empirically based research on VLE adoption, assumption was made with regard to adoption, the staff distribution largely corresponds to the general distribution that Rogers described (later, our analysis shows that this cannot be safely assumed). Zayim et al. (2006) claim that predictors for early VLE adoption (an important user category, since it is key to attaining critical mass) include "non-professorhood" and a high level of self-efficacy. Rogers (1975) has also made a smaller study on instructional innovation in tertiary education, showing (again) that relative advantage is important, as well as observability and trialability, but not compatibility or complexity. He did not study this at adopter category level, which is one of our major foci in this paper.

Table 1: Predictors for the adopter category of VLEs (Keesee & Shepard, 2011)

Category	**Predictor**
Innovators	Compatibility and Complexity
Early Adopter	Relative Advantage, Complexity and Observability
Early Majority	Complexity
Late Majority	Compatibility, Complexity, Trialability and Observability
Laggards	Relative Advantage, Compatibility, Complexity and Organisational Support

When the VLE or new features are rolled out, it is important to know which users are innovators and early adopters, since these will diffuse the innovation to the remaining social system. Keesee & Shepard (2011) have developed a predictive model (Table 1) specifically for VLEs. Later, the paper examines the stability of this model closely by focusing on this research case organization.

METHOD

The research method was based on quantitative study collecting demographic information and user perceptions, with minor qualitative supplements (not reported directly in this paper).The intended participants were teaching staff of the Royal University of Bhutan.

Statistical analysis was carried out by using the SPSS package. Descriptive statistics were used to provide patterns of adoption, and logistic regression was deployed to predict the types of staff under various adopter categories.

PARTICIPANTS

The targeted participants were the full-time as well as visiting staff at various colleges under the Royal University of Bhutan. The study also targeted colleges that offer courses through local language instruction as they also offer programs through the VLE. This selection was expected to result in acceptable response rates from all major categories of respondents.

Around sixty percent of the total staff have been trained in producing courses with good usability, and in the administration and management of the VLE. However, colleges such as Samtse College of Education (SCE) had prior knowledge on its use as the majority of its faculty members have been providing distance education programs to in-service candidates. Participants in this survey were focussed on teaching staff since they are the ultimate users creating and enabling a platform for their own subject by adding materials and learning activities to be offered for the continuous use of their students. Thus, adequate faculty participation is clearly a critical success factor of the VLE.This is expected to match the requirements outlined in the criteria specified in this study. The specific criteria requirements for participants are illustrated below:

- Full-time teaching staff VLE administrators (they are either teaching staff or members of staff responsible for the VLE)
- Adjunct staff who have the same access rights as regular staff, although they are less exposed to training and less familiar with the ICT facilities.

INSTRUMENTS

The quantitative instruments providing the demographic information were developed from the Diffusion of Innovation theory (Rogers, 2003) and in particular Keesee and Shepard (2011). Samples were thoroughly discussed with the Directors, Deans of Academic Affairs and non-IT personal to match the level of understanding of RUB staff as VLE users.All questionnaires were in English (all staff have competency in English to read and write) and divided into three parts, Part 1, Part 2 and Part 3. Part 1 focused on the demographics of respondents, training and experience in VLE, frequency of using VLE, number of modules uploaded and VLE features used for their uploaded online module. Part 2 was based on the 4-point Likert-type scale with a scale range of 1 to 4 to rate their perceptions between two extremities:1 (*Strongly Agree*)and4 (*Strongly Disagree*). This is a small improvement of the original Keesee & Shepard instrument, developed in order to force choice (see also Clason & Dormody, 1994). Part 3 contained open-ended questions to enable the respondents to provide their suggestions and comments for future improvements.

Cronbach's alpha test was applied to assess the internal reliability of instruments. The individual predictors' internal reliability values were as follows:

Relative Advantage: 0.770
Compatibility: 0.975
Trialability: 0.890
Observability: 0.792
Complexity: 0.682

The reliability analysis of the overall instruments showed a Cronbach's Alpha of 0.934.A validity test was not conducted as all dependent and independent samples were adopted from Keesee and Shepard (2011) who already deployed it.

DATA COLLECTION

Data were collected from January 2013 to 30 August 2013, both online and by hardcopy questionnaires. The online questionnaire was developed using Google apps and was distributed by email to the following Colleges:

1. Sherubtse College (SC)
2. Samtse College of Education (SCE)
3. Paro College of Education (PCE)
4. Gaeddu College of Business Studies (GCBS)
5. College of Science and Technology (CST)
6. College of Natural Resources (CNR)

At the same time, printed copies were distributed to Jigme Namgyel Polytechnic (JNP) – 30 copies, Institute of Language and Culture Studies (ILCS)– 25 copies, Royal Institute of Health Sciences (RIHS) – 20 copies, National Institute of Traditional Medicine (NITM) – 10 copies, College of Science and Technology (CST) – 30 copies, 20 and 30 copies to Paro College of Education (PCE) and Sherubtse College Education (SCE) respectively. Out of these, 58 stakeholders (GCBS – 33, CNR – 19 and Sherubtse College – 6) responded online and, 143 (PCE – 25, NITM – 9,RIHS – 17,Sherubtse College – 20 and JNP – 14)were received by post.

RESULTS AND ANALYSIS

In total, 201 staff members participated from all Colleges of RUB, resulting in a response rate of 41.61% out of 483 staff, including expatriates. Thus, the sample collected was considered sufficiently

Table 2: Demographic distribution (N = 201)

Items	Group	Frequency	Percentage (%)
Gender	Female	46	22.9
	Male	155	77.1
Age	20 to 25 years	11	5.5
	26 to 30 years	43	21.4
	31 to 35 years	45	22.4
	36 to 40 years	40	19.9
	41 and above	62	30.8
College	SC	25	12.4
	CST	33	16.4
	JNP	14	7.0
	CNR	11	5.5
	ILCS	18	9.0
	RIHS	17	8.5
	NITM	6	3.0
	PCE	25	12.4
	SCE	19	9.5
	GCBS	33	16.4
Training	No	69	34.3
	Yes	132	65.7
Duration	No training	69	36.3
	1 to 3 days	95	45.3
	4 to 6 days	10	5.0
	One week and above	27	13.4

representative for this research study. Out of the 201 respondents, 46 (22.9 %) were female and 155 (77.1%) were male. The age group '41 years and above' is the single largest group with 62 (30.8%) respondents. CST and GCBS had the highest response rate (33 or 16.4%), followed by SC and PCE 25 (both on 12.4%).The response rate at SCE was 19 (9.5%), at ILCS 18 or 9.0%, at RIHS 17 or 8.5%, at JNP 14 or 7.0 % and at NITM 6 or 3.0%.

It was found that a total of 132 or 65.7 % of participants have been trained in administration and the management of Moodle. Training was conducted at the respective college premises with varying duration from 3 days to more than a week. 27 participants received training for more than a week, and 10 attended 4 to 6-day courses. Table 2 shows the demographic backgrounds of the participants in detail:

FREQUENCY OF USAGE BY STAFF MEMBERS

Table 3 shows the frequency of VLE use in daily teaching and learning.

Table 3: Frequency of using VLE

College	How often do you use VLE for your teaching and learning?							
	Missing	**Daily**	**Once a week**	**Once a month**	**Once a semester**	**Only once**	**Never**	**Total**
SC	2	3	9	6	2	2	1	25
CST	2	4	13	7	3	4	0	33
JNP	0	1	6	2	0	1	4	14
CNR	0	2	2	3	1	1	2	11
ILCS	2	1	8	2	0	3	2	18
RIHS	4	1	5	4	1	1	1	17
NITM	1	0	1	4	0	0	0	6
PCE	2	2	12	5	0	2	2	25
SCE	0	8	8	1	1	1	0	19
GCBS	0	0	3	6	0	9	15	33
Total	13	22	67	40	8	24	27	201

The above indicates that around 22 participants have used the VLE only once, and around 27 (12.9%) have not used it at all in teaching and learning. There are missing values (around 7.4 % of respondents) and some apply to system administrators in the colleges, since these do not fall under the teaching category. However, the interpretation of the work of Choeda et al (2014, p. 214), which uses a different data set, largely corroborates the distribution on the RUB level as a whole.

UTILISATION OF VLE FUNCTIONALITIES

Different Moodle functionality is used for the delivery of different teaching contents such as materials, audio visuals, online assignments, grading, forums, online surveys, interactive courses and resources developed using multimedia tools (including more interactive content). Table 4 shows the various existing functionality deployed on courses in the respective colleges. Uploading documents (MS Word, PDF, etc.) has been adopted most widely at CST.

Table 4: Moodle features deployed

College	Material (Word, Pdf, etc)	Audio/ Videos	Assignments	Online Grading	Forums or Chats	Surveys	Multi-media tools (more interactive)
SC	21	2	17	1	8	2	1
CST	31	1	24	13	4	4	0
GCBS	12	4	10	1	2	2	1
PCE	22	4	12	6	10	1	1
SCE	17	11	19	13	11	3	3
ILCS	12	3	13	4	1	0	0
RIHS	11	1	8	3	4	0	0
NITM	4	0	4	1	2	0	0
JNP	14	1	13	4	1	0	0
CNR	8	3	6	3	3	0	0

Online assignment is becoming common in the colleges. However, RUB staff is less prone to use interactive contents involving multimedia tools, even though these are used by a few colleges (SC PCE, SCE and GCBS). Other features such as Forums, online grading and audio/video are also used by most of the Colleges. Figure 2 illustrates the overall usage of Moodle activity for the delivery. The uploading of simple teaching/learning material(word, PDF, etc.) features is the most commonly implemented at all the colleges (29.93%), followed b

online assignments with 36.10 %.The lowest usage is interactive contents using 'multimedia tools' (1.43%), followed by online Surveys (2.85%). Other functionalities have

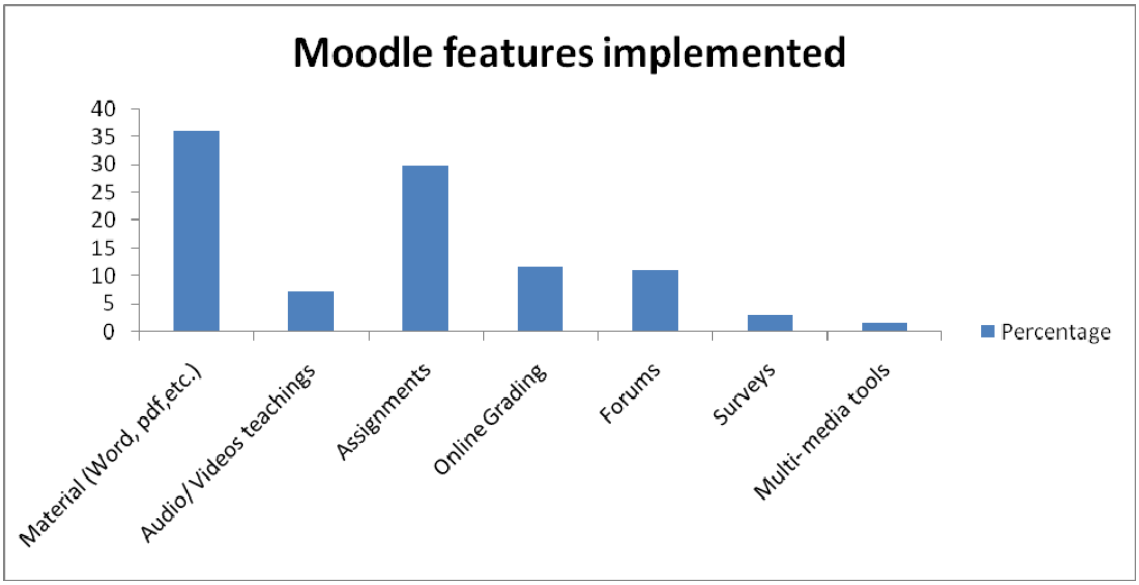

Figure 2: Overall percentage of features used

Some what similar rates; Audio/Video Teaching (7.13 %), Online Grading (11.64%) and Forums/Chats (10.93%). These data shows that while the VLE will be treated as a whole in the later logistic regression analysis, it is a simplification; a VLE is actually adopted in parts. Overall, these data do not indicate successful complete adoption of the VLE, but only partial adoption, with some colleges having significantly lower levels of use.

PREDICTORS FOR ADOPTION

Table 5 (next page) lists some of the instruments derived from Keesee &Shepard (2011) to assist researchers in identifying actual learning activities deployed by academic staff. These instruments were also used to calculate the adopters' status at ten RUB colleges. The right column in the Table 5 was used to categorize the adopter's group by assignment of dichotomous variables (0, if it does not belong, and 1, if it falls under that particular category). The respondent was asked 3-4 questions with dichotomous answers. The respondents were categorized as the adopter group with the highest resemblance to the

Table 5: Instruments for verifying the categories of staff

Instruments	**Adopter Type**
I try new available features of VLE on my own.	Innovators
I try new VLE features with the aim of improving teaching and learning.	
I share my experience of VLE with my colleagues.	Early Adopters
My colleagues often ask me for help to solve VLE problems.	
I am using VLE after evaluating its value.	
I make sure that the VLE for my module is free of problems.	Early Majority
I make sure that I have the necessary technical support to use VLE.	
I am not convinced about the value of VLE in my teaching.	Late Majority
I started using VLE when the majority of the staff started using it.	
I use VLE only when it is necessary.	
I do not use VLE for my teaching.	Laggards
I am not interested in using VLE for my teaching.	
I think VLE will make my teaching worse.	
I do not use VLE as my teaching works well without.	

stereotype (i.e. agreeing to all statements for that category). Respondents had to rate their attitudes based on the statements related to the predictors. These were later subjected to analysis, in which the attitudes were matched

with Rogers' predictor categories. The concept was derived from Keesee & Shepard (2011).The overall distribution of staff categories across the colleges is given below:

Table 6: Distribution of adopters

College	Innovators		Early Adopters		Early Majority		Late Majority		Laggards	
	Total	%	Total	%	Total	%	Total	%	Total	%
SC	3	12	6	16	8	16	4	16	4	16
CST	5	15.15	8	24.24	12	36.36	7	21.21	1	3.03
JNP	3	21.43	1	7.14	3	21.43	2	14.29	5	35.71
CNR	4	36.36	3	27.27			3	27.27	1	9.09
ILCS	2	10.53	7	36.84	4	21.05	4	21.05	2	10.53
RIHS			1	5.88	7	41.18	5	29.41	4	23.53
NITM	1	16.67			4	66.67			1	16.67
PCE	2	8	7	28	9	36	4	16	3	12
SCE	2	10.53	10	52.63	6	31.58	1	5.26		
GCBS	1	3.03	1	3.03	11	33.33	5	15.15	15	45.45
Total	23	11.39	44	21.78	64	31.68	35	17.33	36	17.82

The Early Majority consisted of 64 staff followed by Early Adopters (44). Late Majority and Laggards had almost the same numbers, with 35 and 36 staff respectively. The Innovators category comprised the lowest, with only 23staff.

The mean and standard deviations of the attributes or predictors are:

Table 7: Mean and standard deviations (Stdev) of predictors

Predictors	**Mean**	**Stdev**
Relative Advantage	3.11	0.89
Complexity	2.90	0.84
Compatibility	2.79	0.89
Trialability	2.63	0.88
Observability	2.80	0.83

Table 7 shows the predictors (independent variables) with the mean and standard deviation calculated. These were considered for the logistic regression to predict the probability of staff categories. The logistic regression analysis was applied to calculate the odds and odds ratio (Exp (B)). The significant predictors (significant value considered was less than 0.05) can predict the likelihood of category membership as provided by Rogers. The predictors are Relative Advantage, Complexity, Compatibility, Trialability and Observability.

Table 8: Results of the significant predictors for RUB Staff Categories

RUB Staff Categories	**Relative Advantage**	**Complexity**	**Compatibility**	**Trialability**	**Observability**
Innovators	Exp(B): 1.624	Exp(B):0.340 Significant	Exp(B):0.531	Exp(B): 2.711 Significant	Exp(B): 9.105 Significant
Early Adopters	Exp(B):1.680	Exp(B): 2.467 Significant	Exp(B): 1.174	Exp(B):0.947	Exp(B): 0.739
Early Majority	Exp(B):0.698	Exp(B): 1.537	Exp(B): 2.224 Significant	Exp(B): 0.781	Exp(B): 1.041
Late Majority	Exp(B): 0.970	Exp(B): 0.294 Significant	Exp(B):1.123	Exp(B): 1.168	Exp(B): 1.091
Laggards	Exp(B): 0.945	Exp(B): 1.298	Exp(B): 0.320 Significant	Exp(B):0.977	Exp(B): 0.228 Significant

Table 8 reflects the odds ratio (Exp (B)) that determines the likelihood to accurately predict an adopter category. If an odds ratio is more than 1, this signifies that perceived predictors amongst staff are more likely to belong to that category. However, if it is less than 1, this signifies that perceived predictors amongst staff are less likely to belong to a given category. Space restricts a full explication of how to derive probabilities and other characteristics; but an example of how to translate these results regards the odds for innovators, using the natural logarithm of the standard logistic regression model (see Grimm &Yarnold, 1995). Table 8 shows that the participant perceptions Relative Advantage, Trialability and Observability will result in the odds 1.624, 2.711 and 9.105 to 1 that a VLE user belongs to the innovators category. However, if Complexity (0.340) and Compatibility (0.531) are indicated, the odds of being an innovator are low – and so on for the rest of the items in the table. However, only the significant predictors can be used for our final purposes.

As indicated in Table 8 shows that the significant predictors are Compatibility for Early Majority and Laggards, Complexity for Innovators, Early Adopters, Early Majority and Late Majority, Trialability for Innovators, and Observability for Innovators and Laggards.

DISCUSSION

In relation to previous research by Keesee & Shepard these findings can be summed up as follows (Table 9). Table 9 indicates that the predictors are quite different in local contexts. General models for predicting adoption should be used with caution. However, some commonalities were also found. An interesting feature of Keesee & Shepard is that all groups find complexity important. Hence, this is not useful for

Table 9: Our verified predictors as compared with previous research

Membership group	Predictor found in both studies	Keesee & Shephard only	Our Present study only
Innovators	Complexity	Compatibility	Trialability and Observability
Early Adopters	Complexity	Relative Advantage and Observability	No category
Early Majority	No category	Complexity	Compatibility
Late Majority	Complexity,	Compatibility, Trialability, and Observability	No category
Laggards	Compatibility	Relative Advantage, and Complexity	Observability

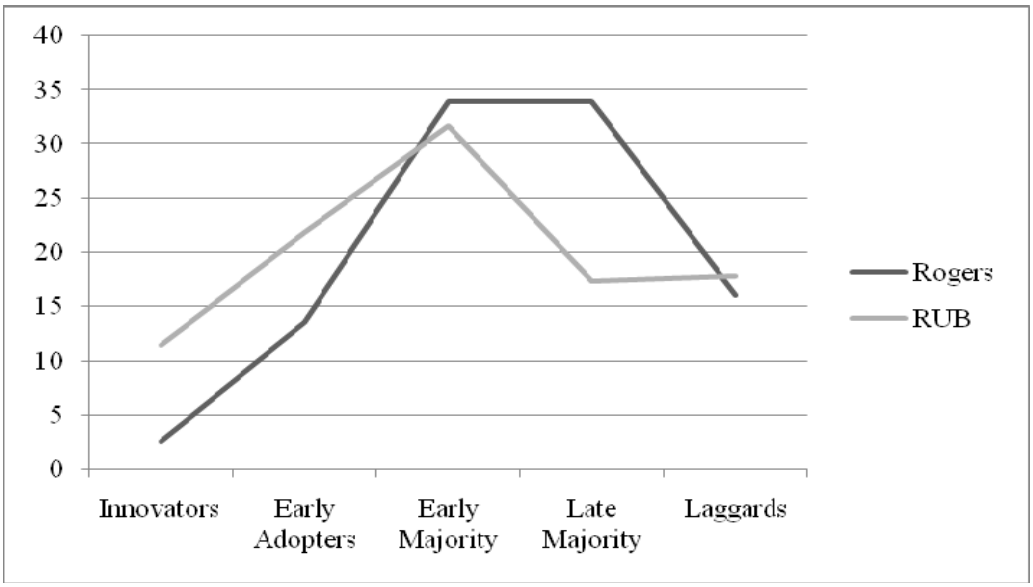

Figure 3: Variations in adopter categories

Table 10*:* Variation of adopter categories

	Innovators	Early Adopters	Early Majority	Late Majority	Laggards
Rogers (standard Bell curve)	2.5	13.5	34	34	16
RUB	11.4	21.8	31.7	17.3	17.8

predicting adopter category, as "complexity" attention of a user cannot be used as a differentiating attribute. In this model, however, the Early Majority and Laggards can be ruled out. There are significant variations between the graph illustrated by the distribution of RUB Adopters and Rogers' bell curve (Figure 3). Deviation in the innovator part of the curves can be observed. However, while this result may be important, the careful drawing of conclusions from it was taken into consideration. The distance between the curves is large, but the RUB curve is based on very few innovator-respondents, so there is a risk of a respondent bias.

Table 10 shows that the distributions of adopters at RUB were compared with Rogers, signifying a clear distinction in variations in distribution patterns. It shows that the distribution is more favourable at RUB. The percentage of Innovator and Early adopters is higher than in Rogers, that of Early Major and Laggards is almost equivalent to Rogers, that of Late adopters is lower than Rogers as compared to the predicted power of adoption from Rogers' population distribution. What is more interesting is that a majority of the population (staff around 65%) belonged to the categories of Innovators, Early Adopters and Early Majority at RUB, as compared to 50% in the case of Rogers. This would normally indicate (ceteri paribus) that the organisation easily adopts innovations that they are exposed to, yet it is not the case here, despite training and management support. It is the policy of RUB for each College to upload at least 10 to20 % modules of the programs (Author, 2011) although no specific encouragement has been given in terms of using interactive modules. (Choeda et al, 2014; Author, ibid) state that most of the teachers and students at RUB perceived VLE as useful as it saves a significant amount of their time and resources and was used to share benefits with other users. It can be inferred from Table 2 that many of the staff who used document uploading haven't implemented the more interactive/"advanced" features. The VLE does not appear more complex than comparable Moodle installations (although this study has not formally investigated this). Does lack of training account for the reluctance to adopt VLE? Rogers (2003) explains that the adoption rate depends on the individual's perception and the extent of the 'promotion efforts', and training will naturally change perceptions. Around 40% of the staff have not been trained and, moreover, new staff members are recruited at the beginning of every year. It takes time for them to get accustomed with the educational technology although they have been informed by their college on the VLE. It is difficult to find studies that benchmark VLE training across institutions, but it is reasonable to assume that some other universities have managed richer and higher adoption rates with less training. Indeed, other studies of VLE use at RUB show that uptake is slow despite training (Kinley, 2010). Rogers (1983, p. 233) gives three other factors of importance:

1. Type of innovation-decision, where 'authoritative decisions' are the fastest. RUB's adoption of the VLE is championed by the top management and is a kind of authoritative decision, yet it has not assisted the process.
2. Communication channels. The study lacked the data in this regard; this *remains a possible explanation to the slow adoption process*.
3. Nature of the Social system. This is *also a possible explanation*. RUB's existing norms, degree of interconnectedness, etc., may be impeding the processes.

This shows that adopter frequency and perceptions do not show the full picture of adoption, as Rogers concedes (but sometimes the other factors above are overlooked in the model; Keesee & Shepard is an example of this). It also shows that adoption in the VLE case is not an issue of adopting the *whole* of an innovation (which is also briefly mentioned in Rogers (1975)).If the VLE is considered as a tool for the distribution of PDFs to the students for their course, then Rogers' model has more (but still not good) explanatory power.

There are alternatives to Rogers' explanation, such as Moore and Benbasat's refined instrument (1991). Another intellectual option is to abandon the attempt to establish general models. Some studies go for in-depth studies of VLE adoption (Nyvang, 2008), and typically find additional case-specific variables, rather than the 'universal' predictors. In-depth studies also reveal whether the VLE is a non-changing unit of analysis, or if users gradually start to perceive it not as one VLE-object, but as several, or in a qualitatively new way. It is not the objective of this paper to show the merits of the alternative sex emplified above, but further research may fruitfully compare them in the area of VLEs.

CONCLUSION

The findings of the study reveal that perceptions of predictors by academic staff determine the likelihood of belonging to a certain group of VLE adopter, e.g. Early or Late Majority. RUB has implemented VLE to enhance the current traditional types of learning. The study reflected that the utilization of VLE is not particularly satisfactory in terms of deploying the interactive contents. The regression analysis shows that RUB diverges from previous research in terms of the prediction as to which adoption type staff belongs to. This means that to generalizing findings across institutions and innovations within the area in question will be ill-founded. Rogers was also painfully aware of the limitations of his own approach (see Rogers, 1983, p. 130ff). This research work has provided empirical ground for the many conceptual critiques (Schön, 1973; Lundblad, 2003; see Denning (2010) for a good introduction) of Rogers. Nevertheless, our study also shows that it is possible to build a local theory of adoption of VLEs that can be useful for RUB itself. Accordingly, it may be fruitful for other institutions to apply the instrument from this article, and to derive an equivalent model, based on their own data. Another route is to make the instrument more comprehensive in order to achieve cross-institutional generalizability. Keesee & Shepard do not take all factors of rate of innovation into account. It could be interesting to add these (innovation decision, communication channels, and the nature of the social system) to the instrument, or to investigate which complementary research tools would cover these factors satisfactorily.

Furthermore, universities should be aware of the fact that the adoption distribution is far from uniform within the organisation, and that it may not predict the adoption very well at college-level. Some colleges have large bases of early adopters. A diversified strategy for broadening the user base seems important, as the case of RUB shows. In some colleges, the majority of adopter groups are under the category of Late Majority and Laggards, which signifies that the college management or RUB need to offer more assistance to them and add more importance to the significant predictors that can help them force as the adoption of VLE amongst academic staff, as well as group memberships. This applies in particular to Late Majority and Laggards to make sure that they do not remain undetected.

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Prevalence and Impact of Cyberbullying in a Sample of Indonesian Junior High School Students.

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ABSTRACT
In recent years cyberbullying has become widespread throughout junior high schools around the world, resulting in high numbers of adolescents affected by cybervictimization. Cybervictimization is associated with negative psychological health outcomes. The objective of the present study was to examine the impact and prevalence of cybervictimization in a sample of junior high school students in Jogjakarta, Indonesia. A total of 102 seventh grade students were involved in the study: 72 (70.6%) boys and 30 (29.4%) girls. The majority (80%) of the students in this study reported experiencing cybervictimization occasionally to almost every day. The results suggest a positive relationship between cybervictimization and level of students' psychological distress. General recommendations for anti cyberbullying programmes are discussed.
Keywords:cyberbullying, cybervictimization, psychological distress, junior high school students

INTRODUCTION

The number of people using the Internet in Indonesia is growing considerably from year to year. In 2010, the number of Internet users in major Indonesian cities rose from 30-35% to 40-45%, reaching a total of 55 million Internet users by 2011 (MarkPlus, 2011). Ease of access to the internet in this country has increased with widespread availability of smartphone and other web-enabled technology (Weiss, 2014). A large proportion of Internet users in Indonesia (50-80%) are young people from 15-30 years of age (MarkPlus, 2011) with a considerable proportion of this age group using the Internet for social networking. Social media platforms such as Twitter (Hamayotsu, 2013) and Facebook (Abbott, 2013: Yulianti & Tung, 2013) have become the most popular means of online communication in Indonesia (Galih & Ngazis, 2012). It is estimated that 30 million people in Indonesia have a Twitter account (Semiocast, 2013) and up to 51 million have a Facebook account (The Global Review.com, 2013). With advancements in technology, people are now constantly connected to the online world and have access to social media 24 hours a day (Sticca, Ruggieri, Alsaker, & Perren, 2013).

Use of internet and social media is associated with both benefits and consequences. Positive benefits include access to information (Subrahmanyam & Šmahel, 2011), access to teaching and learning resources (Louge, 2006), and increased levels of social support (Amichai-Hamburger & Hayat, 2011). Sense of community and social connectedness are valued in Indonesian culture; therefore, use of social media applications such as Twitter and Facebook is popular (Nugroho, 2011). Such online communities can provide space for people to discuss issues that might otherwise be associated with stereotyping in Indonesia (see Nugroho et al., 2012, for discussion). Although use of the internet and social media platforms is associated with clear benefits for Indonesian communities, the ubiquity of internet and social media has also been associated with considerable negative implications. This includes unwanted exposure to sexual material (Finkelhor, Mitchell, & Wolak, 2000), cybercrime (Tokunaga, 2010), cyberstalking (Sheridan & Grant, 2007) and cyberbullying (Langos, 2012). Cyberbullying is a form of harassment and humiliation associated with significant psychosocial problems (Bastiaensens et al., 2014; Dehue, 2013; Ouytsel, Walrave, & Vandebosch, 2014). This includes increased social anxiety (Juvonen & Gross, 2008), low self-esteem and depression (Campbell, Slee, Spears, Butler, & Kift, 2013). This form of bullying typically occurs through mobile phone and online social networking websites (Dooley, Pyzalski, & Cross, 2009; Juvonen, & Gross, 2008; Vandebosch, & Van Cleemput, 2008). While traditional highschool bullying is associated with abuse that occurs during school hours (Besley, 2009), cyberbullying can occur long after school has ended (Griezel, Craven, Yeung, & Finger, 2008). Issues concerning traditional bullying have been discussed extensively in the literature; however, cyberbullying is a rapidly developing phenomenon that past generations who grew up without constant digital access have not yet experienced (Samodra & Mariani, 2013). The harmful impact of cyberbullying is a growing area of concern amongst parents, teachers and researchers (Navarro, Serna, Martinez, & Ruiz-Oliva, 2013). In order to support young people in Indonesia who are exposed to cyberbullying, it is important to examine the frequency and impact of such events on this population.

Definition and Types of Cyberbullying

Cyberbullying has been defined as behavior that is repetitive, aggressive, hurtful and intended to cause harm by creating power imbalance (Dehue, 2013; Langos, 2012; Vandebosch & Van Cleemput, 2008). "Direct" cyberbullying occurs privately, for example when the perpetrator messages the victim directly via private message, such as short message service (SMS) message or email (Langos, 2012). "Indirect" cyberbullying, is where the perpetrator enlists the help of others to abuse the victim (Sleglova & Cerna, 2011; Snakenborg, Van Acker, & Gable, 2011). This includes the dissemination of material about the victim online for the purposes of defamation (Willard, 2007). It is the possibility of an infinite online audience which can amplify the level of humiliation experienced during cyberbullying over traditional bullying (Bauman & Newman, 2013).

The literature reports numerous subtypes of cyberbullying (Willard, 2004) including: (a) 'Flaming' which is posting angry, rude or vulgar content about someone through an online group, email or other electronic means. (b) 'Online harrasment', where offensive messages are sent repetitively over email, social media or other electronic means. (c) 'Cyberstalking' which is online harassment including threats, intimidation or messaging repeatedly with the intention to stalk the victim. (d) 'Denigration' (put-downs) which is where hurtful or vicious statements about the victim are messaged or posted online. (e) 'Masqueradinge' is pretending to be someone else and sending or posting material that makes the victim look bad. (f) 'Outing' is sending or posting material about the victim that contains sensitive, private or embarrassing information. (g) 'Exclusion' occurs when one person is singled out of an online group.

Characteristics and Frequency of Cyberbullying

Teenagers experience cyberbullying through various mediums. Li (2005) surveyed 177 Canadian teenagers and found that 22.7% of students experienced cyberbullying through email, 36.4% through chatroom and 40.9% through multiple sources. Li (2007) later found that out of 133 teenagers, 21.8% of respondents experienced cyberbullying through email, 30.8% through chatrooms and approximately 13% via mobile phones. One third (30.9%) experienced cyberbullying through other media or a combination of communication technology mediums (e.g., Facebook, Twitter, Yahoo Windows Messenger). The same study also found that 20.4% of participants carried out cyberbullying via email, 27.8% through chatrooms, 5.6% via mobile phones, and 39.4% did through other media or mixed (SMS, Facebook).

The frequency of experiencing cyberbullying appears to fluctuate according to the literature. One study by Li (2007) reported a high incidence rate in their sample, with 54.9% experiencing cyberbullying approximately 4 times, 20.3% experiencing this 4-10 times, and 21.1% of them experiencing cyberbullying more than 10 times. In the same study, the frequency of committing the abuse was also high with 20.7% of participants admitting to committing cyberbullying more than 10 times, 43.% doing it 4-10 times and 30.5% doing it less than 4 times (Li, 2007). Further research by Beran and Li (2007) found inconsistent frequencies, with more teenagers being bullied 'a few times' in school alone (19%) or both in school and online (7%), rather than online alone (1%).

Psychosocial Impact of Cyberbullying

Cyberbullying can have a deep, long lasting impact on victims. Several studies report that cyberbullying victims are predisposed to experiencing wider mental health problems, drug abuse and suicidal ideation (Goebert et al., 2011; Gradinger et al., 2011). Bauman (2009) found that of 221 adolescents, participants who had experienced cyberbullying exhibited increased emotional distress and likelihood of acting out. Other studies have shown that teenagers who were victims of cyberbullying showed decreased concentration, absenteeism and poor academic achievement (Beran & Li, 2007). On the other hand, the literature reports that all forms of bullying (not just cyberbullying) have the potential for harm amongst adolescents. Gradinger, et al. (2011) found that the victims of both bullying and cyberbullying show poor adjustment, aggression, depression and other somatic symptoms compared with students who had not experienced either forms of bullying. Therefore, while bullying and cyberbullying are carried out via different mediums, there are noted similarities in the responses experienced by victims.

Many studies have identified an association between cyberbullying and emotional, social and academic difficulties (Beran & Li, 2006; Li, 2007; Patchin & Hinduja, 2010). Factors that have been used in the past to predict incidences of cyberbullying and victimisation include age, gender, intention of internet usage (Li, 2007; Slonje & Smith, 2008). Frequency of online use has also been identified as a risk factor for experiencing cyberbullying (Sticca et al., 2013). Past research has found a positive association between cybervictimisation and bullying in highschools (Beran & Li, 2006; Li, 2007; Slonje & Smith, 2008).

Previous Research in Asia on Cyberbullying

The prevalence of cyberbullying in adolescents is difficult to report due to varying measures and definitions applied on this concept (Dehue, 2013; Kowalski & Limber, 2013; Roberto, Eden, Savage, Ramos-Salazar, & Deiss, 2014; Tokunaga, 2010). Incidences of teenage cyberbullying have been examined extensively in past research overseas (Juvonen & Gross, 2008; Riebel, Jager, & Fischer, 2009;). Few studies have examined the impact of cyberbullying among young people in Indonesia.

In Indonesia, the number of children and adolescents who experience cybervictimization is reported to be high. Ipsos (2011) surveyed 18,687 parents in 24 countries including Indonesia, and found one in ten parents reported that their children had been victims of abuse through online media. Indonesian parents in the sample were aware that cyberbullying was an ongoing phenomenon (91%), they felt that it required special attention from parents and schools alike (89%) and they knew of a child in their own community who had experienced cyberbullying (53%). Minimal research has since been conducted in Indonesia regarding the impact of cyberbullying on teenagers in this country.

Yulianti (2015) found in her study high prevalences rates of bullying and cyberbullying among Indonesian adolescents. Her study also found no significant difference between publioc and private schools in terms of the incidence rates of cyberbullying. In terms of frequencies of being cyberbullied and cyberbullying others. Based on UNICEF and Indonesia Ministry of Communication study among 400 adolescents (10-19 age) in 17 province found 58% of them did not understand about cyberbullying (UNICEF, 2014). The present study will focus on these issues within a sample of teenagers in Jogjakarta, Indonesia.

Research Objectives

The purpose of the current study was to explore the nature of cyberbullying in a sample of Indonesian teenagers. To our knowledge, there has been no published research on the impact of cyberbullying in Indonesia despite there being considerable Internet usage across the adolescent population. It is anticipated that the findings of this study will be helpful for those involved with designing prevention programmes, in addition to policy makers, schools and parents. The following research questions were developed to guide the study:

1. How frequently does cyberbullying occur in a sample of Indonesian adolescents?
2. What strategies are employed to deal with cyberbully attacks?
3. What psychological impact does cyberbullying have on teenagers?
4. Is there a relationship between the kinds of activities that teenagers conduct on the internet and the likelihood of being cyberbullied?

The primary aims of the study were to: A) examine occurrences of cyberbullying in an Indonesian sample, B) document the methods used to commit cyberbullying, and C) learn more about the coping strategies used by teenagers. Secondary objectives were to explore the psychological impact of cyberbullying on teenagers. The third was to examine the relationship of intended use of online activity with the frequency of cyberbullying incidence.

METHOD

Questionnaire

A questionnaire was developed for the purposes of this study after adapting items from previous research (Bauman, 2009; Kwan & Skoric, 2013; Li, 2005;). A pilot study was conducted to test the validity and reliability of questionnaire before being used to collect data. The consistency internal tests of reliability were carried out using Cronbach alpha, and content validity was assessed using professional judgment. Two external experts in the field of psychology were involved in checking items in the questionnaire.

The questionnaire contained general questions on the frequency of cyberbullying; i.e., *"Have you ever experienced cyberbullying?"* Response options included: *never, once or twice, several times, often, almost every day. Q*uestions measured the type of media used by bully, such as *"What kind of online media was used by bully to harrass you?" (Response options included: email, phone call, text, Facebook, and video), who perpetrated the abuse, and how they responded after being bullied, i.e., "What did you do when you experienced cyber victimization? (Response options included: ignored it, fight back, told the teacher, told the parent, told the police, and told a friend*).

The questionnaire also contained a cyberbullying victimization scale which contained several items that measure the frequency of cyber victimization experienced by the participants (*"I have received nasty messages on my social networking account (Facebook, twitter), mobile phone and email". "I have received insults on my social network account (Facebook, Twitter), mobile phone and email". "I have received unwanted sexual*

suggestions/ sexually explicit pictures on my social network account (Facebook, Twitter), mobile phone and email"). Response options comprised of a four-point scale, from e.g., "I have not been bullied" (scored 1), "only once or twice" (2), "two or three times a month" (3), and more than three times a month" (4).

The final section of the questionnaire was adapted from Beran and Li (2007). It contained psychological distress scale which had several items to indicate the severity of burden experienced by participants (*if you have experienced cyberbullying, how it make you stress? I feel sad, angry, anxious, fear, cry, difficult to concentrate, miss the school, got low grade, and blame my self*). The psychological distress measure had a four-point response scale, from e.g. "not stress at all" (scored 1), "little bit stress" (2), "quite made me stress" (3), and "very stressful" (4). Table 1 presents the results of reliability, the mean and standard deviation of the scale of this study.

Table 1. *Reliability of Questionnaires*

Variable	**α**	**M**	**SD**
Cyberbullying Victimization	0.810	14.86	4.80
Psychological Distress	0.863	18.50	3.56

Participants

A total of 102 seventh grade students were recruited into this study from a private school in Jogjakarta, Indonesia. 70.6% (72) of the sample were boys and 29.4% (30) were girls. 19.6 % (20) of the students in the sample were aged 12 years, and 75.5 % (77) were 13 years. All participants was agree to involved in the study without coercion or incentive.

A total of 46.1 % (47) of participants owned one computer device (*laptop or desktop computer*), while the remaining 53.9% (55) owned more than one computer device. Based on demographic questions regarding socioeconomic status, results indicate that students were from a mix of upper (35, 34.3 %) (*have a own home, car, and other*), middle (30, 29.4%) (*have a home, motorcylce, not a car),* and lower (37, 36.3 %) (*have no home, car, and motorcylce*) socio economic status. 33 % (34) of the participants reported using the Internet on average for 1 hour each day, 43% (44) of participants using the Internet an average of 2 hours, and 23% (24) of participants using the Internet an average of 3 hours. Regarding the purpose that participants use the Internet for, as many as 29% (30) of participants use it for academic work, 40% (41) for online social networking (Facebook, Twitter, WhatsApp), 23% (24) for playing online games. Table 2 below describes the respondents' demographic characteristics.

Table 2. *Respondents' Demographic Data (N= 102)*

Variable	**Content**	**Frequency**	**%**
Gender	Male	72	70.6%
	Female	30	29.4%
Age	12 years old	20	19.6%
	13 years old	77	75.5%
Number of computers at home (desktop or laptop computer)	1	47	46.1%
	more than 1	55	53.9%
Time spent online daily	1 hours	34	33.3%
	2 hours	44	43.2%
	More 3 hours	24	23.5%

Data Analysis

Quantitative data analaysis was performed for the purposes of this study. Descriptive analysis, pearson correlation, ANOVA and MANOVA were applied to acheive the aims of the study. SPSS version 18 was used in the quantitative data analysis

RESULTS

Overall frequency data

Out of 102 junior high school students, results indicate that 14.28% (14) of the sample had never experienced cybervictimization, 25.5% (26) experienced it occasionally (*one or twice*), 20.6% (21) experienced it some of the time (*twice or three times*) and 27.5% (28) experienced it often (*four or five times)*. The remaining 12.7% (13) of participants experienced cybervictimization almost every day (*more than five times*). Approximately 80% of the sample had experienced cybervictimization from occasionally to almost every day. In this sample, a total of 19.6% (20) had never experienced bullying in school, 10.8% (11) experienced occasional bullying, 29.4.9% (30) of participants experienced bullying several times and 27.5% (28) of participants experienced bullying often.The remaining 12.7% (13) of participants experienced bullying almost every day.

Gender, age, psychological distress, and cyberbullying victimization

There were no significant differences of gender in cyberbullying victimization. Boys and girls had equally experienced cybervictimization ($F_{(1,100)} = 2.418$, $p > .05$). Age had no significant association with cybervictimization ($F_{(1, 100)} = 1.784$, $p > .05$). There were no significant differences in psychological distress among boys and girls in the sample ($F_{(1, 100)} = 3.195$, $p > .05$).

Gender and cyberbullying act

There were significant differences in cyberbullying acts amongst boys and girls. Boys (mean= 1.3) committed slightly more cyberbullying acts than girls (mean = 1.1) ($F_{(1, 100)} = 5.556$, $p < .05$, eta square = .053). This result suggests that gender has a determinant effect on cyberbullying acts in this sample.

Type of cyberbully's media used

There were no significant differences in psychological distress levels related to the type of cyberbullying media used (e.g., Facebook, phonecall, SMS) to commit cyberbullying abuse ($F_{(1,14)} = 1.013$, $p > .05$). This indicates that all media used by cyberbullies has significant impact on victims. Out of 102 students, 14 (14.28%) participants had never experienced cyberbullying. Many participants experienced cyberbullying on Facebook (28, 27.5%), Twitter (13, 12.7%) and SMS (13, 12.7%). The rest of the participants experienced cyberbullying via phonecall, Twitter, Youtube and Facebook (34, 33.6%).

Type of cyberbullying act

There were no significant differences in psychological distress levels related to the type of cyberbullying act (e.g., name calling, threat, etc) experienced by participants ($F_{(1, 12)} = 1.387$, $p > .05$). All types of cyberbullying acts had equal impact on those who reported experiencing it. The majority of participants had experienced name calling harassment (46, 45.1%). 12.7% (13) had experienced name calling and denigration (defamation) acts, while 5.9% (6) had only experienced denigration. 4.9% (5) of participants had experienced name calling, denigration and threats and 3.9% (4) of participants had experienced name calling and abusive threats. The remainder of participants (14, 13.7%) had experienced multiple types of cyberbullying act such as name calling, exposure to unwanted sexual materials, denigration, disclosure of personal information and threats.

Who does the cyberbullying?

53.9% (55) of participants in the sample did not know who committed cyberbullying against them. 11.8% (12) noted that the bully was their friend in class, 6.9% (7) reported that the bully was their former best friend, 9.8% (10) said that the bully was someone in their school, and 3.9% (4) of the participants said that the bully was someone from another school.

What did you do when you are cyberbullied?

Regarding what action was taken when the participants experienced cyberbullying, 48% (49) ignored the behaviour, 31.4% (32) fought back against the bully, 7.8% (8) told a teachers/school administrator, 6.9% (7) said that they tell their parent about it, and 5.9% (6) told a friend about what happened to them.

Psychological distress, cyberbullying and bullying victimization

Participants who never experienced cyberbullying had lower psychological distress levels compared with participants who often experienced cybervictimization ($F_{(4)} = 46.31$, $p < .001$, eta square = .656). Results indicate that 65.6% of the variance in psychological distress was attributed to experience of cybervictimsation?

The present study also found significant difference in the levels of psychological distress between participants who experienced traditional bullying in schools with participants who have never experienced bullying ($F_{(4)}= 123.883$, $p < .001$, eta square = .836). Results also indicate that 65.6% of the variance in psychological distress was attributed to experience of bullying?

The results suggest that there is a positive relationship between cybervictimization with the level of participants' psychological distress. The more often students experience cybervictimization, the higher levels of psychological distress experienced by them ($r = .288$, $p < .05$). The study also found a significant positive relationship between cyberbullying victimization with bullying victimization ($r = .727$, $p < .01$). Therefore, becoming a bullying victim is linked with an increased likelihood of also experiencing cyber victimization.

Online activity and cyberbullying

In this sample, 30 (29.4 %) participants indicated using the Internet to do homework, while 40.2 % (41) of the participants use the Internet more for social media activities such as facebook or twitter, while 23.5 % (24) participants are using the Internet to play games online. Participants who used the Internet for the purpose of online social networking (Facebook, Twitter, WhatsApp, Yahoo Messenger), and for online gaming, were more likely to experience cybervictimization than participants who used the Internet for academic tasks ($F_{(2)} = 101.22$, $p < .001$, eta square = .672). This suggests that Facebook and other online social networking is a gateway for cyberbullying.

DISCUSSION

The findings from the present study suggest that cyberbullying has become a problem, not only in the Western world, but also in developing country like Indonesia. Results indicate that 80% of participants in this study had frequently experienced cyberbullying and that cyberbullying is considered a stressful life event.

Past research has attributed experiences of cybervictimization with frequency of internet use (e.g., Smith et al., 2008: Sticca et al., 2013); however, our results show no evidence that the frequency Internet use (e.g., time spent online daily) was related to incidences of cybervictimization. Rather, the type of Internet use and online behaviour was more significant in the experience of cybervictimization. Participants who interact through online social media experience more cyberbullying incidences than those who use the Internet for academic tasks (e.g., homework). This finding is consistent with past research on cyberbullying (Kwan & Soric, 2013; Snell & Englander, 2010; Ybarra & Mitchell, 2004b), where students who used chatroom and other social media platforms were more likely to experience cyberbullying than those who did not. Though access to socialising on the internet provides benefits to users, parents and educators who allow internet access to highschool students may wish to consider the increased risk for cyberbullying via this medium.

Results suggest that boys were more likely to commit cyberbullying than girls. This finding supports past studies (Doane et al., 2013; Li, 2005; Li, 2007; Slonje & Smith, 2008; Wong, Chan, & Cheng, 2014), which report boys being involved in more cyberbullying acts, but contradicts Smith et al., (2008) who found that girls were more likely to be cyberbullies. Further research may offer enhanced insight into why these gender differences exist. Bullying prevention programmes may be more effective if certain elements are targeted according to gender (Kowalski, Morgan & Limber, 2012). There were also no significant differences regarding the *experience* of cyberbullying victimization between boys and girls. The present study found that both boys and girls equally experience psychosocial consequences as a result of cyber victimization, which is is consistent with past research (e.g., Beran & Li, 2007; Juvonen & Gross, 2008; Li, 2006).

Many participants in our sample (53.9%) did not know the identity of their cyberbully, which is consistent with past research (Bauman, 2010; Li, 2005). The anonymity of cyberbullying means the perpetrator can hide their identity when using online media, allowing them to act without fear of getting caught (von Marees & Petermann, 2012). It is unlikely that bully prevention programmes will be able to address user anonymity; however, they can teach skills to highschool students about responding to potential cyberbullies. In the present study, the majority of participants (48%) took no action when they were cyberbullied, and 32 (31.4%) of participants reported that they retaliated when it happened to them. Approximately 7% told a parent when they experienced cyberbullying, while 6% reported that they would tell a friend. This finding is lower than previously published reports where up to 12% of students would tell an adult at school and 9% would tell a parent (Bauman, 2010). These phenomena was happened because the Javanese culture " tatakrama" "ungah-unguh" influence how parent communicate to their children. The majority parents in Javanese society apply more close communication style with their children. They seldom use two-way communication with their children. These parenting style makes majority children in Javanese society reluctant to share their feeling with their parent. The children also afraid to make their parent worry regarding what problem they experienced. Other explanation, that the faith a child places in an adult (e.g., teacher) rbeing able to successfully deal with the bullying is significant in whether they will ask for help or not (Elledge et al., 2013). This may explain why some of the children in our study did not report their experiences of cyberbullying. Additionally, students may not inform an adult following abuse because they don't want their media devices restricted.

The literature points to an overlap between traditional bullying and cyberbullying (Kowalski & Limber, 2013; Perren & Gutzwiller-Helfenfinger, 2012; Sticca et al., 2013: Wong, Chan, & Cheng, 2014), which was also identified in this study. Past research has highlighted a complex relationship between cyberbullying and cybervicitimisation, meaning that someone who experiences cybervictimisation is more likely to commit cyberbullying as well (von Marees & Petermann, 2012). Ybarra and Mitchell (2004b) suggest that someone who is bullied in the schoolyard may use the internet to assert dominance over others, which could partially explain this relationship. The cycle of bully-victim is an important consideration for developing more hollistic intervention programmes in the future (Li, 2005).

The current study has several limitations. First, there needs to be further exploration of cyberbullying in Indonesia by having a more representative sample. In addition to having a larger sample size, participants from different regions of Indonesia (e.g., rural and urban) would have improved the generalizability of study findings. It should also be noted that our sample contained a higher proportion of boys than girls, which may have impacted on the relationships between variables observed in the results. Finally, as has been suggested in other research regarding cyberbullying and adolescent samples (Ybarra & Mitchell, 2004a: Kowalski et al., 2012: Sticca et al., 2013: Menesini et al., 2011: Kowalski & Limber, 2013), the use of longitudinal research would be beneficial in establishing predictors and outcomes associated with cyberbullying.

This study adds to the field of cyberbullying by providing data on the frequency and impact in a sample of Indonesian teenagers. Results indicate that cyberbullying was associated with psychological distress amongst the teenagers in our sample. Evidence based bullying prevention programs offer some promise in reducing incidences of cyberbullying in the future. More research is needed to effectively design a successful, targeted prevention program suitable for highschool aged boys and girls. In conducting prevention program, present study suggests to look at gender and type of media online. Related to gender, boys should become the primary target to resolve in prevention program, while facebook should also being take care as the dominant media where young people experienced cyberbullying victimization.

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Students' Framing of a Reading Annotation Tool in the Context of Research-Based Teaching

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ABSTRACT
In the studied master's course, students participated both as research objects in a digital annotation experiment and as critical investigators of this technology in their semester projects. The students' role paralleled the researcher's role, opening an opportunity for researcher–student co-learning within what is often referred to as research-based teaching. Drawing on a sociocultural approach, this article reports on how this setting may affect students' framing (Goffman, 1974). It compares students' framing of the tool used during the digital annotation experiment (Case 1) with students' framing of the tool when investigating the technology in their semester projects (Case 2). The study shows that students' framing of the tool and researcher–student collaborative inquiries were principally different in the two cases. Case 1 mostly adapted the original framing of the tool (*tool perspective*), whereas Case 2 challenged this framing (*tool inquiry perspective*). The exploration of these two foci provides a better understanding of students' epistemological, social, and affective framing under varying contexts and the consequences these have for their tool inquiries.
Keywords: Framing, activation of contextual resources, annotation technology, research-based teaching, co-learning.

INTRODUCTION

Digital annotation tools are an emerging educational technology, but they have not yet been extensively used and examined in education (Novak, Razzouk, & Johnson, 2012). The purpose of this study is to explore students' use of what is commonly referred to as annotation software/technology (Novak et al., 2012; Ovsiannikov, Arbib, & McNeill, 1999; Wolfe, 2002) within the setting of *research-based teaching* (Healey, 2005). The research-based teaching context has several potential advantages: it brings attention to the knowledge construction, here, the construction of the tool as opposed to merely its use; it involves students more as co-learners/co-constructers of knowledge and draws more actively on their experiences; and it can increase the pace and quality of the proof of concept testing (Griffiths, 2004; Heron, Baker, & Mcewen, 2006).

The basic principle for annotation software is to add data to other data. The researcher argues that to varying degrees, studies of this type of technology have tended to treat it as a *ready-made* resource simply *passed on* to the students instead of as being *in-the-making* and *co-constructed* between researcher/teacher and student (Latour, 1987). A minority of the studies problematize how this technology is constructed through its use (Arnseth & Säljö, 2007; Ludvigsen, 2012; Ludvigsen & Mørch, 2003), but not as a process of co-construction where the students take a more active position as co-learners. This prevents the experience of using the tool from becoming a richer learning experience, for example, where students learn to reflect on how the tool mediates their learning (Wertsch, 1991).

This article is based on a study of a master's course in technology-enhanced learning in Norway that attempted to build on principles of research-based teaching. The goal of the article is twofold: first, to provide a brief review of the educational use of annotation technologies in order to get a better sense of what roles this technology may play as well as list current challenges and opportunities to address in future research. The second goal is to explore researcher–student co-learning by describing students' framing of the particular annotation tool. *Framing* refers to how certain aspects of reality take precedence in individuals' perceptions and in groups' collaboration and communication as well as the social mechanisms involved in these processes (Goffman, 1974; van de Sande & Greeno, 2012). To help explore the participants' framing, the contextual resources they rely on (Linell, 1998), and how they activate these resources (van de Sande & Greeno, 2012), a sociocultural approach (Rasmussen & Ludvigsen, 2010; Wertsch, 1991) will guide the study.

The two research questions are as follows:

1. What is the educational role of annotation technologies, and what are the current challenges that require further research?

This question provides context for the focus of the research and the teaching in the research-based teaching and hence a potential context for the framing of the technology addressed in the second research question:

2. What characterizes the participants' framing of the technology?

The second section begins by elaborating the concept "research-based teaching." The third section addresses research on framing and the current study's theoretical position. The two following sections contain a case description (the fourth section) and the methodology (the fifth section). The sixth section examines related technologies and provide answers to the first research question. The seventh section presents findings in relation to the second research question. The eight section summarizes the findings by comparing participants' framing in two cases, and the ninth section provides conclusions and suggestions for further research.

RESEARCH-BASED TEACHING

The master's course had a strong focus on research as part of the teaching and learning processes, and the experiment tried to adapt to this focus, i.e. the research–teaching nexus. One of the most common perception of the research–teaching nexus is that the research findings are integrated into lecture courses; hence, the research influences the subject knowledge students learn. This is, however, a very restricted way of seeing this nexus. Students may, for instance, do the following:

> learn about research methods and techniques; they may undertake their own projects…; they may assist staff with their research; and they may gain experience of applied research and consultancy through work-based learning… Staff may model research-based approaches in the way they teach, through, for example, adopting an inquiry-based learning approach. (Healey, 2005, p. 2)

A related matter concerns the direction of the relationship between research and teaching. Conventionally, this relationship has mainly been perceived as unidirectional, from research to teaching; however, this relationship can benefit from adopting a more reciprocal, two-way approach (Griffiths, 2004) in a manner of *co-learning* between teacher and student (Heron et al., 2006):

> Students can provide immediate feedback on research ideas and research findings which, while not informed by the expertise of academic peers, can nevertheless help to identify flaws in the analysis, as well as provide reassurance and motivation. …student learning activity can itself be a source of research materials, especially when this activity is 'research-based' or 'inquiry-based'. Student projects can, for example, help to test the analytical frameworks that academic staff are developing, or provide the beginnings of comparative studies that can later be pursued more systematically. (Griffiths, 2004, p. 722)

The experiment drew on Healey's (2005) distinction (cf. also Griffith's (2004)) between four different ways of perceiving the research–teaching nexus (cf. Figure 1). These distinctions imply different views of teacher/researcher–student collaboration and different research foci.

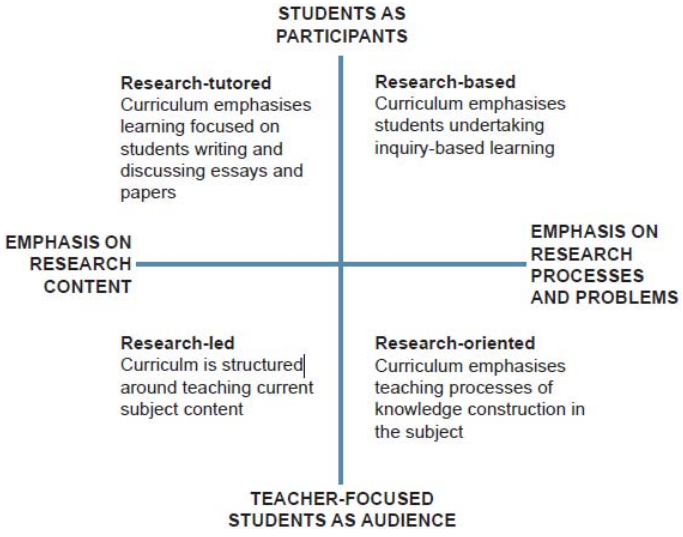

Figure 1. Curriculum design and the research–teaching nexus (Healey, 2005, p. 70).

Traditionally, most teaching has fallen under research-led in the bottom left quadrant, but few curricula taken as a whole fit entirely in one quadrant (Healey, 2005). School reforms over the last couple of decades have called

for a much stronger focus on the research process (cf. research-oriented, bottom right quadrant) but also to combine the former with students' active involvement, in other words, more student-centered approaches (research-tutored and research-based, the two upper quadrants). Inquiry-based learning is particularly highly regarded in this context: "research-based learning structured around inquiry is one of the most effective ways for students to benefit from the research that occurs in departments" (Healey, 2005, p. 8). A concern in the experiment was to increase the focus on research processes and problems and enroll students more as participants/co-learners/co-researchers.

THEORY

A sociocultural approach to framing

The researcher's use of the framing perspective will be grounded in a sociocultural approach. The sociocultural approach perceives learning as a social process that is situated in a particular social, historical, cultural and institutional context and mediated by language and by material artifacts deriving from this context (Vygotsky, 1978; Wertsch, 1991). Whereas the focus on framing in the cognitive sciences has been concerned with individuals' cognitive structures and processes (Minsky, 1974; Rumelhart & Ortony, 1976), the sociocultural approach relates framing to the social structures mediating interlocutors' framing, and seeks to understand these structures (Strømme & Ludvigsen, in review; van de Sande & Greeno, 2012).

Framing

The framing perspective draws on multidisciplinary research, which includes anthropology (Bateson, 1972), sociology (Goffman, 1974), sociolinguistics (Tannen, 1993), media and communication (Entman, 1993), and cognitive science (Rumelhart & Ortony, 1976), among others.

Four essential characteristics of frames emphasized in the sociocultural approach are as follows: Frames are associated with *salience*. A central focus adapted in the learning science has been to try to understand how humans individually and in collaboration try to understand and communicate "What is it that's going on here?" (Goffman, 1974, p. 8), "What is expected in this situation" etc. A second property of frames are *selection*, or phrased as a question, "How does something become salient?" This directs attention to the social act of the *selection*/*construction* of what is regarded as salient and as non-salient. Framing naturally involves two parallel processes, *inclusion* and *exclusion* (Bateson, 1972), both of which are crucial for understanding learning. A third property is the *logic* frames impose, or in question form: "What are the functions/consequences of salience?" These functions or logic can, for instance, be a structure for further thoughts, actions, judgments, or sentiments, e.g.:

> To frame is to *select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation* for the item described. (Entman, 1993, p. 52)

A fourth property is frames' reliance on *social and contextual resources that mediate the framing*. This implies that frames also need to be studied through the logic these resources and contexts provide, in other words, the sociocultural history of the mediating resources.

The perspective of this study is that framing involves a process of *activating latent resources*, and it is necessary to find analytical concepts that can explore this process, for example, how resources are made relevant and become activated or not, including contributing factors and obstacles. In his outline of a theory of context, Linell emphasized that instead of stable, objective contexts, we have "*contextual resources*, potential contexts that can be made into actual, relevant contexts through the activities of the interlocutors in the dialogue" (1998, p. 128). Similarly, Hammer, Elby, Scherr, and Redish (2005) criticize the view of knowledge as an intact cognitive unit/structure that can be transferred from one context to another. Instead, they suggested that we need to focus on *activation of resources* and how multiple aspects of framing interact in this activation process, for example, *epistemological framing* (participants' views about the nature of knowledge and learning), *social framing* (participants' expectations of how to act), and *affective framing* (participants' feelings toward the situation). The social and epistemological framing need further elaboration; here, this study draws on van de Sande and Greeno (2012). *Epistemological framing* refers to:

> the participants' understanding of kinds of knowledge that are relevant for use in their activity and the kinds of knowledge, understanding, and information they need to construct to succeed in their activity (e.g., what kind of information would count as a solution to the problem they are working on). (p. 2)

Social framing, which van de Sande and Greeno (2012) called *positional framing*, refers to:

> the way in which participants understand themselves and one another to be related to one another in the interaction, especially regarding the kinds of contributions each of them is entitled, expected, and perhaps obligated to make in the group's activity (2012, p. 2).

The aspect of social framing they emphasized is how social accomplishments are achieved through taking positions, which they extend by two analytical foci: *source* and *listener*. A *source* is a provider of information (human or nonhuman), which some participants lack in order to construct and reach a mutual understanding. A *listener* is the human participant inquiring into the information. A related term to social and positional framing used in later discussion is *participation structure*.

Double framing

Double framing is the presence of two or more frames. All four emphasized characteristics of frames—*salience*, *selection*, *logic*, and *mediation*—are affected by double framing. When trying to analyze the activation of latent resources, the interrelation between resources that different frames draw from becomes a relevant concern. Resources might be compatible but also incompatible, competing, conflicting, etc. (Hetland, 1996), i.e. they might involve tensions that make some recourses less likely to co-occur. Double framing can therefore impose ambiguities that obscure the latent resources and the activation processes. It is important to draw attention to different types and levels of conflict between frames and how this affects further (re)framing. The study differentiates between two double framing and (re)framing situations—*rekeying* and *breaking frame*:

> The distinction between breaking frame and re-keying are that somehow the existential grounding of meaning is retained in the re-keying, and 'normal' heuristics are used to sort out the uncertainties and options associated with the possible outcomes. (Manning & Hawkins, p. 221)

Rekeying can be solved within the existing frame(s); it does not necessitate a reframing. *Breaking frame*, on the other hand, implies a more fundamental disruption/reframing where the logic of the former frame(s) is/are shattered.

CASE DESCRIPTION

The experiment entailed students in groups of two analyzing an assigned research article from their curriculum through the help of different categories, which they used to categorize the content in the article (cf. Figure 2).

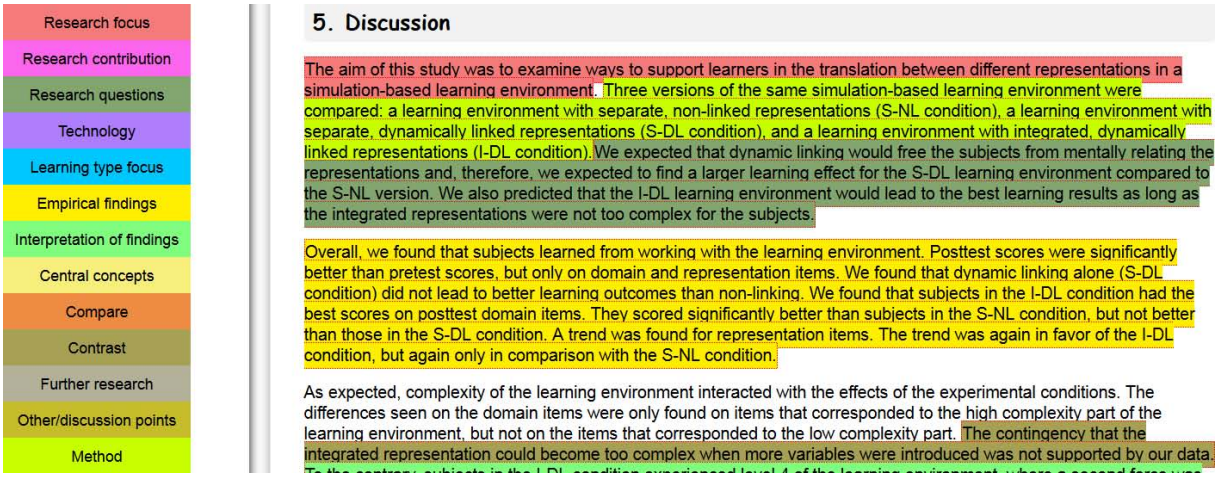

Figure 2. The highlighter/annotation script to the left. To the right, a part of the assigned article that students categorized with the help of the highlighters.

The experiment was associated with a short-term task (students' presentation of the article to the class) and a long-term task (a semester project). More importantly, the semester project made the annotation tool or other parts of the wiki the central object of study (*tool inquiry perspective*), hence enhancing a meta-reflection. This kind of experimental setting constitutes an interesting area for further investigation. That is, a setting that mixes experiences on different levels: using and reflecting on tool functionality (*tool perspective*), scrutinizing its more fundamental conditions (*tool inquiry perspective*), and students being research subjects as well as doing research themselves. Furthermore, which has a focus that parallels the researcher's own research, hence bringing the student and researcher closer together in a potential co-learning/co-researching situation.

RESEARCH DESIGN AND METHODS

Analytical procedure

Interaction analysis was employed to analyze the researcher–student co-learning and inquiry (Jordan & Henderson, 1995). This is a methodological framework for studying socio-culturally embedded moment-to-moment interaction (i.e., microanalysis of meaning production). The unit of analysis is the embedded interaction between humans, including interaction with the socio-material world (e.g., artifacts mediating the interaction).

Participants, tool and task

The subjects in this study were ten female and six male students in their early to mid-twenties participating in a master's course in technology-enhanced learning.
–student co-learning to evolve during the course of the study. The lectures Fourteen of the students came from the Department of Informatics, and two students came from the Department of Education.

The experiment took as its starting point a naturally occurring activity in many tertiary educations—students' reading of research literature and applying some sort of reading tip/guidance from teachers in how to approach and analyze the material (e.g., locating research questions, contributions, theoretical perspective, methodological concerns, etc.). The researcher decided to build the experiment around this activity and to integrate the reading guidelines as scaffolds in an annotation/highlighting script. The highlighting technology was implemented in a wiki and resembles the highlighting pens or the color markers in Microsoft Word, but with the extra feature that each color was linked to a specific category (cf. Figure 2). Each of the categories was also connected to a question or reflection prompt.

At the beginning of the course, guidelines for "how to read an article" were introduced to the students by the course-coordinator. This was a regular activity that was part of the course, not an intervention. The original highlighting/categorization script was a literal copy of these guidelines. Some changes were later made to the script to achieve more critical attention to the research process that led to the particular content knowledge, and hence the relative and conditional nature of the knowledge presented in the article. In comparison, the first script focused on *research content* (cf. left quadrants in Figure 1), whereas the later scripts emphasized *research processes and problems* (cf. right quadrants in Figure 1). Figure 2 shows one of the later scripts.

One of the assigned and graded tasks in the course was as follows: students in groups of two performed a close reading of an article from the course literature and presented this article to the rest of the class. This was a regular task, not an intervention.

However, as an additional task—designed to observe the collaborative use of this particular scaffolding tool—the researcher asked the same student groups to jointly categorize the article they were going to present, using a highlighting scripts introduced by the researcher, which they could make changes to. The students' interaction with the categories was observed and video recorded with a stationary camera and a screencast. The whole interaction was transcribed, and the qualitative data analysis software NVivo was used for a more comprehensive analysis. It should be noted that none of the teachers participated in the experiment. A concern was that the experiment was in need of a teacher's scaffolding and should involve a learning experience. In the teacher's absence, the researcher became more involved in providing for this; hence, the researcher also took on the role of a teacher.

Another assigned and graded task in the course was a semester project. This was also a regular task, not an intervention. However, the course-coordinator decided that the wiki technology implemented as part of the experiment was going to be the focus of the students' semester project. Hence, the technology and task interventions potentially also had an additional impact far beyond the original special purpose annotation task the researcher had created in order to study the technology.

Data collection and participation structures

In the course, there was a contradiction between a curriculum that had a strong sociocultural commitment (which often implies more student-centered approaches) and other parts of the curriculum design that were more traditional and lecture-based. As a result, there were few occasions for the researcher gave few openings. The two most significant opportunities were in connection with the tool experiment and the semester project kick-off meeting with each of the groups, and the data studied therefore draws on these two.

Nevertheless, a wide variety of data was gathered throughout the course (see Appendix 1). The overview illustrates the researcher's range of involvement, and it can be associated with three different roles: the researcher role, the technology developer role, and the assistant teacher role. These roles traditionally relate to different activity types, contextual resources, and participation structures, constituted by 1) researcher vs. research subjects, 2) technology developer vs. user/customer, and 3) teacher vs. student. In order to connect the activity to the relevant contextual resources and facilitate co-learning, the participants had to maneuver between these participation structures, identify the relevant structure, and manage to take each other's perspective. How these roles are negotiated is central to the understanding of how the research–teaching nexus may or may not facilitate co-learning. The two presented cases are representative of two principally different patterns of tool framings and co-learning inquiries and are purposively selected to illustrate these differences.

TOOL DESIGN

The design took its inspiration from wikis, annotation technologies, and knowledge building environments. The review below has two purposes: 1) to address the first research question: What is the educational role of annotation technologies, and what are the current challenges that require further research? 2) to compare the tool design with related technologies.

Wikis

A wiki is a web-based collaborative space where anyone can quickly and easily create, edit, or delete documents and link them to other documents in the wiki (Leuf & Cunningham, 2001). Wikis are part of Web 2.0, the interactive, user-generated web that provides opportunities for everyone to author, edit, and discuss documents, not only read what others have written, hence making students accountable to a bigger community. In the present study, the wiki was a background element—it acted primarily as a platform for enhancing an annotation technology, the focus of the review. However, there can be some inherent conflicts between the presented technologies, so the wiki context may still affect the framing.

Annotation technologies

A survey of Ovsiannikov, Arbib and McNeill (1999) showed that the absolute majority of researchers and students preferred to print out an electronic paper before reading and annotating it. However, electronic annotations have many capabilities that can make electronic annotation not only as good as, but also far superior to, their paper counterparts (Ovsiannikov et al., 1999).

It has been claimed that "annotation is becoming a new form of communication, and that understanding and managing this new medium presents a major challenge" (Buneman & Steedman, 2001, p. 1). This challenge is partly a result of new attempts to move beyond the single user and see annotations as part of a greater ecosystem, where the many forms of collaborative uses poses new challenges (Marshall, 1998). In the context of a larger ecosystem for annotations, many new issues must be addressed, such as, formal versus informal annotations, explicit versus tacit annotations, public versus private annotations etc. (Marshall, 1998). Formal annotations try to secure user interoperability and require compliance to conventions. Informal annotations lack this feature, but is therefore also more flexible. Many personal annotations are telegraphic, incomplete and tacit; they are understandable only for ourselves. The content and meaning need to be more explicit in order for annotations to become a shared resource. However, this requires more effort from the annotator. The informal and tacit nature of personal annotations can make the author see them as private. Enforcing a public sharing of digital annotations can demotivate students from annotating.

Like metadata (data about data) in general, there are fundamental challenges concerning the relation between the source document and its metadata/annotations, and how changes in the source document affect the annotations/metadata (Brush, Bargeron, Gupta, & Cadiz, 2001). The present study, solved this complicated issue by instead focusing on static documents, thereby also compromising the fundamental idea of wiki as an open and dynamic community space (Leuf & Cunningham, 2001).

Annotation technologies regularly involve highlighting or some form of anchoring of the relevant text, often in combination with opportunities to include written comments as marginalia, inline comments, footnotes, threaded discussion etc. (Ovsiannikov et al., 1999; Wolfe, 2002). However, the prototype at the time of the experiment included the highlighting facility, but it did not include an option to add comments. A distinguishing feature with the prototype in comparison with many other annotation technologies, was the possibility to create different highlighting groups (visually separated by colors), in which each group could be defined as a category and further be connected to a prompt or category description to scaffold its use (cf. Figure 2). With respect to this last feature, the prototype bears resemblance to knowledge building environments discussed below (Muukkonen, Hakkarainen, & Lakkala, 1999; Scardamalia & Bereiter, 2006). However, the strong focus on annotation as part of the reading process ties the prototype more closely to the traditional use of annotation technologies reviewed in this section.

What are annotations about? What purpose do they serve? Fowler and Barker (1974) found that highlighting can have a positive effect on retention, but also that the effect might be adverse for the retention of the remaining unemphasized material. Not surprisingly, they found that the effect of active highlighting was superior to the passive reading of highlighted material, though this effect was also dependent on whether the reader had faith in the person responsible for the highlighting. This was the same tendency that Chen and Liu (2012) found when comparing learner-generated and instructor-provided annotations: doing annotations oneself outperformed viewing the instructor's annotations. However, a combination that also reaps the benefits of collaborative learning is even better. For instance, when Hwang and Hsu (2011) investigated the effect of students'

annotations as part of pre-reading (reading before class) exercises, they found that the positive effect was strengthened by students sharing their annotations, which also helped the teacher to identify students' prior knowledge and to prepare the lecture accordingly.

Ovsiannikov, Arbib and McNeill (1999) found that annotation fell in four primary uses: to remember, to think, to clarify and to share. A context for several studies has been to facilitate a deeper level of engagement and more active reading and learning strategies (Porter-O'Donnell, 2004; Simpson & Nist, 1990), which have also been observed to have a positive effect on writing (Porter-O'Donnell, 2004). Annotation studies have been concerned with how annotation affects critical thinking, metacognitive skills, motivation, attitudes toward annotations and the tool, and tool usability (Novak et al., 2012). Wolfe and Neuwirth (2001) identified four main functions of annotation in the current use of annotation technologies:

> 1. to facilitate reading and later writing tasks; 2. to eavesdrop on the insights of other readers (e.g., by examining annotations made by previous readers of a text); 3. to provide feedback to writers or promote communication with collaborators (e.g., by making annotations while reading that are directed to other authors); and 4. to call attention to topics and important passages (e.g., by making annotations while authoring that are directed to the readers). (pp. 336-337)

The conclusion that can be drawn from the reviewed annotation studies is that annotation can serve a wide variety of purposes, also relying on the ingenuity of the users, but that more research is needed to contextualize the use conditions. The annotation studies tend to focus on the isolated learner as a unit of analysis. Missing in the studies is the sociocultural history of this resource. For instance, were the tool and the annotation practices *passed on* from teacher to students, or in some way a *co-constructed* resource, and if so, how? The studies show that annotations play a double role that can be quite problematic, which has been little researched. They are strongly connected to the students' personal habits and preferences. However, they are also subject to the teachers' interventions, because of the key value annotation practices are perceived to have for learning processes. This tension is likely to deeply affect the outcome of the former studies. The current study will shed light on this tension and the co-constructed nature of annotation resources, which are little discussed in other studies.

Knowledge building environments

An important inspiration for combining highlighting with procedural and epistemic categories was the knowledge building environments. The knowledge building framework was created by Marlene Scardamalia and Carl Bereiter, and it has inspired many similar designs, such as Future Learning Environment (FLE) (Muukkonen et al., 1999). One purpose of these designs has been to introduce new theoretical approaches as well as to design learning practices and technology based on these theories. The underlying pedagogic models have tended to imitate scientific thinking, and more generally, experts' knowledge practices. This review will start with Scardamalia and Bereiter's (2006) "Knowledge Forum", formerly known as "computer supported intentional learning environments" (CSILE), to establish central principles for these environments. It continues with reviewing critical research on FLE that has general relevance to the current topic.

Scardamalia and Bereiter (1994) championed the notion that schools should replace traditional classroom discourse with discursive patterns (knowledge building discourse) that characterize knowledge building communities outside school. Schools should try to facilitate intentional learning and the process aspects of expertise (i.e., the research process as opposed to objectifying the research content). Quintessentially, schools should focus on "the continual improvement of ideas" (Scardamalia, 2004, p. 12) and progressive problem solving (Scardamalia & Bereiter, 1994). "Knowledge Forum" targets students' individual and collaborative inquiries, where students try to identify, articulate, and solve problems and build knowledge and theories. The knowledge building tools aim to support "epistemic agency" (Scardamalia & Bereiter, 2006) by providing scaffolds for essential steps in knowledge building processes and to facilitate collaborative learning and knowledge building by making the results of these steps a shared resource. Frequently used epistemic scaffolds are category prompts and sentence openers, which structure students' thinking and knowledge inquiries in a progressive manner and help establish awareness and a shared focus for collaborative knowledge building, e.g.: "My theory; I need to understand; New information; This theory explains; This theory cannot explain". The traditional use of the annotation tools reviewed in the previous section was associated with a source document and the reading process. In comparison, knowledge building environments typically take a real-world problem as their starting point and seek to support the writing process, which is oriented toward exchanging and improving ideas. The annotation facilities are here connected to knowledge building scaffolds that provide support for the creation of notes that address a problem or the earlier contributions/notes to solve that problem. The knowledge building and collaborative capabilities of these environment are best demonstrated in the ways these tools provide "flexible build-ons" and a range of opportunities to display, link, and make the notes objects of further

idea improvements, which is more consistent with how knowledge building processes actually function (Scardamalia, 2004). As for wikis (Leuf & Cunningham, 2001), a concern for the knowledge building environments has been to facilitate better alternatives to the traditional knowledge building and annotation solutions: "Threaded discourse now dominates the Internet, despite the fact that it in many ways defeats knowledge building" (Scardamalia, 2004, p. 5).

Later research has problematized fundamental assumptions in the original knowledge building models, and the possibility of an easy transfer of scientific and expert models to the school context. Ludvigsen and Mørch (2003) found that the progressive inquiry model in the discussion forum in FLE was too rationalistic for students' knowledge building. The model was not sensitive towards students situated meaning making, and rather than aiming at conceptual artifacts, students' knowledge building was task specific and oriented towards the local meaning production. In a follow up study, Ludvigsen (2012) problematized how the transfer of expert models into a school context lost contact with the institutional underpinning of these models, turning the scientific concepts into a set of abstractions. Hence, the models failed to make the scientific practice transparent to the students. The categories, in combination with teacher intervention provided, however, transparency to students' own work, and they could therefore potentially also provide a more systematic orientation toward educational activities. Ludvigsen argued that the categories both supported a focus on the subject content and the working process, but the author claimed that there are great challenges related to both foci.

Arnseth and Säljö (2007) discussed challenges related to what is referred to in this study as the students' and the teachers' *social* and *epistemological framing*. Instead of discussing and evaluating the appropriateness of the available categories, the students tended to choose categories they perceived as neutral and uncontroversial. The "preference for reaching agreement" took "precedence over the need for understanding the relation between a category and a knowledge object" (2007, p. 433). Arnseth and Säljö emphasized the importance of teacher's scaffolding in order for the epistemic categories to work. In their study, the instruction failed to address how knowledge should be tied to the students own accounts, and, how it should be used to support their arguments (i.e., the underlying knowledge model), and how the categories could be exploited as a resource for making judgments about the validity of knowledge and the quality and extension of the students' arguments.

In conclusion, the knowledge building research, but in particular the later critical investigations of these environments (Arnseth & Säljö, 2007; Ludvigsen, 2012; Ludvigsen & Mørch, 2003), has taken a stronger interest in the sociocultural dimensions of these tools. However, the students have been the object of focus rather than participating in the inquiry—the previous studies in this field have mostly studied students' *tool use* rather than the students' *research* on the tool they used. Hence, these studies tend to perceive the tool more as a *passed on* resource, rather than being (potentially) a co-constructed product of the interaction between the students and the teacher/researcher.

ANALYSIS

This section addresses the second research question: What characterizes the participants' framing of the technology?

A letter was sent to the students (cf. Appendix 2) at the beginning of the course emphasizing that the technology was ready to be explored, but was by no means "finished", and how the weaknesses could be productive for their learning and semester projects. Hence, a meta-framing (cf. *tool inquiry perspective*) was verbally present early on in the course. However, the contextual resources relevant for this focus were not equally latent and easy to activate for the participants in the two cases presented.

When introducing the tool, the researcher (in Case 2 also the course-coordinator) emphasized the tension between individualizing the categories and finding a kind of standard or unified language that might better facilitate the communication, collaboration, and comparison of each participant's tagging. This double framing prepared the ground for a *tool inquiry perspective*. However, only the second case activated these resources.

Case 1: Tool focus

What follows are four episodes from the interview of the students in Case 1, where the tool is an object of inquiry. Although the participants' framing of their inquiry involves a lot of zooming in and zooming out, the resources activated in this case maintain a rather local context compared to the next case we will study. The interaction in Case 1 has been translated from Norwegian. In Case 2, all of the interactions took place in English. Transcription notation is based on the Jefferson system.[i]

Excerpt 1:

Episode 1

3	Researcher:	I think partly I ask now, and partly that you tell me in a way what's on the top of your minds, and partly that we look through the text and what you have tagged and (.) that you say something about what you have tagged, and the process, ehm (.) How did the script work this time, do you think? Now you got a chance to make a suggestion that we added the *Method* [*category*], and (.)
4	Student B:	Well (.) it really depends on the article how such a script works (.) and it should be better opportunities to customise it to the work you're doing. And this article was well organised. It was very straightforward and clear, and divided into specific chapters, and was simple to use in that sense. But it would vary a great deal (.) the articles, how useable the script is.
5	Researcher:	Yes, yes, indeed. And it's not really meant to be a completely generic script. The intention is that one creates the script oneself. It is a prototype. It is an early version of the script, and then it is, it is what it is in a way, and it becomes a bit more cumbersome. Well, it was not very difficult, you saw that when we added the *Method* [*category*]; that operation only takes 30 seconds. So it is not worse than that. But I think for the average user, you are technical, compared to the (.) larger group of users (.) it needs to be made easier. Apart from that, what did the script offer for better or for worse with regard to your work?
6	Student B:	Well, it was okay when one could sit together so that one could discuss
7	Researcher:	Umm
8	Student B:	So it was okay (.) yes to discuss the article
9	Researcher:	Umm
10	Student A:	Umm
11	Researcher:	Exactly. Other immediate experiences [*"opplevelser"*] and afterthoughts [*"erfaringer"*], so that I don't lead your thoughts too much with my questions?
12	Student B:	What's sort of the purpose with the script, or what's the idea behind it?
13	Researcher:	((*Long description where researcher elaborates his ideas*))
14	Researcher:	Umm (.) Okay, if you can go through what you have done, just to show me. Talk me through, just scroll down.

In Episode 1, the researcher's framing of the interview situation starts with an open frame (asking the students to share "what's on the top of their minds"). The question deriving from the initial framing is, however, much more narrow: "How did the script work this time, do you think?" Student B claims that how well the script will work depends on the article, which necessitates a customizable script. Her framing focuses on a *tool text dependency*. We can also observe that she moves between two contextual frames when discussing this dependency: the general and the particular. The tool worked okay on this specific article but can be problematic to use on other articles. The researcher supports this line of thinking and adds that it is a prototype (indicating limitations) and that the idea is that the users create the script themselves. However, the researcher's further inquiries in line 5 maintain the local framing—he asks about this particular script with regard to this particular task/article. In lines 6 and 8, Student B frames the situation where the tool had a positive impact (i.e., in collaborative activities, and where one uses it to discuss the article). The researcher waits seven seconds for students' further thoughts before asking for other "immediate experiences and afterthoughts" (line 11). A dimension could easily have gotten lost in translation, since both the words *"opplevelser"* and *"erfaringer"* in the original Norwegian wording are regularly translated into *experiences*. However, *opplevelser* are more immediate and unprocessed and rely more on our feelings or intuition toward the situation, whereas *erfaringer* refer to the cognitively more processed products in which the immediate experience has been integrated with other experiences and knowledge. This last group of experiences is often referred to with words like *knowledge* or *wisdom*, which signify their cognitively more developed status.[ii] Hence, whereas *erfaringer* imply that students' framing should draw actively on cognitive and metacognitive resources, *opplevelser* also have strong connotations for the *affective framing* of experiences (participants' feelings toward the situation), suggesting that the students also can use their feelings as a resource. A potential pivotal moment for broadening the frame is reached in line 12 when Student B raises the question "What's sort of the purpose with the script, or what's the idea behind it?" The researcher has a lot to say about this theme, and a long description of design ideas follows. The students sustain the role as listeners, only nodding as he speaks. Discovering that his design ideas do not trigger further discussion, the researcher proceed with asking the students to elaborate on their tagging.

Excerpt 2 presents three other tool-oriented episodes to elaborate upon the framing and to illustrate its further development.

Excerpt 2:

		Episode 2
85	Student B:	((*Scrolls*)) The *Learning type focus*, is in a way okay, but it's difficult fo- like for us technology students who don't speak about learning (.) that is (.) this tag ((*points*)) is only for education=
86	Researcher:	=Eh (.) yes and no=
87	Student B:	=I will claim=
88	Researcher:	=but mostly no. Eh (.) I have worked with implementation of technology for some years now. And you will never be skilled in that job if you don't find out what are the main activities and what are the main objectives=
89	Student B:	=Yes, but with this particular tag "learning type focus", I feel that in this subject this is a relevant tag to have, but in the other subjects I take=
90	Researcher:	=Yes yes (.) yes yes=
91	Student B:	=this wouldn't have been a relevant tag=
92	Researcher:	=No, indeed, this [*script*] is addressed to this particular curriculum, yes yes=
93	Student B:	=So here I think it fits, but (.) yeah=
94	Researcher:	=No, no this script with its particular focus is very tailored to this course, so the epistemic tagging must somehow maintain the focus of each course
95	Student B:	Yes
96	Researcher:	You know
		Episode 3
111	Student B:	Umm ((*scrolls down several pages with little variation in the tagging*)) Here it was a little more ((*short laugh*)) happening
112	Student A:	Umm
113	Student B:	But I think they often are very clear, yeah (.) some of the tags were very simple, and there were some that were a little more like (.) didn't quite fit anywhere, but (.) yeah
114	Researcher:	Yes
		Episode 4
121	Student B:	Yeah ((*scrolls to the end of the article*)) that was it.
122	Researcher:	Um.. yeah, but, good job, I would say. And I agree that this article as a start was very well structured. And I, I also felt that the script was a bit easier to handle now, for in the former [*script*] too much was too similar, and then it became a discussion if one were to take this or this or this ((*refers to different tag-categories*)) (.) and then these choices were maybe not especially productive.
123	Student B:	Yeah

In Episode 2, Student B scrolls down the article (line 85) and pause to comment on the relevance of the category *Learning type focus*. She claims it is "difficult" for them as technology students and that this category is "just for education". The researcher disagrees (line 86, 88), claiming that in order to be successful with technology implementation one needs to investigate the main activity and goals, which in this course were learning and technology for learning. Student B claims (line 89, 91) that although the category is relevant for this course, it will not be relevant for her other courses. The researcher discover the misunderstanding (line 90, 92), quickly adding that this script is tailored for this particular course, and that the epistemic tagging has to attend to the focus of each individual course.

Episode 3 starts with Student B scrolling past several pages where they only had used the category *Empirical findings* (line 111). Her comment "Here, it was a little more happening" can indicate that she sees variations in categories as more relevant, which raises a question about their task understanding and epistemological framing. The utterance "But I think they often are very clear" (line 113) is ambiguous, but in the context of Student B's utterance in Episode 1, line 4, the statement probably refers to the article text/authors, rather than the tool/script. The last part of the utterance refers to the tool/script—she makes a distinction between the categories that were easy to use, and the ones that "didn't quite fit anywhere". She maintains the tool text dependency framing observed in the first episode. The phrase tags that "didn't quite fit anywhere" indicates that she understands the task to be about finding instances for all of the categories in the script. The researcher does not interrogate further, but instead replies with a confirmative statement[iii] (line 114).

In Episode 4, the final episode concluding the interview, the earlier framing is maintained. The researcher builds on Student B's framing, the tool text dependency, and agrees with her that the text was well structured and hence made the tool easier to use. However, he also emphasizes that the development of the script made it easier to handle.

Case 2: Tool inquiry focus

The next set of data is taken from another case associated with the students' semester project, where the researcher follows one group of four students. In an outline of their project, the students suggested a redesign of the annotation tool that allowed them to 1) define their own tags, 2) compare their tags with others' tags, and 3) collaborate synchronously in answering the questions presented. Their semester project outline shows that they were aware of the potential conflict between the first and second suggestion for redesign:

> We believe that giving the students the freedom to tag and comment with no constraints would help improve the process of collaborative knowledge creation. However, this change is likely to complicate the information management and organization of the learning tasks, which would be further explored in the future deliverables. (Students' semester project draft)

The tension between individual and shared annotation practices was also addressed by the course-coordinator in his written comment on their semester project draft:

> Allowing students to create their own tags is interesting as it is a topic of research in e.g. end-user development. But you ought to discuss the pros and cons of having user-tailored shared tags in collaboration software like Wiki, as there is a tension between shared knowledge (tags that are understandable to many, possibly provided by a teacher with a set of learning goals behind, but sometimes not relevant for oneself) and private knowledge (relevant for one's own tasks, but not understandable to all, possibly including teacher). (Teacher's feedback)

The semester project proposal together with the teacher's comment constitute the background for the following discussion that took place during the first five minutes of a consulting meeting.

Excerpt 3:

4	Course-coordinator:	It is little bit (.) it is something that is a little bit confusing (.) in your text. I (.) [*inaudible*] what tag should be the starting point? Is it something about questions? I am not sure what you meant about questions [*inaudible*] that was based on question tag. But you are more interested in modifying the tags. Right?
5	Student B:	Okay, so I think before we go down this road, maybe we should explain that we changed our inquiry to this. So maybe it would be better to describe the newer plan, if that's okay. Ehm (.) I was (.) you guys probably haven't seen this [*inaudible*] five minutes ago
6	We:	((*laughs*))
7	Student B:	That's why I didn't say anything. Ehm (.) so (.) that's a document that kind of describe the new, so do you want to read about it, or do you want us to describe it to you?
8	Course-coordinator:	Yes you can describe it. Since we don't have the text
9	Student B:	Okay. Ehm (.) well the first thing we did, was we realized that the problems arise in the province of aggregating peoples' tags if they used different tags is quite problematic, because [*inaudible*] (.) parallels necessarily between the tags that different people develop. So (.) ehm (.) we also (.) no offense Jan Erik, we don't really like the tags (.) not at all (.) because people at the Master level tend to already have developed their own conventions and habits. And they have a (.) we have a way of reading text that works for (.) for us, but (.) ah (.) [*inaudible*]=
10	Student A:	=separate from each other=
11	Student B:	=its separate from each other, and its most likely separate from whatever tags are being given. So we wanted to include a way to engage with the texts that can also facilitate collaborative learning, but (.) eh (.) have it be more open. So instead of having tags where in the mean of a system where students can individually go through the article, and (.) it is kind of like in Microsoft where you can highlight things and can add comments (.) uhm (.) can be able to do that kind of things. And then (.) after everyone has done that divide students into groups of three to five. And have those (.) eh (.) different (.) different [*inaudible*] so have kind of like heat map [*Ref. to visual representation*] eh (.) like all the highlights (.) ehm put together [*inaudible*] which paragraphs have been highlighted by more people than other people, but not necessarily that has to do with a particular tag or (.) ehm (.) scaffoldings, because it is just (.) eh (.) closes the discussion [*inaudible*] more open ended, and (.) um (.)

One of the other semester project groups proposed a redesign that included a "question tagging" that was used to annotate and ask questions about unclear sections of the articles. The course coordinator has difficulty understanding how this group's focus on questions (cf. their third suggestion for redesign) is integrated with the redesign of the annotation tool. Instead, he understands their framing to be about "modifying the tags" and asks for clarification (line 4). However, based on the written feedback from the teacher, the students revised their original draft—Student B takes charge and suggests that they instead should describe their new plan (line 5).

In line 9, Student B identifies two sources leading to their reframing. Firstly, the problems of aggregating people's tags if they used different tags, secondly, and in her own words, "so, ehm, we also (.) no offense Jan Erik, we don't really like the tags (.) not at all". The discussion continues with the students explaining that their annotations follow personal conventions and differ from each other's. However, this reframing also has consequences for the students' collaborative learning design, since this can no longer be built on a common notation. Hence, they are also forced to develop a new idea for how the individual annotations can facilitate collaborations.

DISCUSSION

The following discussion summarizes the findings by comparing the students' framing in the two cases.

Regarding the *social/positional framing*, in both cases, the students and the researcher/teacher alternate between being the *source* and the *listener*. The exchange of roles appears to be transparent and smooth. The context of Case 2 seems to provide a simpler participation structure that is probably well known from other school activities. However, the experiment and co-learning context in Case 1 enrolls the participants in three different participation structures, constituted by: 1) researcher vs. research subject, 2) technology developer vs. user/customer, and 3) teacher vs. student. In order to connect the activity to the relevant contextual resources and facilitate co-learning, the participants have to maneuver between these structures, identify the relevant resources within each structure, and manage to take each other's perspective. Each of the participation structures naturally involves an exchange of the position as *source* and *listener*. However, conflicts/misunderstandings can easily arise in situations where there is a different understanding of which participation structure is at work and where the participants' role as *source* or *listener* differs depending on the choice of structure. If participants assume the same role, this can prevent either active listening or the presence of an active *source*. We see in Case 1 that the researcher's role as *source* and *listener* also involves disagreeing with students (cf. Excerpt 2, line 88). His framing here is that technology designers, including the students, need to familiarize themselves with the domain they are working with in order to have a positive impact. Hence, when the domain is information and communication technology (ICT) and learning, they should not only explore the technology, but also the learning focus, and how the two foci align. The researcher's role here seems to rely more on his capacity as a teacher and designer than on the traditional research role. His framing also requires the students to take on the role of designers, not merely students or users. Returning to the potential pivotal learning moment in Excerpt 1, line 12—and why this framing did not lead to further discussion after the researcher's presentation of his design ideas in line 13—this might be because the question prompted a shift in the participation structures. Whereas the researcher might have waited for the students to extend their thoughts based on his contribution, the students might instead have perceived the answer as given in his capacity as the designer or teacher and more in order to inform them than to enroll them in further inquiry and co-learning. Hence, they also took on the role of *listeners* waiting for his next move.

The students in Case 1 seem to strive in finding the *epistemological framing* of this experiment (cf. Excerpt 1, line 12). The goal of the script, the true nature of the problem, and what knowledge they need to activate in order to solve the problem are unclear to them. They frame the problem as being about tool text dependency, and that a *predefined script* will not work. However, for the researcher, this frame is just a temporary limitation (the predefined script issue was solved later in the course). Instead, he wants to frame the co-learning more in terms of envisioning a prospective instructional design in which the elementary prototype limitations are solved. However, the students' framing of the design problem to be solved seems to maintain the focus on a *predefined script*, which also makes the tool text dependency framing more relevant. In the context of the research–teaching nexus, it is interesting to observe that instead of students aligning with the researcher's framing, the researcher aligns with the students' framing, which also preserves the rather local focus on contextual resources.

The most dominant *source* of scaffolding for the co-learning in Case 1 seems to be *nonhuman* (i.e., the existing design limitation and students' experiences with it). Nonhuman *sources* also played a decisive role in Case 2, and two sources in particular. The first is, as in Case 1, the *predefined script*. However, the group's thinking in Case 2 transcended to greater extent the local context of a *tool perspective* observed in Case 1—they also made inquiries into the tool's epistemological foundation. A second *source* was the conflict between personalized tags

and unified tags as a collective resource (i.e., an aspect of the design problem introduced by the researcher and the course coordinator). This *source* possibly constituted an even bigger challenge as these two frames may appear to be incompatible. Aligning the two suggests that they might even have to sacrifice their main idea: the personalized script. Hence, this double framing was not only a *source* for a regular reframing*/re-keying*, but it constituted a *breaking frame*—the grounding and heuristics of the initial frames lend little support for how to frame the new situation (Manning & Hawkins, 1990). The students needed to co-construct a new schema (van de Sande & Greeno, 2012). Initially, they tried to do this by making questions (their third design idea) a bridge between the individual and the collective (cf. private vs. public annotations), but they found it problematic to figure out how questions could make personal annotations a collective resource. In their new framing, the collaborative level exploits the frequency of annotations, building on the annotation of everyone that had tagged the same text passage (visualized through a heat map) rather than trying to exploit annotations related to different categories.

That the opportunity to create their own script was not optimal was salient in both cases' discussions and framing of the technology. However, their further framing differed with regard to using a *tool perspective* versus a *tool inquiry perspective*, in which the last focus signifies that the premises of the tool to a greater extent are made an object of critical inquiry. Facilitating the last focus is important, as it has a greater potential for providing a transcending learning experience (i.e., transcending the logic of the tool to include other potential contexts).

In Case 2, the students' *affective framing* was foregrounded in their epistemological framing, which probably caused them to focus more on the *epistemological framing* of the learner and to use this epistemological framing as a resource for their (re)framing of the tool. In Case 1, the students struggled with the epistemological framing, and their framing aligned with rather than challenged the logic of the *tool perspective*. Hence, their reframing involved a *rekeying* rather than a *breaking frame*.

CONCLUDING REMARKS

This study was conducted via a short-term and a long-term task, was associated with both a *tool perspective* and a *tool inquiry perspective*, and paralleled the researcher's own research. Hence, it provided extended opportunities for the students' research participation and for focusing on research processes and problems. This setting constitutes an interesting area for further investigation. The setting can involve a double framing and methodological challenges, both of which require further research. When the tool is made the object of a critical extended inquiry, which the semester project aimed for, it can change the tool practices (e.g., students' perspectives and motivation toward using the tool, cf. affective framing). A *tool perspective* and *tool inquiry perspective* are in some respects opposites, which implies that in reality, the students were exposed to two contradictory "treatments"; this can make it more challenging to explore the learning process. The embedded emphasis in a *tool perspective* is that the tool somehow aids in accomplishing a task and that the tool's functionality prescribes the relevant framing. It can involve criticism of the tool, but this criticism, for whatever reason, does not manage to transcend the logic of the tool. The *tool inquiry perspective* takes a more critical stand and problematizes not only the functional alignment implied in the *tool perspective*, but also whether this functional alignment is the *only* or even the *most* relevant context for assessing the tool. Hence, the *tool inquiry perspective* extends the *tool perspective* by calling into question the fundamental epistemological assumptions of the *tool perspective*. The *tool inquiry perspective* has more contextual resources at its disposal and greater potential for reframing, but it regularly requires more cognitive effort—students need to explore both the framing of the *tool perspective* and their alternative framing, compare the frames, argue for their reframing, and determine how to achieve it. Where the students can reason within the frame provided by the *tool perspective*, the *tool inquiry perspective* naturally leads to a double framing; here the frames are often conflicting, competing and even incompatible (Hetland, 1996), and the reframing often involves a *breaking frame* (Manning & Hawkins, 1990). Ideally, criticism emerging from the *tool perspective* further leads to a *tool inquiry perspective*. However, more research is required to explore whether, how, why, or why not this happens.

Further research is needed to identify and describe the different contexts and resources participants rely on in their framing, and the challenges of activating these resources (Hammer et al., 2005; Linell, 1998). The above discussion has foregrounded students' framing. To improve the understanding of researcher–student co-learning and co-construction in research-based teaching, future research should also address the researcher's framing and how it affects the students' framing. This can tell us more about the nature of students' research participation (Healey, 2005), e.g., to what extent the students' research is informed by the researcher's framing, or must be considered more as a parallel inquiry.

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APPENDIX

Appendix 1

The data sources in the study were the following:

- **Records of earlier courses**: The researcher used this to get a sense of the course and what role the technology could play.
- **Course preparation**: Email correspondence, preparation meeting, and discussions with the course coordinator regarding the content and organization of the course and the implementation of the wiki learning environment.
- **Course introduction**: Introductory presentation for potential students that considered following the course held by the course coordinator and the researcher. The researcher's three roles in this course was introduced: 1) teach on one of the sessions, 2) provide the learning design/platform and assist students and teachers, and 3) research and gather experiences from students and teachers.
- **Students' drafts of their idea for the semester project**: The researcher read, commented and discussed the drafts with the course coordinator.
- **Kick-off meeting with semester project groups**: Observation and audio recording. Mainly, the interaction was between the course coordinator and the students, but the researcher also gave some feedback. Since their project was about the wiki environment that the researcher had designed, the researcher was the expert and a key stakeholder.
- **Students' annotation of an assigned curriculum article**: Observation and video recordings. The researcher conducted informal short interviews with the students about their experience with the tool, their categorization decisions, etc. All of the video recording (eight hours in total) was transcribed and analyzed with the qualitative data analysis software NVivo. Two types of video were recorded: 1) a screen capture of the activity on the computer. This recording made it possible to study in closer detail how different resources (cues and textual resources in the article, category scaffolds, active use of cursor as a pointing device to organize and nominate ideas for talks, etc.) mediated the interactional discourse. 2) A stationary video camera was placed on a tripod so that it could capture the use of other resources, students' body language, etc.
- **The researcher's own reading and annotation of the same article**: To get a better sense of the constraints and affordances of the tool, the researcher tried using the categorization script on the same article before the experiment. In this way, the researcher was able to better relate to the user experiences and potential troubles with the categorization script with regard to each article (the scripts were generic, not tailored to each article—the idea was that the students instead could change the script themselves). In addition, the researcher could compare and contrast the students' tagging with the researcher's own annotation as a more experienced reader.
- **Students' presentation of the article to the class**: The researcher observed their oral and PowerPoint presentations, and got a copy of the PowerPoints.
- **Lectures**: Beside observing the classes and taking field notes, the researcher was also responsible for one of the lectures and played the role of an assistant teacher in the other lectures.
- **Talks with teachers**: Informal talks with lecturers to gain insight into their experience with the course and interaction with the class.
- **Students' class presentation of their semester projects before handing them in for final evaluation**: Draft of the paper. The course coordinator asked the researcher to contribute with two critical questions to each of the four semester groups.
- **Semester project papers**: Copy of the final paper.
- **Student evaluations**: Focus group discussion with the two sensors

Figure 4. Data sources.

Appendix 2

What follows is the letter that was sent to all of the students. It describes a framing of the technology that can benefit their learning task.

> Hi everyone,
> Thanks for the last seminar. Regarding the TEL course and your participation as a student in the course, I have created a user account for each one of you to access the wiki-based learning design that we will use. I will send the account information in a separate email.
>
> **Semester project**
> It is a long and tricky process to develop learning technologies, and the design is by no means "finished" (in quotation marks to signal that you should question whether a learning design can ever be "finished"), but hopefully, it is finished enough to start using it, experiencing its weaknesses and strengths, and discovering its opportunities and potentials.
>
> We have made the wiki design with its many features the topic for your semester project this year (see http://217.171.199.148/uio/Final+report), thereby giving you an opportunity to experience a learning design, different design problems, and learning design interventions first hand. From a learning perspective in a TEL course, there is probably much to be gained from experiencing a design that is a little unfinished, imperfect, and messy. In this way, the technology becomes more visible in its affordances and constraints, its pro and cons, and its dependences. This can be a motivating and productive starting point for creating design ideas and suggestions for further development and improvements.
>
> Remember, your task is not only to make suggestions for improving the design, but also to base this work on scientific arguments from the curriculum literature and other relevant research. Your knowledge claims about the design need to be rooted in research and scientific reasoning.

Figure 5. *Letter framing the technology.*

ACKNOWLEDGMENTS

I want to thank my PhD supervisors, Per Hetland and Anders Mørch, for their many valuable contributions to this article, and Palmyre Pierroux for her suggestions and comments on an earlier draft. I am also grateful for the discussions and feedbacks from my colleagues Sten Ludvigsen, Jan Dolonen, Line Ingulfsen, Sven Magne Bakken, Renate Andersen and others. An especially big thank you to the students who participated in the experiment.

NOTES

[i] The transcript notations are based on the Jefferson system, but they follow a simplified and more accessible version (Strømme & Ludvigsen, in review):

[ ]	Text in square brackets represents clarifying information regarding the discourse.
(( ))	A description inserted between double brackets denotes contextual information.
=	Indicates that there is no discernible pause between two speakers' turns.
?	Rising intonation.
:	Indicates prolongation of a sound.
Underlined:	Emphasis in speech.
(.)	Short pause in the speech.
[…]	Utterances removed from the original dialog.
-	Single dash in the middle of a word denotes that the speaker interrupts him or herself.
--	Double dash at the end of an utterance indicates that the speaker's utterance is incomplete.

[ii] Not all dictionaries address this important distinction, but cf. Wikipedia: "The word 'experience' may refer, somewhat ambiguously, both to mentally unprocessed immediately perceived events as well as to the purported wisdom gained in subsequent reflection on those events or interpretation of them" (Wikipedia, 2015, September 4).

[iii] The original Norwegian phrasing was "*ikke sant*". In line 114, the instance was translated to "yes". Other translations used in the transcript are "indeed" (line 5, 92), "exactly" (line 11), and "you know" (line 96). *Ikke sant* (literal meaning "not true") is a pragmatic idiom traditionally used to *appeal* for agreement: "Du skal bli

med, ikke sant?" (You are going to join us, right?/aren't you?). Line 96 ("you know") resemble the traditional use; however, today the idiom is also frequently used to *express* agreement in *response* to former statements (Svennevig, 2007). The other instances of *ikke sant* fall into this category. In both uses, *ikke sant* serves to confirm common knowledge, understanding, or agreement.

Teacher Perception of Barriers and Benefits in K-12 Technology Usage

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ABSTRACT
This study explores K-12 teachers' perceptions of the benefits and barriers to technology integration by either teachers or students in K-12 instruction. The sample was composed of 68 students enrolled in online classes in the graduate studies in education department of a small private liberal arts institution in the southeast. Data was collected using an anonymous, online survey. Open and axial coding was used to identify themes in barriers and benefits in both student and teacher technology use. Even with the emphasis on providing 1:1 technology, availability of technology was most frequently identified barrier, while increased engagement was the most frequently identified benefit. Content instructional issues or teacher knowledge were not as stronger identified barriers or benefits.

INTRODUCTION
Since the advent of computers in the mid 1970s, educators have extensively discussed the potential they have for helping to improve student learning (Hew & Brush, 2007). The possibilities seemed endless, but originally the ratio of students to computers was too high to allow for frequent usage. The ratio of students to computers in 1983 was estimated at 168 to 1 (Anderson & Ronnkvist, 1999). Since that time there has been an influx of new computers and digital devices as schools attempt to meet the academic needs of the 21st century learner.

The National Center for Educational Statistics (IES, 2010) reported that 97% of United States teachers had at least one computer in their classroom every day with 93% of those computers having Internet access. They found that the ratio of students to computers was 5.3 to 1. However, only 40% of the teachers interviewed reported that they often used computers during their instruction. But computers are not the only technological options open to educators. Schools have recently experienced an increase in the types of information and communication technologies available. Most schools currently have high speed Internet access as well as other digital equipment such as printers, video projectors, digital white boards, iPads, iPods, and smart phones. These expanded technology options have transformed the educational landscape (Robinson, McKenna & Conradi, 2012).

Even though schools have embraced the digital revolution, reading and mathematics test scores are at about the same level that they were 40 years ago (National Assessment of Educational Progress, 2013). Consequently as Kozma (2003) indicated, it is evident that the positive impact of technology does not happen automatically. Its impact is determined by how teachers use the technology in their classroom instruction, not just the acquisition of technology.

THE STUDY
This study explores K-12 teachers' perceptions of the benefits and barriers of educational technology when used by teachers or students in K-12 instruction. Data was collected using an open ended qualitative survey format from a sample of students enrolled in online classes in the graduate studies in education department of a small private liberal arts institution in the southeast. The students were invited to complete an anonymous survey about their perceptions of the benefits and barriers to their use or their students' use of educational technology.

REVIEW OF LITERATURE
Students come to the classroom ready to use technology to explore their world. Research has indicated that technology can increase student motivation, attitude, engagement, and self-confidence, while improving organization and study skills. All these factors taken together were found to significantly improve school attendance and academic performance (Warschauer, 2006). Spektor-Levy and Gronot-Gilat (2012) determined that students who were taught in a 1:1 digital environment outperformed students who were taught in a more traditional classroom when given a complex, computer-based learning task. Using a researcher designed computer based instrument, the researchers found that students from the 1:1 digital classrooms significantly outperformed their peers in 9 of the 15 literacy skills assessed. This improved academic performance is particularly important because many of the high stakes standardized assessments are currently technology based

(WGBH Educational Foundation, 2014). However, Dawson (2012) found that the technology benefits were not just academic. He reported that computer usage also resulted in better teacher-student and home-school relationships.

Many states have developed technology goals. Florida has identified five educational goals. The third goal, *Florida's Digital Educators* is to "empower educators with the skills necessary to integrate technology to improve students' rates of learning" (Florida Department of Education, 2006, para. 4). Although the goal is technology integration, this has been defined in a variety of ways. Hew and Brush (2007) defined it as the use of computing devices for instructional purposes. These devices could include desktop computers, laptops, iPad, iPods, smart phones, handheld computers, software, and Internet resources. However, teachers through their lesson planning impact the actual technology practices in any school (Spektor-Levy & Garanot-Gilat, 20012. Consequently it is important to determine the factors that enhance or restrict teachers' technology implementation.

World-wide teachers are struggling to find the most effective ways to integrate technology into their instruction (Nyagowa, et al., 2013; Orlando, 2013; Peeraer & Van Petegem, 2012). Hutchison and Reinking (2011) in their survey of 1,441 United States educators found a significant gap between teachers' perceptions of the importance of integrating technology and their classroom use of these skills. On a Likert scale ranging from 0 to 3, the mean teacher perception of importance for evaluating information online was 2.08, but the mean frequency of classroom use was only 1.03 (Hutchison & Reinking, 2011, p. 322). This difference of -1.21 indicated that teachers thought students should be able to evaluate information online, but they did not incorporate those skills into their instruction. The United States is not the only place this phenomenon occurred. Jordanian teachers reported rarely using technology for educational purposes (Al-Zaidiyenn, Mei, & Fook, 2010), while in Tanzania, the integration of technology into classroom learning rarely occurred despite several national initiatives aimed at improving technology integration (Mwalongo, 2011).

Technology integration can be impacted by a variety of different factors. Ertmer et al. (1999) classified barriers into first and second order barriers. First-order barriers would be those that are outside of the teacher, such as a lack of resources. While his classification is dated, the concepts hold true today. Multiple research studies have identified potential obstacles to technology integration (Hew & Brush, 2007; Spektor-Levy & Gronot-Gilat, 2012), one of the most common is a lack of technological tools which would be an example of a first order barrier. Second-order barriers would be those that occur because of factors within the teachers, such as their attitudes or skills.

Hew and Brush (2007) in their meta-analysis of 48 studies on technology integration classified the identified barriers to integration into five main categories: resources, knowledge and skills, institutional attitudes and beliefs, assessments, and culture. In their analysis they found that the first two categories, resources and knowledge and skills were most often identified. Consequently this study focused on these two barriers. They were analyzed more extensively in an attempt to understand the barriers caused by the resources and lack of skills. The resources category would be a type of first-order barrier and would include such factors as access to the technology, time, and technical support. They found that factors such as the amount of technology, where the technology is housed, ease of access to technology, and the limited number of technical support personnel all impacted teachers' decisions about whether to integrate technology in their instruction.

Ertmer (2005) indicated second-order barriers such as the teachers' perception of their knowledge and skills were important because these factors impacted whether the teachers chose to use the available technology in their instruction. He argued that teachers need effective technology integration professional development that focused on content appropriate technology and skills, provided hands on opportunities, and addressed teachers' needs.

Another barrier to digital integration could be teachers' technology skill levels. Moradi-Rekabdarkolaei (2011) administered the ICT Literacy Assessment to 384 secondary students and 367 teachers in Iran in an attempt to compare teachers' and students' technology proficiency. The ICT Literacy Assessment measured "cognitive problem solving and critical thinking skills associated with using technology to handle information" (Moradi-Rekabdarkolaei, 2011, p. 45). Moradi-Rekabdarkolaei, (2011) found a "meaningful difference between the ICT literacy of teachers and students" (p. 43) with the students scoring higher than the teachers on all areas of accessing, managing, integrating, evaluating, and creating information. The teachers involved in the study indicated that they were reluctant to use technology in their classrooms because they felt deficient in their technology skills. Teachers' lack of proficiency could explain why educators are not yet integrating technology into their instruction. This lack would be a second order barrier.

However, Waycott, Bennett, Kennedy, Dalgarno, and Gray (2010) questioned whether there was a digital divide between students and teachers. Although students are often referred to as "digital natives" (Waycott et. al., 2010, p. 1202), the research revealed that their "digital immigrant" teachers were just as likely to embrace technology (Waycott et. al., 2010). The authors found that assuming teachers are reluctant to integrate technology due to a resistance to technology was a misconception. Perrotta's (2013) findings supported Waycott et al (2010) and he further warned of the dangers of "bashing" teachers and portraying them as "outmoded, obstructive, or ignorant" (p. 325) simply because they continued to utilize traditional instructional methods. When Perotta (2013) surveyed 683 teachers in 24 secondary schools across the United Kingdom, he discovered that conflicting expectations and school-level circumstances were more significant determinants to technology integration than the individual characteristics of the teachers.

DESIGN

Technology integration could be examined in various ways; through first person perception expressed in surveys, teacher observation studies comparing teacher technological practices, and action research. This study used a qualitative survey to analyze teachers' perceptions.

Three hundred and ten students enrolled in online classes in the graduate studies in education department at a small private liberal arts institution in the southeast were invited to complete an anonymous survey regarding their technology usage, and the barriers and benefits K-12 teachers and students experienced when using educational technology. The graduate students were sent an email containing a link to the anonymous online Qualtrics survey. The email explained the purpose of the research, that participation was voluntary, and that all responses would be anonymous. The study sought to answer the following questions.

1. What factors impact technology use in K-12 instruction by teachers enrolled in online graduate studies in education programs?
2. What factors impact how teachers enrolled in online graduate studies in education program incorporate technology in their K-12 instruction?
3. What K-12 digital instructional benefits and/or barriers were identified by K-12 teachers enrolled in online graduate studies in education programs?

Email invitations to participate in the study were sent to the 310 students enrolled in the three online graduate studies in education programs: Exceptional Student Education, Reading, and Educational Leadership. Using a mixed methods survey design, the study explored K-12 teachers' perceptions of the benefits and barriers of educational technology when used by teachers or students in K-12 instruction. The sample of convenience was composed of 68 students enrolled in online classes in the graduate studies in education department of a small private liberal arts institution in the United States. Data was collected using an anonymous, online survey. The students were invited to complete the anonymous survey regarding their perceptions of the benefits and barriers to their use or their students' use of educational technology and the types of and frequency of technology used in the K-12 classroom.

The survey was comprised of quantitative and qualitative questions. First, nominal measurement scale demographic information was collected for each respondent to ascertain the grade and subject level of the teacher respondents. Demographic data provided the researchers with a rich description of the sample who participated in the research. Next, using an interval measurement Likert scale, the researchers surveyed the frequency and types of technology utilized in the classroom by both teachers and students. Factors assessing teachers' and students' utilization frequency and type of technology integrated in the classroom were analyzed using percentages and frequency counts. Finally, four open-ended qualitative questions assessed teachers' perceptions to barriers and supports for integrating technology in the K-12 classroom. Factors impacting teachers' and students' technology use, and teachers' perceived benefits and barriers were analyzed using axial and open coding methodologies to identify themes. All qualitative data was coded by each researcher for interrater reliability. All quantitative and qualitative data was corroborated and triangulated to ensure the validity of the results

RESULTS

Analysis of demographic information revealed most respondents (74%) taught in the areas of reading and/or language arts. Nearly two-thirds identified they taught in STEM classes (math and science) while fewer than 10% taught elective classes. The majority of respondents indicated they taught primary (K-2) elementary school (41%) with one – third (33%) indicating they taught intermediate (3 – 5) elementary and middle school. Less than one-fifth of the respondents indicated they taught high school (19%). The majority of the respondents appeared to be elementary teachers on the kindergarten through fifth grade level who taught multiple subject areas.

With regard to technology utilized in the classroom and with what frequency, most respondents indicated they used a computer (100%) and digital projector (89%) at least weekly with most indicating they used a computer (93%) and a digital projector (85%) daily. Approximately half of the respondents indicated they used an interactive white board (56%), digital camera (48%) or iPad (47%) at least once a month. Nearly three fourth of the respondents (77%) indicated they never used text messaging in their classrooms and half (50%) indicated they never used smart phones in their instructional delivery.

Respondents were asked four open-ended survey questions:

1. What are some of the barriers you face in implementing technology into your daily classroom instruction?
2. What are some of the benefits you experience when implementing technology into your daily classroom instruction?
3. What factors impact the frequency with which you as the teacher use various types of educational technology?
4. Which factors impacted the frequency and purposes for which your students use educational technology?

Each researcher coded the data and reviewed it for inter-rater reliability. During this process, the researchers debriefed to identify any variations in coding and coexistent themes. Following the interrater reliability check, the researchers finalized the data results in overarching themes leading to recommendations. Data interpretation allowed the researchers to theorize toward developing patterns and meanings or in other words to "make sense" of the data. Using an analytic inductive reasoning process, data coding and concomitant interpretation, the researchers were able to:

1. Ascertain the common themes or recurring regularities that emerged from the data (Patton, 2002). This entailed internal homogeneity or the extent to which data belonged to a certain category or theme or dovetailed with a category of theme. This also entailed external heterogeneity or the extent to which the data did not belong in a category and to identify that the differences between categories was clear (Patton, 2002).
2. Test the data for convergence, or identify how the data did not make connections with themes or categories or align with the research questions and broader environmental scan purpose.
3. Identify deviations from the common themes and, when possible, to provide explanations of the deviations. Deviant cases or data that diverged from the categories or themes was given careful consideration and examination as to why it did not "fit" into the categories or themes.
4. Bring forth the stories or a narrative enquiry that emerged from the data analysis from which to draw recommendations.
5. Bring forth patterns or themes that may suggest additional data that needs to be collected.
6. Align the themes and narrative stories that emerged with the review of literature.

Data analysis and interpretation provided the structure for the ensuing results, analysis, and recommendations. Interrater reliability was evident in the themes identified. Overwhelmingly, based on the work or classification system developed by Etmer, et al., respondents indicated first order barriers to technology use. The availability of the technology impacted teachers' decisions as to when and whether they utilized technology. Approximately three-fourths of the respondents identified first order barriers while one fourth identified second order barriers. Four different types of first order barriers were identified. The preponderance of the respondents (80%) were concerned about the amount and availability of technology. Though not as significant, the location of the technology, the amount of student instructional time, and the availability of technical support personal were also identified as barriers (See Table 1).

Table 1: *Teacher Perceived Barriers to Technology Use*

Total of 54 Barriers Identified	Number*	Percentage
Total First Order Barriers Identified	41	76%
Amount of Technology	33	61%
Location of Technology	3	6%
Amount of Instructional Time	3	6%
Availability of Support Personnel	2	3%
Total Second Order Barriers Identified	13	24%
Teacher Knowledge and Skills	13	24%

*Note. Number of responses based on 54 barriers identified.

Increased student engagement was the most frequently perceived benefits of incorporating technology. About half of the respondents (59%) indicated that the use of technology increased student engagement. A quarter of the respondents indicated the benefit of increased student understanding. The remaining quarter of the responses

were split between technology providing a method for differentiation, an opportunity to work on researching skills, and providing more current content information (See Table 2).

Table 2: *Teacher Perceived Benefits of Technology Use*

Benefit	Number*	Percentage
Increased Student Engagement	38	59%
Increased Student Understanding	15	23%
Increased Instructional Differentiation	6	9%
Increased Exposure to More Current Content Material	3	5%
Increased Opportunities to Use Research and Evaluation Skills	2	3%

*Note. Number of responses based on 64 benefits identified.

The next two questions attempted to compare the reasons for the frequency with which teachers used technology and the reasons for the frequency with which students used technology. Slightly more than half of the time teachers' decisions about technology were determined by its availability or lack of availability rather than its connection or applicability to the content. A quarter of the time the decision was influenced by instructional factors such as an opportunity for differentiation, student interest, or content objectives. The final quarter of the responses were divided between teacher issues such as available time and ease of use and district policies.

Respondents were asked to identify factors impacted the frequency and purposes of students' technology use. Responses were divided between positive and negative factors, with three-fourths (75%) of the respondents identifying negative factors impacting decisions about students' technology usage. Half of the respondent identified concerns about the availability of the equipment. One quarter of the responses were divided between concerns about bandwidth and the available time. The final quarter of the responses focused on instructional concerns such as the learning objectives, doing research, and constructing and presenting information (See Tables 3 and 4). Some barriers only affected teacher or student use, but not both. District concerns only impacted teacher usage and bandwidth was only a concern for student usage.

Table 3: *Factors Impacting Teacher Technology Usage*

Teacher Factors	Number*	Percentage
First Order Concerns		
Total School Constraints	39	67%
Availability of Equipment	36	62%
Instructional Time Schedule	3	5%
Total District Constraint	1	2%
Amount of Instructional Time	1	2%
Second Order Concerns		
Total Instructional Constraints	15	26%
Curricular Content Issues	6	10%
Student Engagement	7	12%
Differentiation of Instruction	2	3%
Total Teacher Knowledge and Skill Constraints	3	3%
Ease of Use	3	3%

*Note. Number of factors based on 58 factors identified.

Table 4: *Factors Impacting Student Technology Usage*

Student Factors	Number*	Percentage
First Order Concerns		
Total School Constraints	36	75%
Availability of Equipment	27	56%
Instructional Time Schedule	5	10%
Bandwidth	4	8%
Second Order Concerns		
Total Instructional Constraints	12	25%
Curricular Content Issues	6	12%
Student Content Generation	3	6%
Student Research	3	6%

*Note. Number of factors based on 48 factors identified.

CONCLUSION

The results indicated that first order barriers, such as technology availability, are still major concerns that impact both student and teacher use. Equipment availability, more than any other factor, seemed to have the greatest impact on whether technology was incorporated into classroom instruction. Teacher knowledge and skill, although a concern, was not the teachers' first consideration. The major reason teachers chose to use technology was because they felt it resulted in increased student engagement. Some of the same factors that impacted whether students used the computer were evident in the decision about whether teachers used technology. Equipment availability, instructional time schedules, and curricular concerns were all concerns that impacted both teacher and student technology usage. Bandwidth, on the other hand, was not an inhibiting factor in teacher use, but it was in student use.

In 2006 Florida established the goal of empowering educators to improve student learning through technology integration (Florida Department of Education, 2006), consequently it was hoped that teachers would identify second order barriers rather than first order barriers. However, seven years after the law was passed, teachers' most frequently identified concern was the availability of technology. This supports Hew and Brush's (2007) findings of the most significant barrier to technology integration is a lack of technology resources. However, the results of this study did not indicate that teacher knowledge was a perceived barrier for this sample of teachers. These results may have been impacted by the sample chosen for this study.

Teachers in this study more frequently viewed technology as a tool for increasing student engagement and understanding, rather than for the higher order skills of research and evaluation thus supporting Hutchinson and Reinking's (2011) findings that teachers are not using technology as frequently for evaluating information. Expanding educators' technology knowledge base might expand technology usage in evaluating curricular content, increasing student engagement, and differentiating instruction. As these issues are addressed, teachers might develop more extensive ways to use technology for research and evaluation.

Instructional concerns, which seem like they should be the driving force in technology usage in education, were not the primary concerns. Instructional concerns were determining factors only about a quarter of the time. After teachers determined that the technology was available, then they considered the instructional content and how technology could be used to enhance instruction.

The open ended format of this research allowed the participants to identify as many areas or factors as they felt were relevant for each question. Some respondents identified only one issue while others identified multiple factors. As long as a factor was identified in the response, it was included in the open and axial coding of the responses. A future study would be necessary to consider the weight or impact each of these factors had on educational planning. Researchers might also want to further examine and prioritize the identified first and second order barriers. Teachers reported the perceived benefits of increased student engagement and understanding, further research would be needed to determine whether these perceived changes can be quantified.

There are some limitations inherent in this study. The majority of the respondents were elementary (K-5) teachers who taught multiple subjects, even though middle and high school teachers were included. Consequently the data might more accurately represent the concerns of elementary teachers rather than middle and high school teachers. In addition, the sample was composed of students who had chosen to enroll in an online graduate program. The study sample might represent a subset of teachers who feel comfortable in the digital environment. Therefore, the results might not be able to be generalized to the larger teaching population. The respondents predominately taught in Florida public and private schools, so these results might represent the concerns of Florida's teachers rather than national concerns. These are all questions that would need to be addressed in other studies. Technology and access to technology are ever changing variables. Future research may want to explore teachers' access to, not only the technology, but also to opportunities for professional development focused on integrating technology into instruction.

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The ECO European Project: A New MOOC Dimension Based on an Intercreativity Environment

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ABSTRACT
The ECO European Project funded by the European Commission is dedicated to bringing MOOCs to a new dimension by taking advantage of the new possibilities offered by the Social Web (O'Reilly, 2005). This paper focuses on the intercreative aspects of MOOCs. It takes a look at the characteristics of the new ECO MOOCs to see if they are designed and implemented within an intercreative environment. The methodology is quantitative and data collection was conducted using self-administered questionnaires with closed or semi-closed questions. This study includes the so-called sMOOCs, which stress intercreativity to work towards collective intelligence.
Keywords: Intercreativity, sMOOC, MOOC, collective intelligence, e-learning, m-learning

INTRODUCTION
The ECO project (eLearning, Communication and Open-data: Massive Mobile, Ubiquitous and Open Learning) was created to design and implement MOOCs in regional hubs with the ultimate goal of showing teachers at all educational levels how to organise, design and develop their own MOOCs using mobile technology. The project is funded by the European Community "Competitiveness and Innovation Framework Programme" (CIP). Theme 2: "Digital content, open data and creativity". Obj. 2.3.a: "Piloting and showcasing excellence in ICT for learning for all". The purpose of the initiative is to extend to a pan-European scale the most successful MOOC experiences in Europe. ECO will help increase awareness of the benefits of Open Educational Resources (OER) for citizens and institutions. The ECO MOOCs are based on the idea of accessibility, i.e. removing barriers in teaching-learning processes for all kind of users: people with special needs and those at risk of exclusion due to social status, age, etc.

The project is a consortium of twenty-two partners: eleven universities and two specialised higher education centres from six countries, seven small and medium enterprises specialised in social media, and institutions from outside of the EU. The MOOCs are offered in six different languages: English, Spanish, French, German, Portuguese and Italian. The ECO project started in February 2014 and will last for three years.

Table 1: The ECO project partners (Osuna & Coord., 2014).

Part. no.	Participant Organisation Name	Participant Short Name	Country
	Universities and other Specialized Centres of Higher Education		
1	Universidad nacional de educación a distancia	UNED	Spain
2	Open Universiteit Nederland	OUNL	Netherlands
3	Universidad de Valladolid	UVA	Spain
4	The University of Manchester	UOMAN	England
5	Universidade Aberta	UAB	Portugal
6	Universidad de Oviedo	UNIOVI	Spain
7	Politecnico di Milano	POLIMI	Italy
8	Universidad de Zaragoza	UNIZAR	Spain
9	Universidad de Cantabria	UNICAN	Spain
10	Fundacion Universidad Loyola Andalucía	LOY	Spain
11	Sünne Hanna Eichler	SE	Germany
12	Universite Paris III Sorbonne Nouvelle	SOR	France
13	Vereniging van European Distance Teaching Universities	EADTU	Netherlands
	Specialized SME of the Social Media		
14	Montiel Molina Vicente	TABARCA	Spain

15	Telefónica Learning Services S.L.	TLS	Spain
16	Fedrave	FEDRAVE	Portugal
17	Humance AG	HUM	Germany
18	Prisma Vista Digital S.L.	RIV	Spain
19	Reimer IT Solutions B.V.	REIMER	
20	Geographica	GEO	Spain
	Extra-communitarian Institutions		
21	Universidad de Quilmes	UNQ	Argentina
22	Universidad Manuela Beltrán	UMB	Colombia

Reports discussing MOOCs, such as "MOOCs and Open Education: Implications for Higher Education" published by Li Yuan and Stephen Powell in March 2013 and "MOOCs. Massive Online Courses" developed by Michael Gaebel in January 2013 (updated in 2014), have shown that most MOOCs are designed following traditional formal education methodology despite using ICT. The ECO project wishes to break with conventional teaching and learning to expand human intellectual capacity. The ECO MOOCs are based on Connectivism (Siemens, 2004) and Social Constructivism (Vygotsky, 1978). Both theories advocate intercreativity environments where students create learning communities to build knowledge and social engagement. "Viewing learning and knowledge as network phenomena alters much of how we have experienced knowledge in the last century" (Siemens, 2006, p.vii). These environments will help develop the collective intelligence of all the participants.

This study explores variables that promote intercreativity, such as collective intelligence and communication and interaction, in the fifteen MOOCs offered by ECO to determine whether they have been designed following a new teaching and learning system where teachers and students are *prosumers* (Toffler, 1980).

THEORETICAL FRAMEWORK

MOOC (Massive Open Online Course) is a recent acronym coined in 2008 by Dave Cormier when nearly 2,300 people enrolled in "Connectivism and Connective Knowledge (CCK08)", an online course organised by George Siemens and Stephen Downes. There are many definitions of what a MOOC is. Some examples include: "MOOCs are a technology-enabled development of the slightly longer-lived open educational resources movement that has provided access to many of the supporting materials used in higher education teaching programmes" (Lane, 2008); "A MOOC is an online course with the option of free and open registration, a publicly-shared curriculum, and open-ended outcomes" (McAuley, Stewart, Siemens, & Cormier, 2010, p. 10) and "it is an online course designed for large number of participants that can be accessed by almost anyone anywhere, as long as they have an internet connection, is open to everyone without entry qualifications and offers a full and complete course experience online for free" (Fueyo, et al., 2015) given by the ECO project.

Since the term originated MOOCs have been categorized into different types depending on their pedagogical model. The largest groups are the cMOOCs and the xMOOCs. The first to be used in 2008 were cMOOCs thanks to the "Connectivism and Connective knowledge" course taught by Siemens and Downes and developed by the University of Manitoba. Its pedagogical model was based on the theory of Connectivism posed by George Siemens in 2004. Its main focus was the significance of social platforms and networks, such as blogs, wikis and forums, where content, students and learning communities connect with each other to create joint experiences and knowledge. It was based on the philosophy of a horizontal and bidirectional learning atmosphere. Siemens (2012) highlighted that their model emphasizes creation, creativity, autonomy, and social networked learning. The first xMOOC appeared in 2011 when the "Artificial Intelligence" course given by Thrun and Norving at Stanford University was created. According to Daniel (2012) this model followed a more behaviourist approach than the cMOOCs. It was based on a "conductist" or traditional educational model where teachers offered the content and created knowledge and students remained passive. Their system was vertical, lineal and unidirectional.

It is possible to talk about a third type of MOOC, the sMOOC, which is the basis for the ECO project. As explained in section D2.2 'Instructional design and scenarios for MOOCs' "the ECO sMOOC is social because the learner is put central in a social networking approach, learning through interaction and conversation with other learners and seamless because of the inclusive model and approach that crosses borders and allows access across devices" (Fueyo, et al., 2015). A sMOOC follows the culture of participation, specifically "there are no barriers to citizen expression, it supports creativity and sharing of individual and collective creations. Individuals believe in the importance of their contribution and feel a connection between what people say and their own contributions" (Aparici & Osuna, 2013, p. 138). The ECO MOOCs are both social and seamless, which is why they are called sMOOCs, and offer a new perspective that differs from others. "ECO sMOOCs are "social",

since they provide a learning experience marked by social interactions and participation, and "seamless", since ideally they should be accessible from different platforms and through mobile devices and integrate with participants' real life experiences through contextualisation of content via mobile apps and gamifications" (Fueyo, et al., 2015, p. 8).

The ECO sMOOCs present the following main characteristics: they are multilingual courses designed with special attention to both people in risk of social exclusion and people with visual and hearing disabilities; they facilitate interaction, communication and feedback with other students doing the course and with the academic staff; they promote collaboration, creativity and personal reflection; the learning environment facilitates participation in a multicultural context and a variety of scenarios, game-based exercises and technologies; they allow maximum accessibility and usability and are available on mobile devices; the courses structure is flexible and based on Constructivism, Connectivism and social networking where everybody being involved is *EMEREC* (Cloutier, 1973).

One of the main characteristics of sMOOCs is intercreativity. Tim Berners-Lee came up with the term in 1996 by joining the words interactivity and creativity. According to Camarero Cano (2014) it refers to the ability of individuals to create original and more productive elements within a virtual environment through collaboration and participation. The idea delves deeply into the creation process, from the birth of an idea, its development and until it is brought to a close. In short, it is a social process of creative exchange and a way to collectively build knowledge.

The main features that MOOCs must have to take place within an effective intercreative context (Camarero Cano, 2014) are:

- Communication must be horizontal and bidirectional: true communication is only possible when the receiver is also a transmitter. According to Kaplún (1998) this fact is essential as a source of pre-feedback in order to inspire messages.
- They should be established based on the Theory of Social Constructivism (Vygotsky, 1978): knowledge is acquired based on the relationship between the subject and their socio-cultural environment.
- They should be established based on the Theory of Connectivism (Siemens, 2004), which is defined as the amplification of learning, knowledge and understanding throughout a personal network (Siemens, 2004). Stephen Downes emphasises this idea when he says that "knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks" (Downes, 2007).
- They must create collaborative learning communities: Students must be active agents responsible for their own learning (Freire, 2003). The learning environment must allow them to create learning-teaching communities where they can share their ideas and feedback, so they can make their knowledge grow. Engaged learning relies on collaboration among the members of the learning community (Conrad & Donaldson, 2004).
- Teachers and students must both be *prosumers*: teachers and students must both be producers of knowledge. "Digital convergence has eliminated the boundaries among different types of media, and has created the conditions in which that digital content can be distributed, shared and consumed across different networks" (Camarero Cano, 2014) making it possible for everyone involved in the learning environment to be a *prosumer*.
- The concept of ICRT (Information + Communications + Relation + Technology) (Gabelas, Marta-Lazo & Aranda, 2013) is useful here. It proposes an evolution of ICT (Information Communication Technology) to ICRT by introducing the "*Relational factor*". "Students become autonomous, critical and learned beings that develop strategies. In this process of building competencies or skills the *R Factor* acts as a relational force in the horizontal and dialogical dynamics, which are amplified and redimensioned within the digital environment" (Gabelas, Marta-Lazo, Hergueta, 2013).

If these characteristics are applied, the sMOOCs will be created based on an intercreative pedagogical system. Transmissive educational values are thus left behind and a new way of learning and teaching, typically found in "techno-social communities", is given an opportunity (Camarero Cano, 2015). This is in line with Piaget's idea: "to understand is to discover, or reconstruct by rediscovery, and such conditions must be complied with if in the future individuals are to be formed who are capable of production and creativity and not simply repetition" (1973, p. 20).

It is important to bear in mind that the Internet has permeated every single aspect of our lives. That is why it must be used extensively in education. As Manuel Castells referred: "Internet is now, and will become even more so in the future, an essential means of communication and interaction in this new kind of society we live in that I call the network society" (Castells, 2001, p. 1). sMOOCs take advantage of every educational resource

(ICT, OER) available on the Web. A learning community needs these resources to be intercreative and to encourage the culture of participation, which in social media would require the following changes:

- "fewer barriers to citizen expression,
- web 2.0 in general and social media in particular will be the platform for generating creativity and sharing knowledge,
- greater value will be given to experience and
- the opinions and recommendations of our peer will be considered as a way to jointly build a new fairer and more democratic society" (Aparici & Osuna, 2013, p. 142).

If this intercreative environment is achieved, it will be possible to talk about collective intelligence and therefore, about a common brain. No one knows everything, but everyone has certain skills and some knowledge. Collective intelligence is much more than the sum of individuals. If everyone joins in and shares their bit of knowledge society will be one step closer to achieving one stronger common force with everyone working in the same direction (Lévy, 2004).

RESEARCH METHODOLOGY

The general objective of this study was to analyse different dimensions in the fifteen MOOCs offered by the ECO project that promote intercreativity and contribute to developing factors such as collective intelligence.

The specific objectives were:

- To examine the gender of the students enrolled in the MOOCs.
- To evaluate content assessment.
- To analyse course content.
- To study communication e interaction.
- To evaluate user satisfaction.

This research was a first approach to the study of intercreativity. The methodology used here was quantitative and once the results were analysed a second part that focuses on the qualitative aspects will be conducted. Finally, both results will be contrasted for a more complete evaluation of the data. This paper focuses on the first part of the research. Data was collected using a self-administered questionnaire with closed or semi-closed questions. It was deployed using the LimeSurvey open source platform and the data collected was analysed with SPSS (Statistical Package for Social Sciences).

Firstly, gender was determined to find out how many women and men took the course. Secondly, the following categories were evaluated for the intercreativity-related dimensions in the fifteen ECO project sMOOCS.

Table 2: The dimensions and categories evaluated.

Dimensions	Categories
Content assessment	- suit the course - are interesting - are rigorous - are up-to-date - accessible to all people
Content course	- Technical problems support - Suitability of tasks and games - Platform usability - Design of collaborative tasks - Videos subtitles - Responses given by teaching team - Design of individual tasks - Load distribution during the course - Audiovisual materials - Documents provided - Videos and video lectures
Communication e interaction	- Social interaction and support given by other participants - Posts and comments made by students - Posts, educational artefacts and shared resources - Feedback and comments on the work done
User satisfaction	- Designed to achieve the proposed objectives - Promotes learner creativity - Promotes discussion and personal reflection

	- Promotes learner engagement

Given its universal scope and the diversity of the courses, a tool had to be designed that:

- "Could be applied to all MOOCs.
- Allows comparison of results across different MOOCs.
- Allows information to be gathered about the people using the MOOCs
- Allows collecting opinions from the participants in the MOOCs.
- Is easy and quick to answer, given that those who participated in the MOOCs come from very different situations, cultures and professional experiences.
- Covers the main dimensions of interaction with MOOCs.
- Does not include aspects and features of the MOOCs that can be monitored using other sources of information, such as the trail left by participating in tasks, forums or quizzes, or information that can be extracted from learning analytics, etc.
- Allows evaluation of the instrument itself, with a view to its application in future pilots in the ECO project" (Fueyo, et al., 2015).

The sample used was the fifteen MOOCs in six different languages offered by the ECO Project:

1. Alfabetización Digital para Personas en Riesgo de Exclusión: Estrategias para la Intervención Socioeducativa.
2. Competencias creativas para el profesorado (Creativity MOOC Camp).
3. Competências digitais para professores.
4. Comunicación y aprendizaje móvil.
5. DIY Education aux médias et à l'information.
6. ELearningProjektmanagement an Schulen.
7. Flipped Classroom.
8. Innovación Educativa y Desarrollo Profesional. Posibilidades y límites de las TIC.
9. Introdução aos Sistemas de Informação Geográfica.
10. M'appare il mondo: dalle carte alla Terra digitale partecipata.
11. PreCalculus: Introduzione alla Matematica per l'Università.
12. MPSW: "Ma pédagogie à la sauce web 2.0".
13. Necessidades Educativas Especiais. Como ensinar, como aprender.
14. Recursos Educativos Abiertos. Aplicaciones pedagógicas y comunicativas.
15. Videos for teaching, learning and communication.

FINDINGS

Below is a summary of the results for each variable related to intercreativity:

A total of 289 people completed the questionnaire: 57% were women, 38% were men and 5% either did not answer the question or declined to.

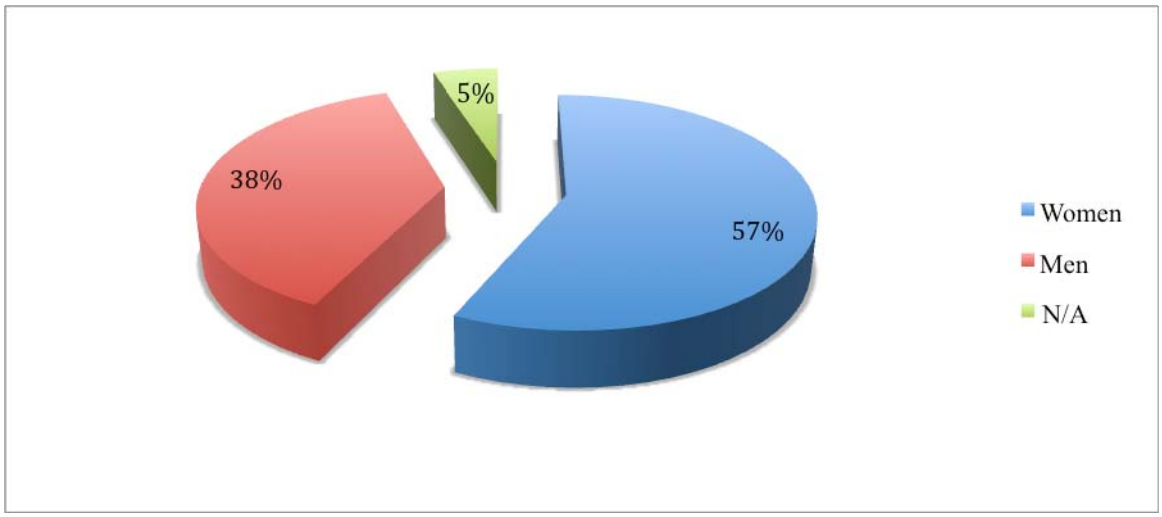

Figure 1: Gender

Most of the participants gave positive values when assessing the content. Five aspects were taken into consideration: 'suitability of the course topic', 87% of the people gave a favourable assessment whereas the opinion of 10% was negative; 'Content is interesting', 87% was favourable while 10% was negative; 'Content is rigorous', 82,5% offered a positive assessment while 14% was negative; 'Content is up to date', 88% favourable assessment and just 9% negative; and the biggest criticism was for 'Content is accessible to all people', where the assessment in 72% of the cases was favourable and in 24% it was negative because the course content was not always accessible by people with different learning experiences.

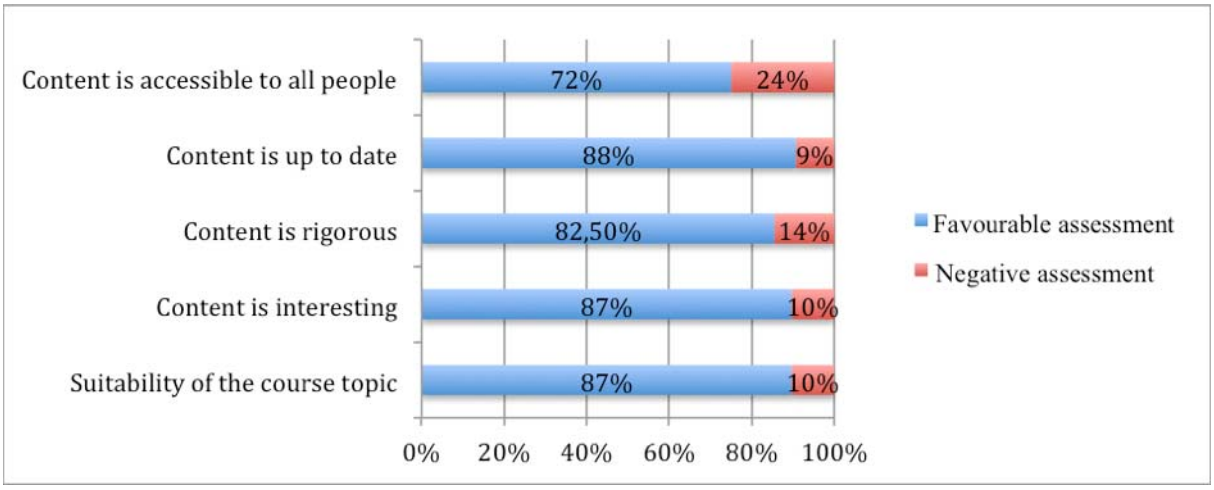

Figure 2: Content assessment.

When it comes to course content the picture was different: on one hand, satisfaction was high regarding the material prepared for each course (videos, video lectures, documents); on the other hand, users were more critical of the technical infrastructure, platform usability, technical support and the design of collaborative tasks. It is important to keep in mind that a high percentage of students did not answer due to lack of technical experience and this should be considered a training obstacle more than a technical problem.

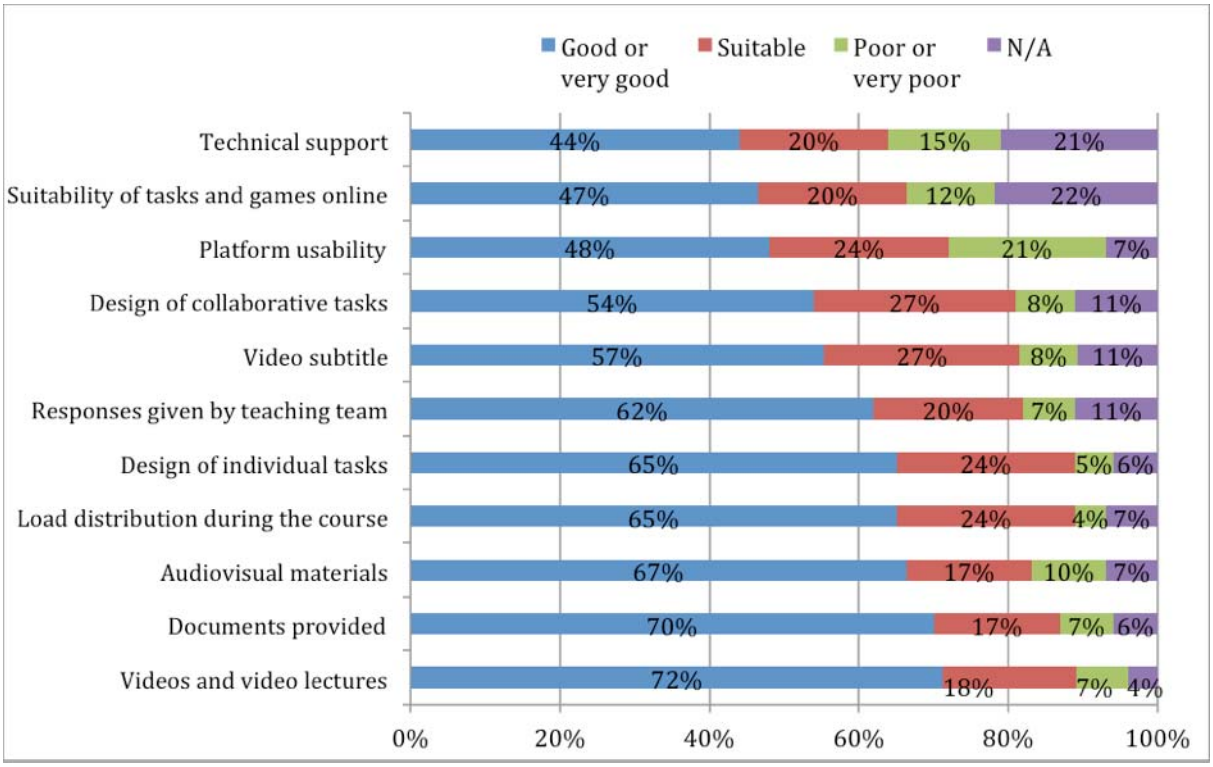

Figure 3: Course content.

The feedback given regarding course communication and interaction was mainly positive. When considering the four aspects within this variable, the courses were seen as participative and encouraging social engagement. However, continual improvement in this area is needed to achieve higher levels of satisfaction.

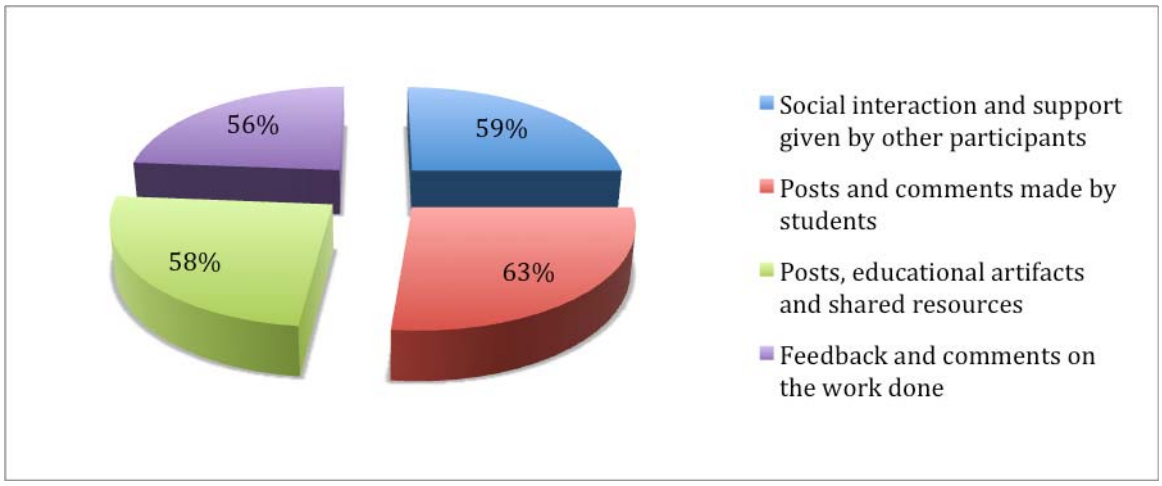

Figure 4: Communication and interaction.

User satisfaction focused on expectations, creativity, discussion and personal reflection, and engagement and interaction among participants. The five aspects received favourable reviews and verify that the design of the courses actively enhance these points.

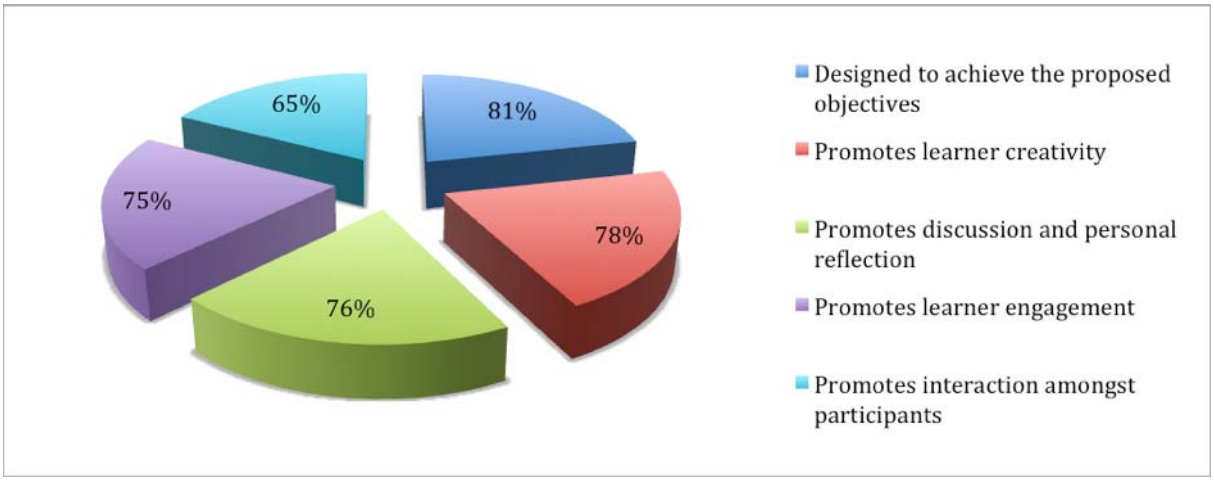

Figure 5: User satisfaction.

CONCLUSIONS

The overall results showed that the ECO project sMOOCs were designed and implemented under the prism of intercreativity. The content of the courses, the way they are presented, and the teaching and learning methodology used, based on Constructivism and Connectivism, are part of an attempt to develop the courses taking into account the characteristics of intercreativity. A strong facet of these courses is that they promote interaction among students and teachers, turning both into active producers of knowledge. It was apparent that the courses have a high ability to spark discussion and personal reflection, critical thought and creativity. The areas that need improvement are mainly technical. Specifically, the courses must be easily accessible for those with special needs, such as people with visual and hearing impairment; and should provide access to the courses from all kinds of devices.

Despite the positive results with regard to intercreativity, work must continue for improvement. This would include, first, “to adapt the intercreative learning to the different multiple intelligences (Gardner, 1983) that each person has” (Camarero Cano, 2014), and second, to bear in mind the four pillars of learning proposed by Jacques Delors: learning to know, learning to do, learning to live together and learning to be (Delors, 1996).

A new qualitative study of intercreativity in the sMOOCs of the ECO project has been launched. The results of both will allow new strategies to be designed and implemented to improve the next iterations of the courses.

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The Instructors' Attitudes toward the Use of E-learning in Classroom in College of Education at Albaha University

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ABSTRACT
E-learning is defined as an element of the combining theories of adult education and permanent learning. Teachers have to accept the use of E-learning in the classroom as a new tool to assist students' learning (Bahhouth & Bahhouth, 2011). The purpose of this study was to explore male and female instructors' attitudes toward the use of E-learning in the College of Education at Albaha University in Saudi Arabia using different predictors that can determine instructors' attitudes. Forty- five out of 100 instructors participated from both College of Education for males and females at Albaha University. Forty- one total responses were used in the analysis after removing four cases of outliers, and the response rate of the study was 92%. The results showed that males group reported a mean of M= 124.46 with standard deviation of SD= 25.84 while females group reported a mean of M= 139.20 with standard deviation of SD= 13.25. The analysis showed four predictors, gender, perceived of computer attributes, perceived of computer competence in education, and perceived of cultural of using computer in education, significantly predicted the dependent variable (N= 41, β = .047, $p< 0.05$). The results showed there was significant difference between males' and females' attitudes toward the use of E-learning in classroom. A T- test between the means gave t (-2, 051) = -2.410 at $p < 0.047$. As $p < 0.05$, the results indicated that there were statistical significant differences in the attitudes ... means as shown in Table of result .047. The findings showed that females' group had positive attitudes higher than males.
Keywords: E-learning, attitudes, technology, classroom, instructors

INTRODUCTION
Instructors who do not use E-learning in class teaching are in urgent need of E-learning tools that help them to teach effectively. Instructors should be aware of the kinds of devices appropriate for classroom teaching. According to Bahhouth and Bahhouth(2011), the study was conducted to find out the significance of online learning and the impact of teaching. E-learning was defined as an element of the combining theories of adult education and permanent learning. It contains of "organizing and analytical abilities, critical thinking, problem-solving skills, oral and written communication, interaction with classmates and instructors and taking initiatives"(Bahhouth & Bahhouth, 2011, p. 1). Learners' feedback was very essential to evaluate the benefits of E-learning. Also, they became the center in in E-learning classroom to study equipment, doing the homework, taking exam and submitting projects. The survey was used to conduct students' vision toward E-learning and traditional learning. The result of this study was robust and students' vision could invest as a principle in designing online courses.

Georgouli, Skalkidis, and Guerreiro(2008) discussed the E-learning in a traditional course. Learning Management Systems are demonstrated the E-learning applications and leaded to more communication between teachers and their students by Internet or email. This application would be either software or commercially. A traditional learning is face to face courses. LMS will invade the traditional way of courses to synchronous or asynchronous distant one. The results show those learners are pleased about the value of using E-learning practice and content. . Advanced technology like MAS can be used in such a way that it can be implemented by teachers to their students who cannot attend to regular class, where it could replace the usual methods of courses (Georgouli, Skalkidis& Guerreiro, 2008).

Martin and Noakes (2012) discussed the necessarily of applying E-learning in Handicraft teaching based on students' feedback. E-learning is more common in the Estonian universities. E-learning is improved the learning process and teaching strategies. The survey was used to conduct this study by email and processed with MS Excel. The benefits of E-learning usage are: assisting students' achievements, flexible, and saving time and material resources. The results of the survey found that the design and contents of E-learning studies supporting the study's results(Ojaste, 2013).

E-LEARNING

Qutechate, Almarabeh and Alfayez (2005) were defined E-learning as a computer and network usage to send information to learners. According to Bahhouth and Bahhouth(2011), the study was conducted to find out the significance of online learning and the impact of teaching. E-learning was defined as an element of the combining theories of adult education and permanent learning. It contains of "organizing and analytical abilities, critical thinking, problem-solving skills, oral and written communication, interaction with classmates and instructors and taking initiatives"(Bahhouth & Bahhouth, 2011, p. 1). Learners' feedback was very essential to evaluate the benefits of E-learning. Also, they became the center in in E-learning classroom to study equipment, doing the homework, taking exam and submitting projects. The survey was used to conduct students' vision toward E-learning and traditional learning. The result of this study was robust and students' vision could invest as a principle in designing online courses. Ojaste (2013) discussed the necessarily of applying E-learning in Handicraft teaching based on students' feedback. E-learning is more common in the Estonian universities. E-learning is improved the learning process and teaching strategies. The survey was used to conduct this study by email and processed with MS Excel. The benefits of E-learning usage are: assisting students' achievements, flexible, and saving time and material resources. The results of the survey found that the design and contents of E-learning studies supporting the study's results (Ojaste, 2013).

LITERATURE REVIEW

Chen (2012) discussed the attention level of students during E-learning classroom. Three groups were included: "a concept-page group, a tutorial-simulation group and a case-study group"(p.379). E-learning became more common in the current time so the researcher has assessed the attention level for learners during online learning course. Video-capture facial- recognition technology was used to notice the students' attention during E-learning class by facial expression. The results of this study showed the interactivity of multimedia instructional resources successfully improves students' concentration (Chen, 2012). Babo and Azevedo (2012) discussed a new way of E-learning evaluation approach on learners relating to organizing the team work and Learning Management Systems. . E-learning courses are commonly assisted by Learning Management System. E-learning became more common in the current time so the researcher has assessed learners by using E-learning methods. The results of this study showed this study is suitable for moving from a traditional way to E-learning method (Babo & Azevedo ,2012). Albirini(2006) explored the instructors' attitudes toward the use of information and communication technologies of high school English as a Foreign Language (EFL) in Syria. Also, the researcher examined the relationship between computer attitudes and five independent variables: "computer attributes, cultural perceptions, computer competence, computer access, and personal characteristics (including computer training background)"(P.373). The suggestion of this study shows that teachers may have positive attitudes toward ICT in education. Attitudes of instructors were explained by computer features, cultural views and computer competence. The results shed light on the instructors' attitudes toward the use of technology tools in educational setting. Hodges (2004), discussed the background of motivation, and two kinds of learning design motivation, and some practices in the learning based on web sites. The self-efficacy is the core of motivation, when designing E-learning experiences should be increased the self-efficacy from students 'efforts. For example, navigation system, feedback and blended learning. Ali, Sait and Al-Tawil (2003) discussed the view of Saudi learners toward E-learning. The advantages of using E-learning are time saving, flexibility, easy to update content and availability anywhere. Another important point is the limit access of Internet usage in Saudi Arabia compare to the number of population. About 700,000 (2.6) users have become online successfully. The students who prefer take a regular class 35% and 29% at home, 36% uncertain. That was because the lack of awareness by Saudi community toward the use of E-learning. Overall, learners did not prefer to take course by Internet usage but not equal to regular courses and not accredited in Saudi Arabia.

METHODOLOGY

A survey was conducted to collect data from instructors' attitudes in College of Education at Albaha University. To identify these responses or possible concerns of instructors who use or do not use E-learning, instructors at college of education were chosen as subjects for this study to obtain information about instructors' emotional response to their use of E-learning. Each variable was evaluated based on a five point Likert scale ranging from five to one: 5 = Strongly Agree, 4 = Agree, 3 = Neutral , 2 = Disagree, to 1 = Strongly Disagree. The survey contained 56 items. Respondents were instructed to select only one response for each item. The items were based on three components: perceived of using a computer in education setting, perceived of computer benefits in education, perceived awareness of using computer in education and two demographic questions: gender and age. The dependent variable was attitudes of instructors toward the use of E-learning in College of Education, at Albaha University. Questionnaire items from 1to 20 were measured : perceived of using a computer in education setting, items from 21 to 38 were measured: perceived of computer benefits in education and Items from 39 to 54 were measured: perceived awareness of using computer in education and items from 55 to 65 were demographics.

The Reliability and Validity of Instrument

The reliability of first 20 items is 2.39, which is not a high level of reliability. The reliability of second 18 items is 2.40, which is not a high level of reliability. The reliability of third 16 items is 2.33, which is not a high level of reliability. The reliability of all 54 items is 2.40, which is not a high level of reliability. Each independent variable measures between 16-20 items. The responses indicated that instructors have different levels of attitudes toward the use of E-leaning usage. This was evident in the difference in male and female students' emotional perceptions toward their use of E-learning.

The main tool to collect data for this study was a survey. Based on G*Power 3 software, the adequate sample size for this study was N = 41 (male and female instructors) in order to meet the following criteria: a desired power of 0.80, a medium effect size (around $^2 = 0.15$), and an alpha level of 0.05 significance. A total number of 100 surveys (50 for males and 50 females) was distributed among Albaha College of males and females. The researcher received 45 out of 100 surveys with complete responses, indicating a 91% usable response rate. Data from a total of 45 surveys were entered into the statistical software (SPSS version 17.0) for analyzing the study. The computer software Statistical G*Power 3 was used to determine the power of the present study. While the reliability of the instrument in Chapter 3 was calculated with piloted data, here the reliability of the instrument was calculated with the study data. After checking the outliers, four cases were removed and 91 should be deleted and the response rate became 91% .After deleting them, the researcher reran the reliability of (Cronbach (α) for the overall survey items = 2.40, number of items = 54) for instructors' attitudes toward the use of E-learning in Saudi Arabia. The values of the Cronbach (α) coefficient resulted from performing item analyses for 41 responses. The results were not supported by a high degree of reliability (Cronbach (α) for the overall survey items = 2.40, number of items = 54) for instructors' attitudes toward the use of E-learning in Saudi Arabia, but the reliability. Using a computer in education setting Cronbach (α) was .2.39 (20 items) perceived of computer benefits in education was 2.40 (18 items), and perceived awareness of using computer in education was 2.33(16 items).

RESULTS

The study was conducted to explore the findings of the instructors' attitudes toward the use of E-learning in Saudi Arabia. The researcher used quantitative methods (survey) to gain information about instructors' perceptions. The survey was designed by Albirini(2006) and conducted by the researcher to collect the data for this study. The researcher was interested in determining which of the four predictors─ The independent variables, factors of instructors' attitudes toward the use of E-learning─ gender, perceived of using a computer in education setting, perceived of computer benefits in education, and perceived awareness of using computer in education ─ are significant predictors of the dependent variable, instructors' attitudes toward the use of E-learning at Albaha University in Saudi Arabia.. The main population of this study was Saudi and non-Saudis male and female. This chapter includes the following: the research question, instrumentation, reliability of the instrument, validity of the instrument, a description of the sample with descriptive data, demographic characteristics, statistical analyses to test null hypotheses, gender and attitudes difference, and a summary. Inferential statistics were used to test the null hypothesis. Results of it are given.

Reliability Analysis of Instrument

Subscale	Reliability: Cronbach's Alpha	N
O: Overall	2.40	41
A: Affect	2.39	41
B: Cognitive	2.40	41
C: Behavior	2.33	41

Reliability analysis – scale (alpha)

Mean	Level
4.0-5.0	High
3.0-3.99	Average
1.99-2.99	Low
1-.98	Very low

Item Statistics

Level of mean	Std. Deviation	Mean	N	ITEMS
Average	1.773	2.83	41	١- أفضل إنجاز أعمالي باستخدام الحاسب.
Average	1.652	2.66	41	٢- أتضايق عند استخدام الحاسب.
Low	1.233	1.93	41	٣- يسرني توفر الحاسب في كافة العالم.
Average	1.312	2.68	41	٤- أخشى من التحدث عن الحاسب لقلة معلوماتي عنه.
Low	.934	1.68	41	٥- استخدام الحاسب شيء ممتع.
Average	1.467	2.44	41	٦- أفضل التدريس التقليدي بدون الحاسب.
Low	.925	1.51	41	٧- يوفر الحاسب الوقت والجهد.
Average	1.450	3.73	41	٨- ستكون المدارس أفضل بدون الحاسب.
Low	1.123	1.80	41	٩- أفضل استخدام الطلاب للحاسب في جميع المواد.
High	1.393	4.10	41	١٠- أعتقد أن تعلم الحاسب مضيعة للوقت.
Low	.980	1.80	41	١١- يساعد الحاسب الطلاب على سرعة الإنجاز.
Low	.774	1.41	41	١٢- الحاسب وسيلة سريعة وفعالة للحصول على المعلومات.
Average	1.660	2.51	41	١٣- أعتقد أني لا أحتاج للحاسب في الصف الدراسي.
Low	.850	1.68	41	١٤- يعزز الحاسب تعلم الطلاب.
Average	1.451	3.51	41	١٥- أضرار الحاسب تفوق فوائده.
Average	1.415	3.44	41	١٦- أفضل أن أعمل الأشياء بيدي على أن أعملها بالحاسب.
Low	1.255	2.02	41	١٧- أفضل الحصول على حاسب خاص بي.
Average	1.504	3.71	41	١٨- أسعى إلى تجنب استخدام الحاسب بقدر الإمكان.
Low	.825	1.66	41	١٩- أود تعلم المزيد عن الحاسب.
Average	1.595	2.39	41	٢٠- أنوي استخدام الحاسب في المستقبل القريب.
Average	1.28	2.48		المحور الأول
Low	.745	1.46	41	21- يؤدي استخدام الحاسب إلى رفع مستوى التعليم.
Low	.865	1.59	41	22- يمنح التدريس باستخدام الحاسب مزايا أفضل من التدريس باستخدام الطرق التقليدية.
Average	1.377	2.17	41	23- قد لا تفند تقنية الحاسب من نوعية تعلم الطلاب.
Low	.673	1.56	41	24- استخدام تقنية الحاسب يجعل المادة التعليمية أكثر تشويقا.
Low	1.351	1.98	41	25- يفيد الحاسب في تعلم اللغة.
Average	1.609	3.24	41	26- لا بد من توفير معمل للحاسب في المدارس.
Low	.922	2.00	41	27- يتوافق استخدام الحاسب تماما مع أهداف المنهج الدراسي.
Average	1.397	2.56	41	28- يعوقني ضيق وقت الحصة عن استخدام الحاسب في الصف.
Low	.837	2.00	41	29- يتناسب استخدام الحاسب مع ميول طلابي التعليمية ومع مستوى معرفتهم بالحاسب.
Low	.872	1.80	41	30- استخدام الحاسب مناسب لكثير من أنشطة تعليم اللغة.
Average	1.581	3.41	41	31- يصعب علي تعلم استخدام الحاسب في التدريس.
Average	1.515	2.83	41	32- أجد صعوبة في فهم الوظائف التقنية للحاسب.
Average	1.380	3.54	41	33- الحاسب يجعل مهمتي في الصف أكثر تعقيدا(صعوبة).
Average	.673	2.29	41	34- من السهل على أي أحد أن يتعلم استعمال الحاسب.
Average	1.351	3.59	41	35- لم أر قط حاسبا في مكان العمل.
Low	1.609	1.63	41	36- أثبت الحاسب أنه وسيلة تعليمية فعالة على مستوى العالم.
Average	.922	3.68	41	37- لم أر قط حاسبا يستخدم كوسيلة تعليمية.
Low	1.397	1.73	41	38- رأيت بعض المدرسين يستخدمون الحاسب لأغراض تعليمية.
Average	.837	2.40		المحور الثاني

Average	.872	3.59	41	39- لن يغير الحاسب شيئا في صفوفنا أو مدارسنا أو حياتنا.
Low	1.581	1.93	41	40- يحتاج الطلاب إلى معرفة باستخدام الحاسب من أجل الحصول على مهن.
Average	1.515	2.61	41	41- يفضل الطلاب التعليم التقليدي عن التعليم باستخدام الحاسب.
Low	1.380	1.83	41	٤2- تكسب المعرفة بالحاسب احترام الآخرين.
Low	1.100	1.88	41	43- نحتاج إلى حاسب يناسب الثقافة العربية والهوية العربية.
Low	.916	1.76	41	44- سوف يساعدنا الحاسب على تحسين مستوى معيشتنا.
Average	1.353	2.34	41	45- يصرف استخدام الحاسب الأجيال العربية عن تعلم تراثها.
Low	.907	1.68	41	46- يزداد انتشار الحاسب في بلدنا بسرعة كبيرة جدا.
Low	.932	1.93	41	47- يستأثر ذوو المهارة بالحاسب على مزايا لا يحصل عليها غيرهم.
Average	1.413	2.95	41	48- سيزيد الحاسب من اعتمادنا على البلاد الأجنبية في البرمجيات.
Average	1.115	2.39	41	49- هناك الكثير من المسائل الاجتماعية التي يجب التطرق إليها قبل مسألة نشر الحاسب في مجال التعليم.
Low	.799	1.63	41	50- إن الإنتشار المتزايد للحاسب سيجعل الحياة أسهل.
Average	1.286	3.54	41	51- يجرد الحاسب المجتمع من القيم الإنسانية.
Average	1.447	2.61	41	52- يؤدي استخدام الحاسب إلى قلة التفاعل الاجتماعي مع الآخرين.
Average	1.458	3.02	41	- يشجع الحاسب على انتشار اللاأخلاقيات.53
Low	.805	1.59	41	54- يجب أن يكون الحاسب من أولويات التعليم.
Average	1.13	2.33	41	المحور الثالث
Average	1.20	2.40		Overall

Component	Highest mean	Lowest mean	Highest mean	Lowest mean	Highest mean	Lowest mean	Overall
Domain1	3.73	1.93	4.10	1.41	3.71	1.51	2.48
Domain2	3.68	1.56	3.59	1.46	3.54	1.59	2.40
Domain3	3.59	1.59	3.54	1.63	3.02	1.68	2.33

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Total	Males	26	124.4615	25.84296	5.06822
	Females	15	139.2000	13.25142	3.42150

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	T	Df	Sig. (2-tailed)
Total	Equal variances assumed	7.382	.010	-2.051	39	.047
	Equal variances not assumed			-2.410	38.646	.021

Males group reported a mean of M= 124.46 with standard deviation of SD= 25.84 while females group reported a mean of M= 139.20 with standard deviation of SD= 13.25. A t test between the means gave t (-2, 051) = -2.410 at p < 0.047. As p < 0.05, the results indicated that there were statistical significant differences in the attitudes ... means as shown in Table .047. The findings showed that females' group had positive attitudes higher than males. (perceived computer attributes) the reported mean of respondents is of M= 3.7 with standard deviation of SD= 0.38. The results indicated that there are positive attitudes toward the computer features. The findings showed that respondents' group had positive attitudes toward computer attributes .

(perceived of computer cultural) the reported mean of respondents is of M= 3.38 with standard deviation of SD= 0.44. The results indicated that there are positive attitudes toward the cultural perception of computer. The findings showed that respondents' group had positive attitudes toward cultural perception of computer ..

(perceived of computer competence) the reported mean of respondents is of M= 1.78 with standard deviation of SD= 0.67. The results indicated that there are positive attitudes toward computer competence. The findings showed that respondents' group had positive attitudes toward computer competence.

Descriptive Statistics

Subscale	Mean	Std. Deviation
B:Effectiveness	2.39	1.59
C:Cognitive	2.40	.837
D:Behavior	2.33	1.13
E:overall	2.40	1.20

CONCLUSION

The results of the T-test analysis showed that, of the four predictors used to explain the dependent variable – instructors' attitudes toward E-learning use – all predictors could statistically and significantly predict teachers' attitudes toward the use of E-learning; (N= 41, β = .047, p< 0.05). That means these predictors should be included in predicting instructors' attitudes in future studies. Future studies should consider other factors, such as culture, when determining teachers' attitudes toward the use of E-learning. The findings are consistent with the previous studies about gender, perceived of using a computer in education setting, perceived of computer benefits in education, and perceived awareness of using computer in education. As valuable predictors of attitude. loss. Educators who do not use E-learning in teaching need time to adjust. They cannot discern E-learning unless they are in a traditional setting. Ultimately, when they become familiar with using it, they will realize the usefulness of the method, which have brought convenience to their daily teaching. Instructors' familiarity with and E-learning method use led to more positive attitudes toward the use of E-learning. This study provides some useful explanations of instructors' refusal to address E-learning in class teaching, including negative associations and negative coping strategies. These results should suggest that gender is still a factor in shaping teachers' attitudes toward E-learning use. However, the current study did support these results. The results showed there was statistically significant difference in attitudes between male teachers (M= 124,46 SD =25.84) and female students (M= 139,20 SD =13.25); t = -2.05, p=.047. This result indicated that female and male instructors had not have the same attitudes toward the use of E-learning. These findings did find the similar results of mean gender with previous literatures. The ANOVA table shows p<0.05 significant, which means the combination of all the predictors ─ gender, perceived of using a computer in education setting, perceived of computer benefits in education, and perceived awareness of using computer in education. ─significantly predicted the dependent variable. This study showed that there is a great need to educate instructors and families about the benefits of E-learning and to reduce prejudices concerning E-learning method.

ACKNOWEGMENTS

I am sincerely thankful to Allah my Creator and sustainer for giving me the strength and knowledge to accomplish my research. I appreciate His grace and support of me as a family man and assistant professor to reach my dream and goal. I sincerely appreciate the assistance of the Ministry of Higher Education, headed by Dr. Azzam Al-Dakhil, in Riyadh City of Saudi Arabia. I wish and offer to give my most sincere thanks and appreciation to my university members Dr. Saad Mohammad Alhareky, Dr. Saeed Saleh Rageb, Dr. Abdullah Mohammed Al-Zahrani and Dr. Ali Mohammed Al-Shehri who have supported me. I sincerely appreciate the assistance of Albaha University, in Albaha City.

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APPENDIX A: ARABIC QUESTIONNIARE

هذا الاستبيان يحتوي على خمسة عناصر يتم قياسها عن طريق المشاركين بمقياس مرتب إلى خمسة درجات.
- أوافق بقوة(٥)
- أوافق (٤)
- محايد (٣)
- غير موافق (٢)
- لا أوافق بقوة (١)

تعليمات وأرشادات

يحتوي هذا الاستبيان على فقرات مقياسها من٥ -١ لغرض بحث علمي بجامعة الباحة وذلك لقياس اتجاهات الأساتذة بجامعة الباحة- كلية التربية نحو إدخال تقنية المعلومات (الحاسب) في المملكة العربية السعودية- جامعة الباحة. الرجاء تعبئة الاستبيان وإعادة ارساله للباحث- قسم تقنيات التعليم قبل 10 من جمادى الآخر١٤٣5هـ. المشاركة بهذا البحث تعتبر تطوعية وإعادة الاستبيان تدل على أن المشاركين من أساتذة جامعة الباحة- كلية التربية من عينة الدراسة وأخذت موافقتهم باستخدام معلومات الدراسة لأغراض بحثية.

في الجدول أدناه ، ضع علامة صح للإشارة إلى الاتجاه التي تراه.

أخيرا، عزيزي الأستاذ، إن تعبئتك لهذا الاستبيان تعني موافقتك على المشاركة في هذه الدراسة.

إذا كان لديك أي أسئلة أو استفسارات، فيمكنك التواصل معي، وشكرا لك مقدما.

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الفقرات اتجاهات الأساتذة نحو استخدام الحاسب في التعليم	أوافق بقوة	أوافق	محايد	غير موافق	لا أوافق بقوة
١- أفضل إنجاز أعمالي باستخدام الحاسب.	٥	٤	٣	٢	١
٢- أتضايق عند استخدام الحاسب.	٥	٤	٣	٢	١
٣- يسرني توفر الحاسب في كافة العالم.	٥	٤	٣	٢	١
٤- أخشى من التحدث عن الحاسب لقلة معلوماتي عنه.	٥	٤	٣	٢	١
٥- استخدام الحاسب شيء ممتع.	٥	٤	٣	٢	١
٦- أفضل التدريس التقليدي بدون الحاسب.	٥	٤	٣	٢	١
٧- يوفر الحاسب الوقت والجهد.	٥	٤	٣	٢	١
٨- ستكون المدارس أفضل بدون الحاسب.	٥	٤	٣	٢	١
٩- أفضل استخدام الطلاب للحاسب في جميع المواد.	٥	٤	٣	٢	١
١٠- أعتقد أن تعلم الحاسب مضيعة للوقت.	٥	٤	٣	٢	١
١١- يساعد الحاسب الطلاب على سرعة الإنجاز.	٥	٤	٣	٢	١
١٢- الحاسب وسيلة سريعة وفعالة للحصول على المعلومات.	٥	٤	٣	٢	١
١٣- أعتقد أني لا أحتاج للحاسب في الصف الدراسي.	٥	٤	٣	٢	١
١٤- يعزز الحاسب تعلم الطلاب.	٥	٤	٣	٢	١
١٥- أضرار الحاسب تفوق فوائده.	٥	٤	٣	٢	١
١٦- أفضل أن أعمل الأشياء بيدي على أن أعملها بالحاسب.	٥	٤	٣	٢	١
١٧- أفضل الحصول على حاسب خاص بي.	٥	٤	٣	٢	١
١٨- أسعى إلى تجنب استخدام الحاسب بقدر الإمكان.	٥	٤	٣	٢	١
١٩- أود تعلم المزيد عن الحاسب.	٥	٤	٣	٢	١
٢٠- أنوي استخدام الحاسب في المستقبل القريب.	٥	٤	٣	٢	١

الفقرات إيجابيات استخدام الحاسب بالتعليم	أوافق بقوة	أوافق	محايد	غير موافق	لا أوافق بقوة
21- يؤدي استخدام الحاسب إلى رفع مستوى التعليم.	٥	٤	٣	٢	١
22- يمنح التدريس باستخدام الحاسب مزايا أفضل من التدريس باستخدام الطرق التقليدية.	٥	٤	٣	٢	١
23- قد لا تفند تقنية الحاسب من نوعية تعلم الطلاب.	٥	٤	٣	٢	١
24- استخدام تقنية الحاسب يجعل المادة التعليمية أكثر تشويقا.	٥	٤	٣	٢	١
25- يفيد الحاسب في تعلم اللغة.	٥	٤	٣	٢	١
26- لا بد من توفير معمل للحاسب في المدارس.	٥	٤	٣	٢	١
27- يتوافق استخدام الحاسب تماما مع أهداف المنهج الدراسي.	٥	٤	٣	٢	١
28- يعوقني ضيق وقت الحصة عن استخدام الحاسب في الصف.	٥	٤	٣	٢	١
29- يتناسب استخدام الحاسب مع ميول طلابي التعليمية ومع مستوى معرفتهم بالحاسب.	٥	٤	٣	٢	١
30- استخدام الحاسب مناسب لكثير من أنشطة تعليم اللغة.	٥	٤	٣	٢	١
31- يصعب علي تعلم استخدام الحاسب في التدريس.	٥	٤	٣	٢	١
32- أجد صعوبة في فهم الوظائف التقنية للحاسب.	٥	٤	٣	٢	١
33- الحاسب يجعل مهمتي في الصف أكثر تعقيدا(صعوبة).	٥	٤	٣	٢	١
34- من السهل على أي أحد أن يتعلم استعمال الحاسب.	٥	٤	٣	٢	١
35- لم أر قط حاسبا في مكان العمل.	٥	٤	٣	٢	١
36- أثبت الحاسب أنه وسيلة تعليمية فعالة على مستوى العالم.	٥	٤	٣	٢	١
37- لم أر قط حاسبا يستخدم كوسيلة تعليمية.	٥	٤	٣	٢	١
38- رأيت بعض المدرسين يستخدمون الحاسب لأغراض تعليمية.	٥	٤	٣	٢	١

الفقرات الإدراك والوعي الثقافي تجاه استخدام الحاسب بالتعليم	أوافق بقوة	أوافق	محايد	غير موافق	لا أوافق بقوة
39- لن يغير الحاسب شيئا في صفوفنا أو مدارسنا أو حياتنا.	٥	٤	٣	٢	١
40- يحتاج الطلاب إلى معرفة باستخدام الحاسب من أجل الحصول على مهن.	٥	٤	٣	٢	١
41- يفضل الطلاب التعليم التقليدي عن التعليم باستخدام الحاسب.	٥	٤	٣	٢	١
42- تكسب المعرفة بالحاسب احترام الآخرين.	٥	٤	٣	٢	١
43- نحتاج إلى حاسب يناسب الثقافة العربية والهوية العربية.	٥	٤	٣	٢	١
44- سوف يساعدنا الحاسب على تحسين مستوى معيشتنا.	٥	٤	٣	٢	١
45- يصرف استخدام الحاسب الأجيال العربية عن تعلم تراثها.	٥	٤	٣	٢	١
46- يزداد انتشار الحاسب في بلدنا بسرعة كبيرة جدا.	٥	٤	٣	٢	١

١	٢	٣	٤	٥	**47- يستأثر ذوو المهارة بالحاسب على مزايا لا يحصل عليها غيرهم.**
١	٢	٣	٤	٥	**48- سيزيد الحاسب من اعتمادنا على البلاد الأجنبية في البرمجيات.**
١	٢	٣	٤	٥	**49- هناك الكثير من المسائل الاجتماعية التي يجب التطرق إليها قبل مسألة نشر الحاسب في مجال التعليم.**
١	٢	٣	٤	٥	**50- إن الإنتشار المتزايد للحاسب سيجعل الحياة أسهل.**
١	٢	٣	٤	٥	**51- يجرد الحاسب المجتمع من القيم الإنسانية.**
١	٢	٣	٤	٥	**52- يؤدي استخدام الحاسب إلى قلة التفاعل الاجتماعي مع الآخرين.**
١	٢	٣	٤	٥	**53- يشجع الحاسب على انتشار اللاأخلاقيات.**
١	٢	٣	٤	٥	**54- يجب أن يكون الحاسب من أولويات التعليم.**
			أنثى	ذكر	**55- الجنس**
					56- العمر

The Pearl Side of Online Portfolios: A Descriptive Study on the Rich Experience of Using Pearltrees by Master Students of Teaching English as a Foreign Language

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ABSTRACT
Teaching English to ESL teachers is a challenging task for a number of reasons, the lack of connection between the target language and the native one being one of the most challenging factors (Ferlazzo & Sypnieski, 2013). Therefore, teachers are supposed to be innovators in creating the tools that could boost the learning process, as well as eliminate the factors that may possibly inhibit it in any way. In the era of information technology, a variety of digital tools that a teacher can use for empowering students to learn languages have emerged. PearlTrees is one of these tools; allowing sharing information fast and communicating efficiently, the specified site can be viewed as a perfect tool for enhancing ESL teachers' skills through shared knowledge, peer assessment (Daniels, 2002), scaffolding (Combs, 2004) and support from the teacher, and active participation.

INTRODUCTION
The idea of using innovative technology as the tools for improving teachers' and their learners' skills is not new (Kwok, 2015); in fact, innovative tools are used actively by teachers and students alike to perfect their skills and acquire new knowledge (Zanón, Monje, & Romero, 2012). However, the adoption of new tools is fraught with major consequences unless the properties of these IT instruments are studied well and their effects are commonly known (Quinlivan, 2012). Herein the necessity to test newly adopted approaches and make sure that they are not going to backfire in any way lies.

Particularly, the idea of incorporating a tool for sharing data online for teachers in the UAE deserves to be viewed as a decent method for enhancing knowledge and skills acquisition among teachers and students alike (Bailey & Damerow, 2014). providing strong grounds for training the newly acquired skills, as well as carrying out per assessments of the tools created for improving the learning process, the specified tool can be viewed as a major foot forward in managing the process of data management and tracing the progress of students.

The tool in question opens a plethora of opportunities for data sharing. The latter, in its turn, presupposes impressive progress in the communication process among the teachers, as well as between the teachers and their students. Consequently, scaffolding of the latter can be promoted with the help of the specified tool, whereas teachers will be capable of reviewing each others' work and provide ideas for further improvements.

THE STUDY
The importance of using information technology in general and online tools, in particular, has been discussed extensively, yet few studies outline the actual reasons for the tools in question to assist students in the process of knowledge acquisition, especially when it concerns general things, such as knowledge sharing, information acquisition, and skills training (Haneda & Nespor, 2012). The PearlTrees site, in its turn, is assumed to provide students with the means of not merely training their skills in data analysis information retrieval and defining instructions for further research but also share information so that all those concerned could acquire the specified skills in a manner as fast and expeditious as possible.

To locate the effects, which the use of the specified site has had on learners, a study has been designed. Involving active use of the opportunities that the site in question has to offer, the research helps understand whether the tools provided to the students are used actively and how important the application of the specified tool is going to be fur the students' further academic progress. Seeing that the site in question provides implicit knowledge and informs the learners on how to arrange and analyze data, it can be assumed that PearlTrees can be used as the means for students and their teachers to enhance the learning process and encourage self-directed learning (Hsin & Wu, 2011) and metacognition (Kim & Cha, 2015) by sharing data, carrying gout peer assessments (Sardareh, Saad, Othman, & Me, 2014) and using scaffolding techniques (Cumming-Potvin, 2007) to train the required skills.

The key research questions, which the specified study seeks to answer, therefore, are as follows:

1. In what way does PearlTrees enhance students' English teaching skills, and how does the specified tool empowers students to apply these skills to real-life problems concerning learning English?
2. What ESL skills does the creation of E-Portfolio at PearlTrees help students to train?
3. Does the process of sharing documents, which PearlTree allows for, create premises for the development of shared knowledge principles along with peer evaluation and scaffolding?
4. To what extent does the use of PearlTree improve ESL Master degree students' performance?
5. Does the use of PearlStudy contributes to improving the education process for Saudi Arabia students, and, if it does, in what way?
6. How does the creation of E-Portfolio helps Saudi Arabian ESL teachers improve their skills?

The research design can be defined as mixed, as predominantly qualitative relations between the key variables are discussed, yet there is a need to quantify the research results so that the findings could instruct the teacher on choosing the further tools for enhancing students' performance. A survey was used as the key tool for data collection, whereas taxonomy and the method of linear regression (Seber & Lee, 2012) were adopted as the foundation for its analysis.

The survey in question consists of three open-ended questions. Particularly, the respondents were presented with three questions regarding the efficacy of the E-Portfolio as a tool. The type of questions was chosen based on the high level of veracity that it provided (Reid & Scott, 2012) as opposed to multiple-choice questions or Likert-type ones (Shuyan, 2012), which provide the research participants with a limited amount of options for an answer. Specifically, the respondents were to clarify whether they liked the very concept of E-Portfolio, whether they thought that using it was a good idea, and how the specified tool could be used in the setting of UAE schools for ESL teachers. The surveys were collected from six students, who were also supposed to submit an E-Portfolio created and shared with the help of the specified site. All the participants involved signed consent forms and, therefore, were fully aware of the fact that the information supplied by them would be used for research. Therefore, the study was carried out according to the existing ethical standards.

FINDINGS

The students' responses show that most of the learners appreciate the opportunities for data management, which PearlTrees provides for its users. Particularly, the opportunity to upload basically any type of data and share it instantly with peers has been identified as the key advantage that the site has to offer. the issue regarding communication options can be viewed as the second most important aspect of the tool under analysis; according to the outcomes of the study, 82% of the respondents agreed that the subject matter is crucial for exchanging information and important works.

Table 1. Typology of the Students' Responses

INFORMATION	CODE	RESPONDENT(S)	%
Data related to the organization and presentation of the information; possible issues concerning safety of the participants' data	Information management; information security	A, E, F	33.3
Using computer and the Internet	Information management and IT-related skills	A, B, D	33.3
Self-evaluation, renovation of continuous revisions	Self-directed learning and metacognition	A, E, F	33.3
In cases of poor Internet connection, E-Portfolio will be unavailable.	Availability	B	16,7
Communication between instructors and the students	Communication	A, C, D, E, F	83.3
E-Portfolio does not cost much; it's relatively cheap	Cost efficacy	A, B, C, E, F	83.3
An advantage for the instructor him-/herself	Teaching strategies	A, C, E, F	66.7
Pitching the idea of using E-Portfolios to the UAE education authorities;	Positive outcome for UAE learners	A, F	33.3
Technology issues may impede the process of intrdocuing UAE learners to PearlTree	Problems for UAE lschools	C	16.7

Unfortunately, significant similarities have also been located in the learners' analysis of the problems that the site may have. Particularly, the lack of security has been touched upon several times (66.7%). According to the chart provided above, most of the study participants feel that, due to the lack of proper security, their personal data may be endangered and, therefore, their safety may be jeopardized.

According to the table provided above, the site can also be deemed as efficient for enhancing futher learning due to the options regarding the IT-related skills and time management, which it provides to learners. 2 students (36.7%) indicated that other students with less advanced IT skills may experience tangible difficulties in adjusting to the new learning environment and managing information, including its acquisition, processing and transfer.

Therefore, the IT issue may return several major problems. According to the research data, a concern about possible issues with acquiring the corresponding IT skills timely and efficiently has been raised. Therefore, some of the students, who are not proficient in using computers and the Internet, may feel insecure about their progress, which will inevitably lead to a drop in the quality of their performance (Shalin, 2013).

Moreover, the cost for advanced setting, which is available to paid subscribers, has clearly raised a few eyebrows. As the study shows, three out of six participants (50%) were concerned about the lack of cost efficacy for the students, who use the specified tool on a regular basis. Despite the fact that one of the research participants (16.7%) indicated that the approach in question can be viewed rather flexible in terms of its financial strategy and the financial opportunities, which it offers to its visitors, the issue still clearly needs further solution. A more detailed analysis of the issue in question, however, will show that the students are clearly eager to use the new site as the tool for their further academic accomplishments (Rad & Vali, 2012).

The technical issues, which students may face in case of using the approach mentioned above, also deserve to be brought up (Wiske & Breit, 2013). One of the respondents brought up that the above-mentioned tool will be unavailable to the students, who experience problems with DNS connection, connection speed or power cuts in their area. Although the issue as brought up by only one of the respondents (16.7%), it still deserves to be heard as a valid statement. However, seeing that only one student has actually brought this point up, it can be assumed that technical issues are not the priority for the students at present and that, from the technological perspective, the specified tool can be deemed as perfect for learners of English.

The table offered above also shows that the communication issue has been listed among the numerous advantages of PearlTrees. Indeed, 5 people out of 6 (83.3%) think that PearlTree is a perfect means of communicating with the tutor and receiving feedback on the projects completed via the designated tool. On the one hand, the site does not offer much in terms of communication, with no outstanding options and merely a set of basic tools. On the other hand, the communication process, which occurs between the teacher and the student, allows pinpointing the actual problems that a student has and, therefore, working on them correspondingly. the fact that the site does not involve a direct conversation and does not incorporate nonverbal elements thereof, the instructions, which students receive, are clear and concise. As a result, the learners are provided with the means of improving their performance, which most of the respondents clearly appreciate.

Moreover, some of the respondents (16.5%, i.e., 2 out of 6) have mentioned the problems associated with the need to introduce the specified approach to the UAE schools. Particularly, the technical issues such is the need to install the corresponding equipment, create accounts for numerous teachers to log in to the site, etc., have been mentioned as the major impediments to the promotion of the technique under analysis in the target area.

Nevertheless, a range of respondents (5 out of 6) have made it clear that the UAE schools are going to benefit from the specified application At this point, one must mention that the benefits such as the opportunity to save time and money was mentioned as the essential positive characteristics of the PearlTrees site (83.3%). In addition, most of the participants of the study claimed that the adoption of the tool in question will help them arrange their work and improve the quality of teaching considerably, allowing for a consistently high-quality learning process (100%).

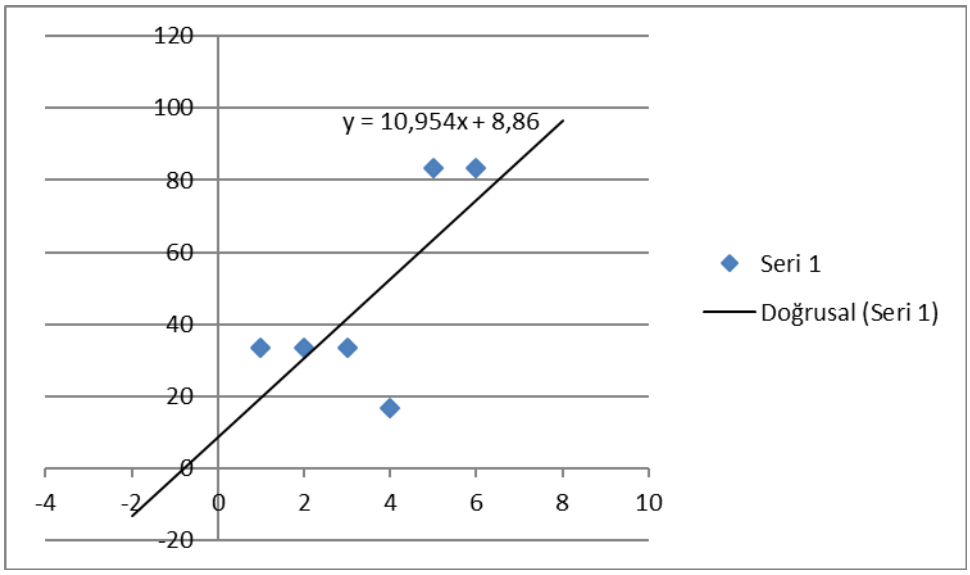

Chart 1. Students' Attitude Towards the Use of PearlTree in UAE Schools

The trend line shows quite clearly that there is a strong tendency among the students interviewed for the study to accept the PearlTrees tool as an important means of communicating with each other and the class. In other words, it is expected that increasingly more students are going to accept the specified tool as a means of improving their teaching skills. Since PearlTrees offers a plethora of options for the specified purposes, the trend can be considered positive. However, a significant improvement of the security rates for PearlTrees is required (Phillips & Siangina, 2013).

As the outcomes of the study show, most research participants agree that the tool in question is very useful in analyzing information and sorting it according to specific parameters. The chart provided above shows very clearly that the students' responses to the questionnaire tend to be rather positive. Despite the fact that most of the participants have doubts concerning the plausibility of introducing the UAE schools to the above-mentioned approach, they still display a positive tendency in accepting the benefits that the program has to offer.

CONCLUSIONS

The analysis has shown that the PearlTrees site enhances the students' English learning skills by creating a platform for them to share their knowledge and information with each other. Additionally, the survey has shown that the learners are most likely to benefit from the use of the specified site along with teachers. Even though the use of the site may not impact them directly, they will be able to receive support from their teachers, as well as from each other, not to mention the fact that they will be able to acquire new skills in information management. Finally. the use of peer assessment will become possible for not only the students, who practice teaching but also their learners, needs to be brought up. Consequently, a significant progress is expected in the overall performance of the learners in the course of lessons (Falchikov, 2013).

Therefore, the answers to the key research questions revolve primarily around the concept of communication, information processing and the ability to access the fellow teachers and the students involved instantly. The major problem, which teachers are likely to face when dealing with the site in question, in their turn, may consider possible hiccups in the Internet connection, possible power cuts and other problems related to the proper functioning of technology. Seeing that the use of the site requires a consistent connection to the Internet and cannot occur offline, it is highly desirable that proper preventive measures should be taken for teachers to have a constant access to PearlTrees in any scenario.

As far as the second question is concerned, the study also indicates that the use of the specified site contributes to the development of the ESL teaching skills such as scaffolding because of the need to communicate in short messages predominantly, instructors will have to provide students with as much support as they can so that the premises for efficient learning could be created.

Herein the answer to the third question lies. Improving both teachers' and students' skills in information management, the site enhances the concept of data sharing. In other words, the every design of the site invites teachers and students to share information.

Thus, PearlTrees increases the rates of students' teaching performance significantly. The char provided above shows clearly that most respondents have experienced a great surge in their enthusiasm for teaching, as well as discovered new strategies as far as teaching English is concerned. In addition, the Master students' performance is improved greatly by introducing the principle of accuracy and order into their work. As the survey results have shown, 3 out of 6 students (50%) mentioned that the tool in question helped them become more organized.

Teaching ESL learners the basics of English is not easy, especially for Master students. With little to no experience in arranging their work, managing their time, finding unique approaches to students in a diverse classroom, etc.. they need support drastically, PearlTrees, in their turn, provide this support and introduce students to the concept of self-directed learning along with efficient data management.

Herein the significance of creating the E-Portfolio lies; students understand what they will have to contribute as teachers and what standards they will have to meet. particularly, they receive further instructions on managing the teaching process and creating their unique teaching strategies, which will promote learning among ES: students and at the same time help the teachers improve their skills considerably.

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