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Message from the Editor-in-Chief

Dear Colleagues,

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

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 The submitted articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET.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

This journal was initiated in October 2002 to share knowledge with researchers, innovators, practitioners and administrators of education. We are delighted that more than 618000 researchers, practitioners, administrators, educators, teachers, parents, and students around the world had visited TOJET's issues since 2002. TOJET has diffused successfully innovation on educational technology around the world. We hope that this volume 18 issue 3 will also successfully accomplish our global educational goal. TOJET thanks the editorial board of this issue.

TOJET, Sakarya University, Governor State University, Ohio University, and Istanbul University – Cerrahpasa will organize International Educational Technology Conference IETC 2019 at George Mason University, Johnson Center, Fairfax, Virginia 22030, USA on August, 2019.

July 01, 2019

Editors,
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Attention! Student Voice: Providing Students with Digital Learning Materials before Scheduled Lectures Improves Learning Experience

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ABSTRACT
This article presents the outcome of research into student experience in accessing digital lecture content before scheduled lectures. The present study explored the extent to which providing students with lecture materials before scheduled lectures influence class attendance. A survey was designed and administered to self-selected students (n=75), enrolled in a first-year Health Science course at a research-intensive University in New Zealand. Students mostly reported that access to digital lecture materials before scheduled lecture contributed immensely to learning. In particular, benefits reported included: better preparation for scheduled lectures, better note-taking during lectures, active engagement with content and the lecturer. Further, the study found that providing students with lecture materials before scheduled lectures did not directly influence attendance. This research contributes to the growing significance of the student's voice in shaping the design and optimisation of learning environments in higher education. It appeals to a need for continuous pedagogical transformation by dynamic and diverse student learning needs.

INTRODUCTION AND LITERATURE
Institutions of higher education are experiencing significant growth in student enrolment, marked by increasing diversity in preferences to access learning materials and teaching (Cathorall et al., 2018; Lubicz-Nawrocka, & Bunting, 2019). Students different preferences to accessing learning, together with the rapid increase in the numbers of students enrolling into higher education institutions means that educators are likely to face the daunting challenge of teaching larger classes while maintaining the quality of learning that caters for diversity (Lawrence, 2019). In the last decade, there has been an increasing attempt to utilise various forms of digital technologies to deliver instructional materials to a large number of students, whether in a blended or entirely online course. Rismark et al. (2007) pointed out that the use of digital technologies represent new opportunities for students to gain prior knowledge ahead of lectures.

Discourses about student access to digital materials and disruption in lecture attendance patterns are not uncommon in the higher education literature. For over a decade now, the digitisation of the teaching and learning landscape within the higher education environment has challenged the traditional teaching practices (Chaplin, 2009; Hiltz, & Turoff, 2005). Students are increasingly using digital technologies to support their learning.

Recent work suggests that most students in higher education are comfortable engaging with digital technologies and use other forms of technologies such as social media for connecting and interacting with friends (Gallardo-Echenique, Bullen, & Marqués-Molias, 2016). Contemporary pedagogical practices in higher education promote student-centred approaches, involving active engagement in the classroom and a higher degree of digitalisation of learning materials. With the increasing number of diverse undergraduate students entering higher education, implementing active participation in massive courses is difficult, primarily because restructuring lectures are time-consuming, administratively challenging and lecture are more likely to resist especially, in the absence of adequate support or reward for new initiatives (Allen & Tanner, 2005; Romer, 1993).

To optimise the learning environment to engage students better requires teachers to listen to student's voice as a way to transform pedagogy (Kane & Maw, 2005) and implement digital strategies to encourage various ways of accessing content. On the other hand, integrating the student voice to the redesign of the teaching environment is critical to enhancing student learning experience (Prensky, 2005). Student's voice is an ongoing dialogue between students and teachers on shaping the

design of the learning environment (Mitra, 2008; Nelson, 2015). It challenges the traditional approach that tends to intentionally exclude a student from the design of their learning experience (Conole, 2008; Fielding, 2004; Nelson, 2015; Osberg, Pope & Galloway, 2006).

On our campus in one of the first year Health Science courses, students have been vocal and repeatedly requested access to the content of digital lecture materials before scheduled lectures. Some lecturers were concerned that providing students with learning materials before lectures would interfere with attendance. The present study was designed to respond to this issue. It was an opportunity to explore the role of students as active partners in the decision-shaping the design of learning environment (Fletcher, 2014), and also catering for students as digital natives implementing new and developing digital technologies along with teaching strategies that resonate and support students (Kincey et al. 2019). While approaching this, we similarly took into account concerns expressed by educators, that provision of lecture materials before scheduled lectures can influence student attendance, because it was well supported by research suggesting (Sheely, 2006; Walvoord & Johnson, 1998).

However, after a review of the literature, we found the body of research that contradicts the view that providing students with the digital content of lecture materials could lead to fewer students attending classes (Walvoord & Johnson, 1998). The literature suggests that students often make deliberate attendance decisions (Billings-Gagliardi, & Mazor 2007). Decisions to attend lecture are by large influenced by the quality of teaching, conflicting assignment deadlines on other classes, the lecturer's ability to engage students, lack of interest in class and illness (Clay & Breslow, 2006).

Further, the transition to teaching in technology-enhanced learning environments usually emphasise active engagement and utilisation of a variety of teaching strategies (Devadoss & Foltz, 1996). For examples, active methods of teaching such as flipped classroom require educators to provide students with the content of lectures before scheduled lectures (Bergmann & Sams, 2012; St Clair, 1999). Brown and Manogue (2001) further showed that in the Sciences providing students with lecture materials before lectures are critical to their learning, an observation echoed by the view that students prefer that university teachers offer lecture notes and slides online before scheduled lectures (Defour, M. 2013). The availability of online lecture materials allows students to compensate for absences by providing them with access to class information they would not otherwise access and that it enriches their learning and performance (Fulton, 2012). More recently, the provision of digital materials to students within the flipped classroom has shown that students benefit much more when learning designs are planned and effectively aligned and that the design itself influences the level of student satisfaction and the extent of engagement in in-class activities (Awidi & Paynter, 2019).

Drawing from the literature, we developed a research-led teaching framework (figure 1) to guide us through the process of further exploring student voice in our research. The framework was based on the assumptions that excellence in enhancing the quality of student learning experience is driven by researching student expectations (Brew, 2002; Russell, Malfroy, Gosper & McKenzie, 2014; Sander, Stevenson, King & Coates, 2000; Zamorski, 2002). The aim of the current research was to explore whether there was adequate evidence to suggest that providing students with digital materials before schedule lectures would lead to a drop in class attendance. We saw this as an opportunity to tune to student's voice as a vehicle to enhance student learning with technology within the higher education sector and at the same time acknowledged educators well-founded concerns. The research pathway that guided us in the research is presented in figure 1. Figure 1 was developed in congruence with the understanding of research-led teaching, a research activity that emphasises the use of the teacher's disciplinary research to benefit student learning and outcomes (Trowler, 2010; Trowler & Wareham, 2008).

Overall, our research is aimed at improving teaching and student learning, because we believe that teaching-led research can provide detailed information about how digital technologies affect students as they learn, which in turn can help faculty who seek to improve the quality of teaching. Most of the research-led teaching problems we explore are either based on observation, student or teacher's concerns. Attending to the student's voice through research, in particular, can enhance student learning (Lehmann, et al., 2000) since students must relate new information to their experience to better understand the learning materials (Lustbader, 1998).

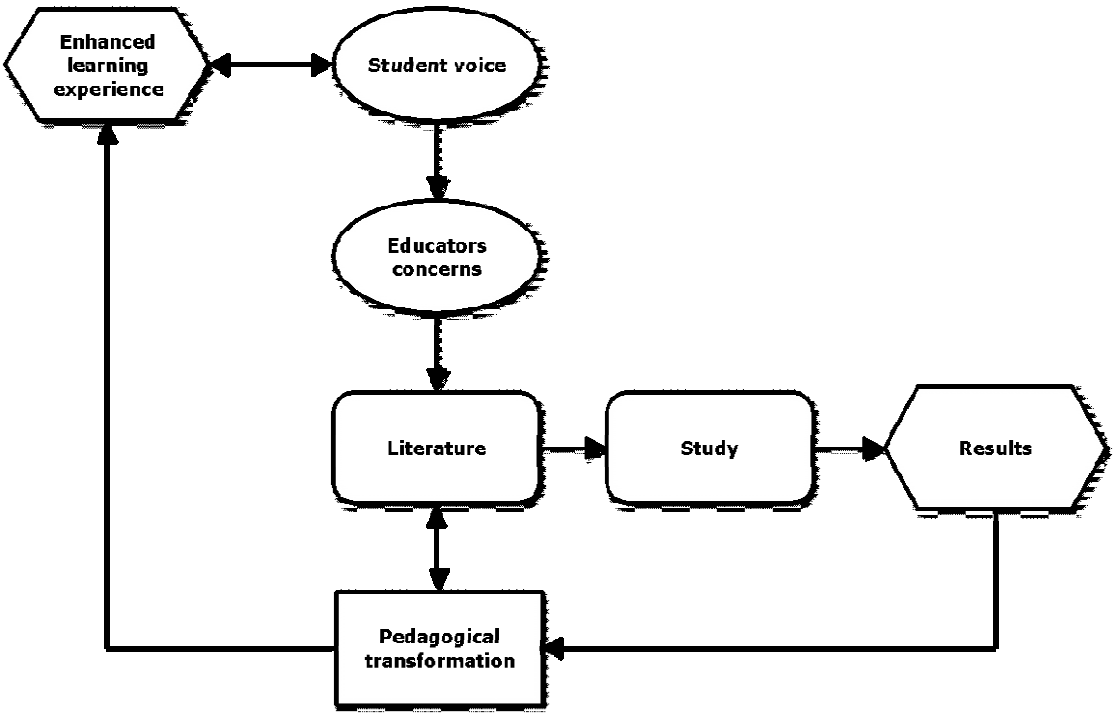

Figure 1. A research-led teaching pathway for addressing the student's voice

METHODS AND PROCEDURES

We surveyed a large first-year Health Science course, broadly looking at access to digital content of lecture materials, class attendance patterns and student engagement with content, peers, and the lecturer. The main questions that concerned us were whether or not the provision of lecture materials enhanced learning. How students were engaging with the content of digital lecture materials and how that has enhanced their learning experience in the course. The research focused on student self-reported perceptions rather than observations and analysis of learning outcomes (e.g. performance in exams).

We utilised a survey design to explore these questions and to gain a good overview of the topic. Respondents were students enrolled in a large Introductory Health Science course at research at intensive-teaching University in New Zealand. Data were collected using a questionnaire with 19 assessment items with some statements measured on a Likert scale (1= strongly agree; 2= agree; 3 = disagree, and 4 = strongly disagree). Since there was no scale to measure student engagement with the content of digital lecture materials before the delivery of lectures, the first stage of the project was to develop to develop the questionnaire based on the outcome of the literature review and more extensive consultations with the lecturers of the course. Lecture materials (PowerPoint slides, podcast, and reading materials) for the final module (9 lectures) of the semester were posted on learning management system (Blackboard) at noon the day before their scheduled lecture for students to access before scheduled lectures. The questionnaire was then piloted with ten respondents, revised and administered online using self-selected convenient sampling (n = 75; a response rate of 8.5%).

Analysis and Participants

Statistical Package for the Social Sciences (SPSS) version 24 was used to analyse data. Descriptive was used to summarise results. We tested the instrument for reliability, and it revealed an overall Cronbach's Alpha showed ($\alpha = 0.79$. Four items on the contribution of enhanced learning after accessing the content of digital lectures and yielded ($\alpha = 0.877$) (table 2), reliability score of another subscale with measuring various ways of engagement with the learning content of digital learning revealed ($\alpha = 0.822$) (table 4). Demographic characteristics (see Table 1) were analyzed, and suggesting that the majority of the respondents (71, 95%) were young with age range (18-24) and self-identified as females (46, 61%) with males comprising (29, 39%). Further, most of the respondents identified were in their first year of university (71, 95%).

Table 1. Respondent characteristics

Characteristics	(n, %)
Age	
18-24	(71, 95)
25-34	(2, 3)
45-55	(1, 1.3)
55+	(1, 1.3)
Sex	
Female	(46, 61)
Male	(29, 39)
Other	(0.0,0.0)
Year in the program	
First year	(71, 95)
Second year	(3, 4)
Third year	(1, 1)

RESULT

We survey asked participants whether providing them with lecture materials before scheduled lectures improved their learning experience (see Table 2). The majority (**64, 86%; *M = 1.51, SD ± 0.99***) mentioned that their learning experienced was enhanced after accessing the content of the digital lecture materials before class but (11, 14%) indicated this was not the case. Students also reported that access to digital learning materials helped them better prepare for lectures (***M = 1.41, SD ± 1.0***), contributed to retained knowledge (***M = 1.51 SD ± 0.95***); improved notes taking (***M = 1.5, SD ± 0.92***) and made revisions easier (***M 1.48, SD ± 1.0***).

Table 2. The contribution of digital resources to learning

Access to digital learning materials:	Mean	Std. Deviation
Help enhance the overall learning experience	1.51	0.991
Makes revisions easier	1.48	1.005
Improves notes taking during lectures	1.55	0.92
Helps in retaining knowledge	1.51	0.95
Helps in preparing for lectures	1.41	1.041

Cronbach's Alpha revealed (α = .89) for 5 items.
1=strongly agree 2= agree 3= disagree 4= strongly disagree

We also asked respondents how they engaged with the digital lecture materials before the lectures. The majority of participants said they used lecture materials to annotate useful content during lectures (29, 39%), and after lectures (10, 13%), while others indicated they used lecture materials to familiarize themselves with the content of the lecture (27, 36%).

Table 3. Provision of learning materials before scheduled lectures and engagement

Provision of pre-lecture materials	SA(n, %)	A(n, %)	D((n, %)	SD(n, %)
Enriched learning experience	(44, 59%)	(20, 27%)	(4, 5.3%)	(7, 9.3%)
Help improved engagement in class	(26, 35%)	(26, 25.3%)	(14, 19%)	(8, 11%)

Help improved engagement with course	(47, 63%)	(17, 23%)	(5, 7%)	(6, 8%)
Help improved engagement with the lecturer	(42, 56%)	(19, 5.3%)	(7, 9.3%)	(7, 9.3%)

SA=Strongly Agree; A=Agree; D=Disgree; SD=Strongly disagree

Table 4. How provisions of digital learning resources contribute to engagement

	Mean	Std. Deviation
Improved engagement in class	1.19	1.074
Improve engagement with course materials	1.56	0.933
Improve engagement with the lecturer	1.49	0.978

Cronbach's Alpha revealed (α = .821) for 3 items.
1=strongly agree 2= agree 3= disagree 4= strongly disagree

Results suggest that the ability to engage with the content of digital lecture materials contributed to the enhancement of learning (see Table 4). For example, access to learning materials before lectures improved engagement in the class (***M = 1.19; SD ± 1.0***); improved engagement with the lecturer of the course (***M = 1.49, SD ± 0.97***), and content of the course material in general (***M = 1.56, SD ± 0.93***). Even though lecture materials were provided before lectures, we were aware that students were more likely to access materials at different times.

The majority of students (64, 85%) accessed lecture materials posted on the learning management system before scheduled lecture; a small number, (3, 4%) accessed after the lecture and (8, 11%) reported that they did not access learning materials at all. Based on the time of access, we were interested in determining whether there was an association between those who access lecture materials before the lectures and those who did not, and whether or not participants reported enhanced the learning experience. We found a significantly positive correlation between participants who reported overall improved learning and accessing lecture materials before scheduled lectures ***r (75) = 0.93, p = 0.01***.

Furthermore, there was a strongly significant correlation between overall engagement with learning materials, and overall sense of enhanced learning experience was observed ***r (75) = 0. .82, p ≤0.05=0.001***, suggesting the more engagement student have with pre-lecture materials, the more they feel a sense increased learning experience. Moreover, overall learning experience and its relationship to various forms of engagement were extremely significant (see Table 5).

Table 5. The relationship between enhanced learning and engagement

		a	b	c	d	e	f
a)	Overall learning experience	—					
b)	Improved engagement in class	.585**	—				
c)	Improve engagement with course materials	.778**	.466**	—			
d)	Improve engagement with lecturer	.814**	.504**	.854**	—		
e)	Retain knowledge	.799**	.532**	.707**	.670**	—	
f)	Improve notes taking during lectures	.508**	.462**	.666**	.544**	.586**	—

**** All correlation is extremely significant at the 0.01 level (2-tailed).**

Furthermore, there was a significant differences in the way male and female perceive the importance of accessing digital learning materials before lectures, and the extent to which this contribute to enhancing learning ***(X^2 = 10.72, df = 3, N = 75, p ≤0.05=0.013**)***; how the digital learning materials contributed to their improved engagement in class ***(X^2 = 9.8, df = 4, N = 75, p ≤0.05=0.04*); (X^2 = 9.8, df = 3, N = 75, p ≤0.05=0.04*);*** improved engagement with course materials ***(X^2 = 12.8, df = 3, N = 75, p ≤0.05=0.001**)***; improved engagement with the lecturer ***(X^2 = 8.5, df = 3, N = 75, p =0.03*).*** Additional, results showed very significant gender differences in agreement on whether or not to attend lectures after receiving digital lecture materials with females 32(43%) more likely to attend lectures than male ***20(27%) (X2 = 9.6, df = 3, N = 75, p ≤0.05= 0.02*)***.

Lecture Preparation
A significant number of respondents mentioned that accessing lecture materials before lectures enhanced their learning (65, 87%). They felt it made preparation for lectures more accessible, more interactive and meaningful. It also made them reflect more on the lectures before lectures. More specifically, it helped them to identify weak areas that needed their attention during the lecture (60, 80%). Participants also mentioned that having access to the materials before lectures made them more likely to recall and retain content during lectures (72, 83%). It also improved their ability to take notes (61, 81%).

Lecture Attendance
Contrary to the views that are providing lecture materials to students before lectures are likely to deter students from attending lectures, our findings indicated that the release of the lecture materials before lecture encouraged students to attend lectures (52,69%), and only (23, 31%) reported that they would not attend lectures. Findings revealed that the most frequent reason given by these students for regularly attending lectures was the likely benefit to their learning.

Engagement in Lecture Materials
About (64, 86%) of participants mentioned that accessing lecture materials before lecture improved their engagement with lecture materials. We also asked participants when they would normally access resources, the majority (64, 85%) indicated they accessed lecture materials before lectures, (3, 4%) mentioned accessing learning materials after lectures (8, 11%) stated they did not access lecture materials at all.

Engagement with the Lecturer
We asked participants whether the provision of lecture materials influenced their engagement with the lecturer during lectures. Respondents indicated that the lecture materials helped improved their interaction with the lecturer (61, 81%). These findings revealed that having prior access to lecture materials helped students identify areas they needed help with, and as such, they were able to have meaningful engagement during lectures. They also indicated that having materials before lectures meant they would have time to listen to the lecture and actively take notes to clarify difficult concepts.

Furthermore, we explored whether providing students with prior access to lecture materials is likely to engage them with peers in the classroom. It seems more than half of participants (62, 70%) indicated their engagement with peers was improved after accessing lecture materials before lectures.

LIMITATION

Results of this research must be interpreted in light of some potential limitations. Ideally, a randomized experiment could have been employed to study the effect of providing lecture materials to students before lectures and students' learning outcomes. Further, the generalisability of this study is limited because it was conducted at a single institution with a low response rate of 8.5%. We are also aware that any pedagogical transformation puts a significant workload on lecturers, most of who are already overworked, we have not explored lecturers' views about the efficacy of this change and its implication in practice.

Since the present study was based on survey data alone, it does not provide in-depth insights into factors that are likely to effectively engage students with digital learning resources to provide to them before scheduled lectures. More recently, alternative methods to understand students' engagement with digital learning materials were proposed. For instance, O'Brien and Verma(2019) observed that much of the current knowledge of how students engage with technologies and the effect on traditional lecture attendance is mainly derived from student surveys rather than comprehensive independent analyses.

Further, the conclusions drawn in the study might not tell much about student learning outcomes. It should also be noted that the cohort in the study was predominately the first year and might not be experienced, learners. This study was a first attempt to provide an overall view of how students engage with digital learning resources and set the stage for further experiments currently underway.

SUMMARY AND CONCLUSION

The requirements of the 21st-century classroom in higher education are rapidly changing with increasing student demands and continuous implementation of technology requiring innovation in pedagogy, and are resulting in improved student outcomes. The lecture form of teaching in the classroom has been a dominant practice in higher education for many years, though its prevalence has been criticised (Sams & Bergmann, 2013; Traphagan, Kucsera & Kishi, 2010), yet this criticism

has not to lead to significant changes in teaching practices (Grant, 2013). As student learning needs become diverse, a growing number of institutions of higher education are now seeking ways to transform the conventional mode of lecture form of teaching to adapt to changes in students learning needs. Some are utilizing online learning technologies to support student learning (Gosper, Malfroy & McKenzie, 2013; Mattick, Crocker & Bligh, 2007). It is expected that utilizing these technologies would personalize student learning experience, and providing students with some level of autonomy in their learning (Walvoord & Johnson, 1998). Student engagement with content, learning, and lecturer enriches learning experience (Anderson, 2003).

In this digital learning landscape, students have become vocal and increasingly demanding that educators include them in the planning and design of their learning environments (Daniel & Bird, 2016). They demand the provision of flexible learning environment that enables them to timely access to various forms of digital educational resources, including lecture notes, and online support. However, there is a myth among some educators that provision of digital learning materials to students in advance of lectures would lead to absenteeism and subsequently poor academic performance.

This article explored whether providing students with lecture materials before lectures improve their engagement with learning. The paper also probes whether such provision reduces class attendance, by asking the students if they were less likely to attend class due to the intervention. The analysis of the questionnaire data does suggest that the students perceive lecture notes to be valuable to their learning and that over a third indicated that they would not attend lectures. Findings in the present study are similar to the literature suggesting that making lecture materials available to students before lectures can increase class participation (Babb, Kimberley & Ross, Craig, 2009; Chen & Lin, 2008; Grabe & Christopherson 2008), and that providing students with pre-lecture materials is likely to led to higher grades, and that pre-lecture preparation is more responsive to learners' needs; moreover, it creates additional incentives to study (Romanov et al. 2019). Further, a more recent study has revealed that the availability of digital learning resources support student's learning and decreases the time needed to engage in notetaking. Provisions of these materials serve as a safety net mechanism for missed notes and the occasionally missed lecture (Wood et al. 2018).

Participants in this study told us they use the content of digital lecture materials to familiarize themselves with the lecture ahead of the class, and claimed it facilitated active engagement during lectures. These findings are consistent with recent findings that in larger classes, providing digital materials together with the utilisation of various forms of digital technologies such as smart classrooms, learning management systems, and better timetabling is likely to achieve the quality of learning achieved in a much smaller enrolment class (Godlewska et al. 2019).

Respondents also mentioned that access to the digital content of lectures before class helped them take better notes during lectures. Though this particular outcome is supported by the literature (Chen & Lin, 2008; Cohn, Cohn & Bradley, 1995), we did not observe student behaviours in the classroom and the kinds of learning activities. However, overall our research has led to some significant pedagogical changes. The lecturers involved in teaching the course are currently making lecture materials available to students before scheduled lectures and exploring active learning strategies in their classes.

Statements on open data, ethics, and conflicts of interest:

a. Data used in the study can be requested from the authors of the article, subject to the ethical guidelines of the institution in which the study was conducted.
b. The study reported in this article has ethical approval from the institution in which the study was carried out. All results were presented in an aggregated and anonymised form. Survey participants were informed about how data will be used and were ensured that the study would identify individuals.
c. The authors of this article declare no conflict of interest in the research reported. The first author of the article was not involved in the teaching of the class. The second author was involved in teaching one of the modules in the course but did not participate in the data collection.
d. Some of the data in this paper were presented in a conference paper EdMedia 2016.

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Co-Designing of a Mobile Educational Tool for Innovative Teaching and Learning at the College of Business Education, Tanzania

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ABSTRACT
Mobile technologies are increasingly becoming tools for enhancing access and smooth sharing of information, products, and services. In this realization, this study used a design science research users' participatory approach to co-design a mobile application prototype known as CBE Mobile Educational Tool (CBEMET) to enable lecturers of the College of Business Education (CBE) in Tanzania to share educational materials. The co-design of the prototype involved 3 researchers, one application developer and 25 lecturers of CBE. The testing of the CBEMET prototype shows that downloading and uploading of education resources to the system is adequate. The results also indicate that the prototype enables the access of uniform departmental-related materials by lecturers of the same department at different locations and, in so doing, it increases the quality of teaching and learning at the college. Furthermore, the testing of the prototype revealed that the design meets the requirements of the lecturers and has brought a significant change in their teaching and learning practices. The impact of the study is that it sets a groundwork for future studies involving lecturers in higher education and developers in co-designing and co-developing mobile education tools for innovative teaching and learning in Tanzania and in other emerging economies.

KEYWORDS
CBE, Tanzania; innovative teaching and learning in higher education institutions; educational technology; co-design and development of mobile educational tools; mobile education tool usage; DSR.

INTRODUCTION
Mobile education tools are regarded as one of the means to enhance innovative teaching and learning. It simplifies, adds value to the way education is delivered, enhances collaboration in learning and is a source of innovative teaching and learning process (Filippo, Barreto, Fuks, & Pereira de Lucena, 2006). With mobile education technologies, teaching and learning can contemporarily be done anywhere, anytime ubiquitously (Virvou & Alepis, 2005; Quinn, 2001; Sharples, 2000; Patten, Arnedillo, & Tangney, 2006; Ryu & Parsons, 2009; Porter, et al., 2016) In other words, technologies have got rid of the need for fixed classrooms and lecture rooms (Lee & Salman, 2012) which were the prerequisite in the past. ICTs technologies, in particular, have improved information accessibility; electronic file exchange; and most importantly enhanced the exchange of information between learner-tutor or learner-learner (Sife, Lwoga, & Sanga, 2007; Abouelenein, 2017) extended learning beyond the classroom (Fullan, 2011). A study by (Heath, Herman, Reeves, Vetter, & Ward, 2005) provide a highlight on how mobile learning application can be used to solve problems of retention of science and mathematics students in universities. Moreover, the new pedagogical method of learning through mobile devices has prominent benefits that other educational media cannot present, such as personal engagement, satisfaction, and high motivation regarding the learning process (Ryu & Parsons, 2009).

Increased application of mobile tools in education in HEIs relates to a concept of innovative teaching, learning, and assessment using social media technologies (Kivunja, 2015). Several studies (Mtega W. P., Bernard, Msungu, & Sanare, 2012; Mtebe J. S., Kondoro, Kisaka, & Kibga, 2015) show that the mobile phone is a useful tool for teaching in higher education solves many previous challenges. Mtebe and Kandoro (2016), specifically write that the Moodle learning management system (LMS) via mobile phones enables instructors and students to view courses, view grades, view notes and be able to hold discussions very efficiently than ever before. Research, therefore, point out that the use of innovative educational technology in teaching should be one of the

requirements for accrediting a higher education institution (Borisova, Vasbieva, Malykh, Vasnev, & Bírová, 2016)

In Tanzania, the growth and advancement of Information and Communication Technologies (ICTs) are changing the mode of teaching and learning (see, Lee & Salman, 2012; Ryu & Parsons, 2009). According to Kazoka (2017) ICTs has enabled 300 teachers from primary schools to higher education institutions in Tanzania to attend teleconference seminars that improve their teaching of science in public schools. Further, the technology has enabled lecturers to teach in more than one school at the same time

Despite this development in using ICTs in Tanzania, many higher learning institutions have not taken the full advantage of the possibilities offered by the information and computer technologies in improving teaching and learning processes. Mwandosya and Suero Montero (2017), for instance, investigated the usage pattern of mobile devices for teaching and learning among teachers and students at the College of Business Education in 2017. They reported that the usage of such gadgets for education was stubbornly low among the participants of the study. It was also found that a substantial number of CBE lecturers only knew WhatsApp, electronic mails (e-mails), and normal text messages. As a result, CBE administration would fail to acquire uniform coverage of syllabi for the same subjects in their dispersed campuses of Dar es Salaam, Dodoma, Mwanza, and Mbeya[1]. This is because WhatsApp, which was the most preferred application, failed to cater for the idionsyncratic communication needs of CBE teachers and students. According to Mwandosya and Suero Montero's study (ibid), CBE lecturers and students needed a mobile device to enable them to share educational resources and discuss the same issues across the campuses. CBE lecturers supposed that such mobile educational tool would enable lecturers and students to share ideas, and educational resources among themselves, and in so doing, facilitating innovative teaching and learning process.

Building on the findings of Mwandosya and Suero Montero in 2017, this study set to co-designed and develop CBEMET prototype by involving stakeholders through interviews, focus group discussions, and participation in design workshops conducted with lecturers of CBE.
The study set to fulfill the following objectives:

1. to identify the mobile education tool's design features and functionalities for innovative teaching and learning at CBE.
2. to co-design design and co-develop a mobile education tool prototype incorporating CBE lecturers' requirements
3. to demonstrate and use the CBE mobile education tool prototype to the CBE lecturers after its development.

The study intended to lay a groundwork for future co-designing and co-developing mobile software for contextualized innovative teaching and learning in higher education institutions in Tanzania and elsewhere.

MOBILE LEARNING THEORIES AND RELATED WORKS

Mobile learning theories

Mobile technologies contributions to the education sector have yielded a number of theories. In their Theory of Mobile Learning, (Sharples, Taylor, & Vavoula, 2005; Pea & Maldonaldo, 2006) consider a technology-mediated mobile learning as a personal and situated activity mediated by technology. The theory clearly explains the convergence between learning and technology, where learning is conducted in a mobile situation away from traditional classrooms and lecture halls through the use of mobile education tools. One of the aims of the Theory of Mobile Learning is to inform the design of new environments and technologies to support mobile learning. The theory is important in this study and has been applied in the sense that the co-designing and co-development of this mobile devices for CBE will enable teachers to share educational experiences and materials for the innovative teaching and learning irrespective of their location and time.

Further, the study applied the Activity Theory. This is a theory which gives insights on how designers can develop mobile tools using mobile technologies to better understand the social and material relations that affect complex human learning and the learners' interaction with others as mediated by mobile education tools (Uden, 2007). The Activity Theory emphasizes the involvement of users in the development of an application, in this case, the CBE teachers. It moves away from teacher-centered or student-centered learning approaches. In line with the theory, the participants move through the activities and progress from being partial participants who are

[1] Distance in kilometers from Dar es Salaam to Dodoma is 584 km, Dar es Salaam – Mwanza is 1145.58 km, and Dar es Salaam – Mbeya is 829.53 km.

heavily dependent on the material mediation of tools, to full participants, who are able to more flexibly use the cultural tools of the narrative practice (Gifford & Enyed, 1999). That is, a mobile technology in this perspective is not perceived as the object of learning, but as a tool to support students' learning activities which are applied in the study involving teachers' aspects in own teaching and learning activities using a mobile technology. Instead of designing mobile learning applications in isolation, the Activity Theory suggests the consideration of important features of human endeavor at large through the participation of the concerned users. This allows us to focus on the context of use. It maintains that mobile technology artifacts can only be understood in their context of use, as embedded in meaningful activity.

These two theories (the Theory of Mobile Learning and the Activity Theory) offered this study an initial framework for theorizing about mobile learning. Similarly, they highlighted and put forward the ground for carrying out further studies about the use of mobile technologies in higher educational environment for sharing teaching and learning activities, among other functions. They rationalized the need to grab opportunities offered by mobile learning to promote innovative teaching and learning. The following sections extend the base obtained from the mentioned theories by looking at multiple studies relating to innovative teaching and learning, collaborative learning, design, and development of mobile applications, and the user experience in the co-design and development of mobile education tools.

Innovative teaching and learning

Teaching innovation is when the appropriate strategies and skills are applied to technology use, making it a favorable tool for teaching, fostering effective learning (Bruce, 1989). Innovative teaching is both the practice of teaching for creativity and of applying innovation to teaching (Ferrari, Cachia, & Punie, 2009; Mtega W. P., Bernard, Msungu, & Sanare, 2012). Fullan, (2011) identified three innovative teaching practices namely: 1. Students' centered pedagogies including knowledge building, self-regulation assessment, collaboration, and skilled communication; 2. Extending learning beyond the classroom including problem-solving and real-world innovation; 3. The ICT use in the service of specific and concrete learning goals.

Research point out that innovations enhance competitiveness in a wide variety of sectors including the education sector. Khurshid and Ansari (2012), for example, separated two groups of students of grade I. One of these groups was the control group and was taught using conventional teaching methods, while the other group was the experimental group and was taught using innovative methods. The innovative methods applied were team projects, individual projects, field trips, flash cards, real objects, audio-visual aids, internet access, computer-assisted instructions, role play, worksheets, smart boards, group discussions, quizzes, and mind maps. A test was administered after one month of the teaching and the result showed that students taught using innovative means scored significantly higher than those taught using conventional methods did.

This confirms that innovative teaching improves learner's capability and that teaching has to be innovative (Lee, 2011; Borisova, Vasbieva, Malykh, Vasnev, & Bírová, 2016). .

With regard to mobile education, technologies now make innovative teaching and learning easy and real. According to (Kaliisa & Picard, 2017), mobile technologies make it possible for someone to learn efficiently in anytime and almost anywhere. This study is therefore informed by the key role of technologies in the innovative teaching and the need to encourage the design and development of innovative curriculums, and mobile education applications designed in a collaborative way to involve the learners, lecturers, and experts in curriculum and application developers (Naismith, Lonsdale, Vavoula, & Sharples, 2004).

Co-designing and co-developing mobile applications

Co-designing and co-development of a mobile application refers to focusing on the users of the system rather than the developers of the system in order to obtain features and functionalities which will be compatible to the users' needs and in so doing to obtain maximum benefits of learning innovatively. Though the users of the mobile tool might not be technically oriented in designs of the mobile technologies, their contribution to the design is very important as they may observe out the functionalities of the application. Involvement of the users may lead to an application tool with ideal features for users. Co-designing and co-development of mobile applications ensure the success of the application in question at the implementation stage. This is because all problems with the application are early noticed by users of the application and are thus corrected during the design stage. A study by (Nielsen, 2017) elaborates ten usability heuristics for user interface design. Similarly, (Millard, Howard, Gilbert, & Wills, 2009), showed steps involved in co-designing and co-deployment of an innovative mobile learning system as: *scoping; sharing understanding; brainstorming; refining; and implementing* in this study, each of the five stages of Millard, Howard, Gilbert, & Wills' were followed through workshops and meetings with technical and domain experts in the design team.

Mobile educational tools – features and functionalities

A study by Filippo et al., (2006) described a mobile device as a tool for coordinating 'conferences' or 'forums' where learners and mediators' messages could smoothly avail collaborative learning. The usefulness of any mobile application is associated with factors such as the quickness in searching and accessing the mobile learning materials and smooth coordination of contents shared by learners and mediators – lecturers at case study of CBE (Filippo, Barreto, Fuks, & Pereira de Lucena, 2006). A number of research have been done on how mobile learning tools can be developed and be applied in different teaching and learning environments.

A four-year project in three European countries to research and develop a practical, easy to use mobile learning toolkit specifically for lecturers, by (Attewell, 2005) produced three toolkits: the first one was a short messaging system (SMS, text message) known as quiz authoring tool, the second one was media board authoring tool, and the third one was pocket PC authoring tool useful for lecturers. The three toolkits suggested by the project study provide an insight on how to design and incorporate a bundle of tools in a mobile application to be used by teachers for effective and innovative teaching. A study by (Li, 2010) worked on a search tool for users to quickly access mobile phone data such as applications and contacts, by drawing gestures. The search tool was found to be useful in searching contents. A study by (Alzahrani, 2017), which was intended to enable students learn through discussion forums reveals the effects of using online discussion forums on students' learning indicating a positive result for enhanced innovative teaching and learning at one of the leading University in Saudi Arabia. It established that many users of mobile applications face slowness in sending requests and receiving feedback. They thus marked this factor as an important aspect to be looked at in the design of any mobile application. A study by (Foti & Mendez, 2014) focused on how students use education-related applications such as Quizlet by LLC a company which creates study tools enabling students to join through their website. The students were able to log in to the app where they found easy to collaboratively learn, do quizzes and some exercises in preparations for examinations. In a study by (Virvou & Alepis, 2005) features of a mobile education tool known as "The Mobile Author" made learning interesting and useful to students and their instructors.

Xie & Parsons (2009) found that functionalities of mobile tools depended on the available portion of the total bandwidth that a user is using. The bandwidth challenge can be solved by developing an application using, for example, the asynchronous JavaScript and XML (Ajax) which is an approach to Web application development that uses client-side scripting to reduce traffic between client and server and provides seamless user application experience (Xie & Parsons, 2009). A study by Ahmad et al., (2004) suggested the importance of learning users' requirements of the interface. Furthermore, according to (Ahmad, Basir, & Hassanein, 2004), the interface of the tool should be easily adapted for different types of users with differing intelligence capabilities.

Gathering from the aforesaid studies, the need to engage users in the design of the mobile applications as a way of motivating them to collaborate is emphasized. In designing CBEMET prototype for the College of Business Education, therefore, lecturers were involved to come up with a system with features and functionalities that meet their requirements.

METHODOLOGY

In order to define the interface design requirements and contents specifically for the CBEMET prototype about how it will look and work, four workshops involving one application developer, 25 CBE lecturers, and three researchers (one based in Finland at the University of Eastern Finland, and two based in Dar es Salaam at CBE), were conducted at Dar es Salaam Campus of CBE. The workshops followed the design science research (DSR) framework which emphasizes the involvement of users (lecturers) from the onset in the design process of an artifact (the CBEMET prototype). By involving the lecturers, and the designers learnt about what to incorporate in the design.

Design Science Research

The DSR users' participatory approach in designing the CBEMET prototype have been pivotal in this study. A participatory design approach is an approach that attempts to bridge a gap between researchers and designers and users by organizing co-operation between them (Muller, 2002). The DSR method is a methodological approach concerned with devising artifacts that serve human purposes (Dresch, Pacheco, & Antunes, 2015). DSR entails a systematic approach to studying a practical problem in order to develop a practical solution for an environment in a real world (Hevner, March, Park, & Ram, 2004; Hevner, 2007; Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007). An important outcome of this type of research is an artifact that solves a domain problem, also known as a solution concept, which must be assessed against the criterion of value or utility. In the present study, DSR Framework by (Johannesson & Perjons, 2014) were adopted and modified (see Figure 1).

In applying the DSR at CBE, the task involved lecturers (ultimate users of the application), the developer (a former student, an ICT diploma graduate at CBE and a member ICT innovation group), and 3 researchers (2 based in Dar es Salaam and 1 in Finland.
In the CBEMET prototype co-designing phase, the prototype features and functionalities were designed through iterative discussions, interviews, observations. After the prototype demonstration and agreement on the proper interface design of the MET. Finally, after the demonstration phase, the MET prototype was presented to users to test its features and its effectiveness for sharing different contents. Figure 1 illustrates the co-designing and co-development process applied in this study.

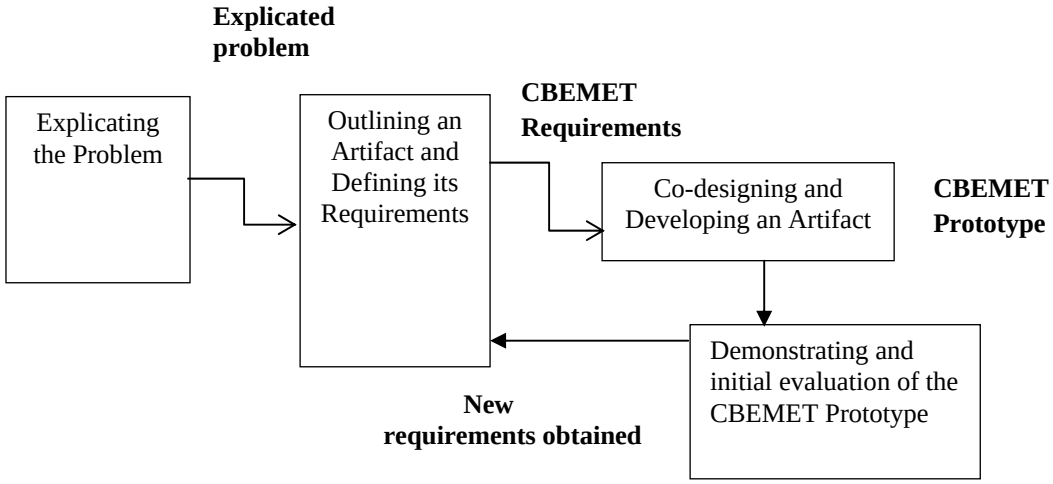

Figure 1. Design Science Research Framework adapted from (Johannesson & Perjons, 2014).

Participants
The population of the CBE academic staff as per the year 2017 records from human resource department is 161 lecturers. Out of 161 CBE teaching staff, whereby; 83 are based in Dar es Salaam Campus, 38 are based in Dodoma Campus, 31 are based in Mwanza Campus, while, 9 are in Mbeya Campus. In this study, 25 lecturers were purposively selected: 10 from Dar es Salaam Campus and 5 from each of the remaining 3 campuses. The purposive sampling was used because the target was the participant with the sought information (Bryman, 2012; Saunders & Philip, 2009; Denscombe, 2003).

Data collection method
Data for this study were collected in two phases. Phase I data aimed to gain an understanding and experience of CBE teachers in using mobile devices for educational related matters (see Table 1). Phase II data targeted soliciting views of the lecturers of the features and functionalities that MET need to possess (see Table 2). Data was collected through four interviews, one at each campus, and one FGD involving 8 teaching staff 2 from each campus. Observation on the working of the MET prototype was done in each campus and notes of the observed and interviews were taken and recorded for improving the application.

After the demonstration of the initial CBEMET prototype, the second phase of an interactive design discussion on the functionalities of the prototype together with the lecturers was undertaken. Table 1 shows sample questions used to probe the design features and functionalities of CBEMET in focus groups and interviews.

Table 1. Sample questions on the features and functionalities of the CBEMET Prototype

Demonstration of MET Prototype	Phase II – MET Prototype Experience
Features expected: 1. Log in interface 2. Available services 3. Navigation through 4. Access to different services 5. Arrangement of icons The demonstration will pave way for the look on the following: 1. Access to the services of the MET 2. Features of the MET 3. Functionalities of the MET **Outcomes:** 1. Testing of the services, features, and functionalities of the MET. 2. Lecturers' suggestions for improvement of the MET	1. What is your overall reaction to the observed functionalities of the MET prototype after using the initial design for two days? Please respond also to the following coming questions in this part: - How do you feel about sharing your contents online? - How do you feel about the arrangement of icons? 2. In terms of functionalities, what is missing? How can it be improved or changed? Why? 3. What is your opinion of the MET in terms of minimizing the educational-related challenges found at CBE? 4. In terms of features found on the screen, what do you think should be improved or changed? Why? 5. Briefly explain if the MET will be a solution to your personal development in your T & L environment and the innovative teaching. If NOT, please elaborate on your reaction.

Data coding and analysis

Data obtained from interviews and focus group discussions were subjected to content analysis while data obtained from observations and discussions, after the demonstration of the application, were used to re-design and develop the MET prototype to generate features of the mobile education tool that fully meets the needs of CBE teachers. The results of the observations and feedback obtained on the features and functionality of the tool are discussed in the results section of this paper.

CO-DESIGNING AND DEVELOPING CBEMET PROTOTYPE

The second objective of this paper was to co-design and co-develop a mobile education tool prototype incorporating CBE teachers' requirements. This was achieved through a series of iterations as presented in the subsequent subsections.

1st Iteration of co-designing and developing CBEMET Prototype

This was motivated as a result of a study by Mwandosya and Suero Montero, (2017) who identified the need for co-designing a mobile educational tool that meets lecturers' requirements of innovative teaching and learning at CBE.

In line with this need, the first phase of workshops for co-designing CBEMET prototype involved 10 teachers from Dar es from Dar es Salaam Campus and 5 from each of the remaining 3 campuses. Figure 2 is a sample of such workshops at Dar es Salaam Campus.).

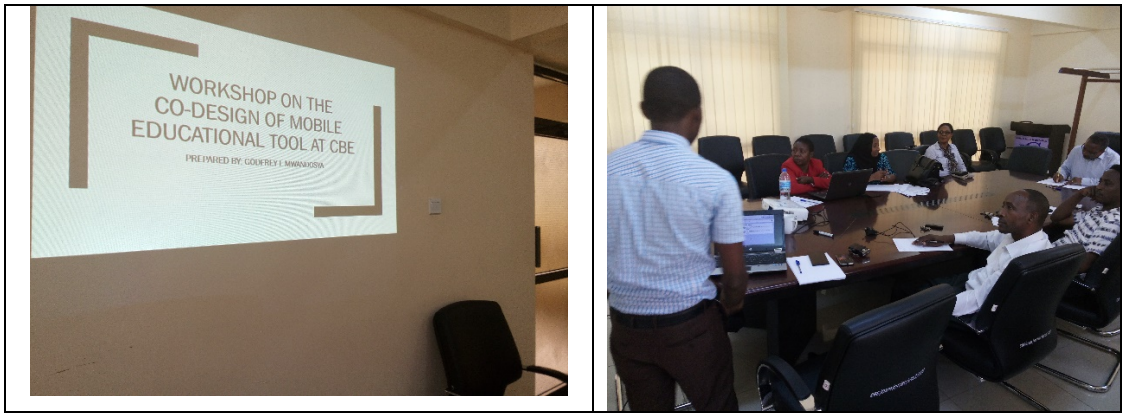

Figure 2. The first batch of lecturers' workshop at CBE, Dar es Salaam Campus

In these workshops, the developer and the researchers introduced the aim of the gatherings to lecturers for them to own the design of a mobile educational tool tailored for them before the start of the workshops.

Outcomes of the workshops:
The following feedback were obtained from CBE lecturers from Dar es Salaam Mwanza, Dodoma, and Mbeya campuses as the initial design requirements for CBEMET prototype

1. The login to the CBEMET prototype should be for CBE as a whole, not by campus-wise
2. The administrator of the system should be able to filter messages so that unwanted messages are blocked or sent to junk mails
3. The contents of the shared educational tool should be arranged by department-wise to minimize time to search and to realize a systematic approach to shared materials of the department in question
4. A lecturer should be able to delete a sent file in case it was wrongly picked or it is irrelevant
5. The CBEMET prototype should allow lecturers to record and post videos, audio presentations
6. CBEMET prototype should store videos and audio presentations for future use
7. CBEMET prototype should allow lecturers to change their passwords at next login
8. The CBEMET prototype should have its logo bearing the colors of CBE
9. It should be mandatory for user to register their first name, last name and e-mail address when logging in. Other particulars such as users' title, education background should remain optional until when users have started accessing the CBEMET prototype
10. Frequently asked questions (FAQs) should be presented somewhere in the system to make it friendlier to users
11. There should be an arrow to direct the user on where go next after logging in to the CBEMET prototype
12. There should be as little information as possible on one window. Only compulsory information should be portrayed at a time

2nd Iteration of the of the Co-design and development of the CBEMET Prototype
The second iteration came after the researchers and the developer of the CBEMET prototype had worked on the observed feedback from lecturers from all the four campuses and produced an initial design of the CBEMET prototype. This was an iterative process as lecturers had produced remarkable ideas for the designing each time they had a chance.

Another workshop was called upon in early December 2017 to proceed with the designing of the CBEMET prototype after obtaining the initial feedback on the design of the CBEMET prototype. In this workshop, the participants were presented the version of CBEMET prototype that considered the feedback they had stipulated in the first workshops. Figure 3 shows the initial design presented to the lecturers during the workshop.

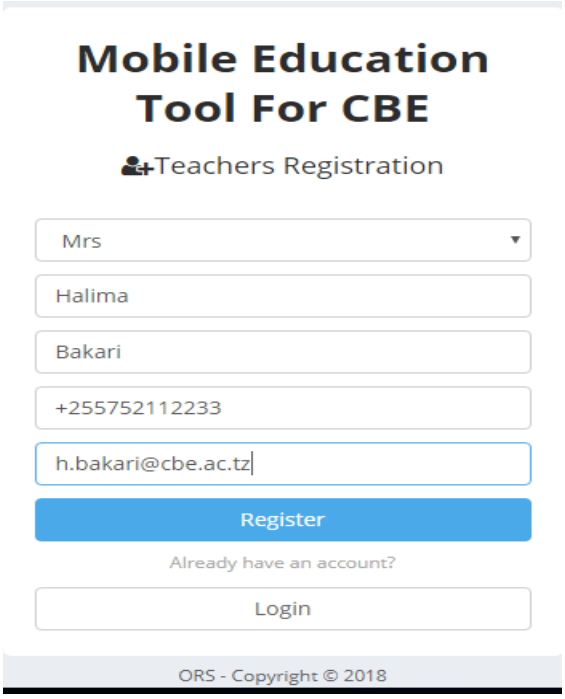

Figure 3: The initial design of the CBEMET – registration, login menu

Activities that took place in this workshop were:

- the installation of the CBEMET prototype in the smartphone and mobile devices of the lecturers
- the navigation through the CBEMET prototype to see what has been done after the requirements

After the above activities, each of the lecturers were given two days to explore all features of CBEMET prototype to determine their usefulness. The findings of the observation would be presented in the following workshop as detailed in the subsequent subsection.

3rd Iteration of the Co-designing and development of the CBEMET Prototype

The next workshop was held in early January 2018 at Dar es Salaam Campus after each of the participating lecturers from all campuses had accessed the CBEMET prototype. Each of the participating lecturers in the co-designing activity had demonstrated a good command of using the CBEMET prototype by going through all the functionalities of the different menu items found.

A number of challenges were revealed during the discussions in this co-designing workshop. First, some of the lecturers had encountered access problem. They reported that the system did not work in their smartphones and other mobile devices their network bundles were small – which was noted by the researchers and the developer for future improvement of the system. Furthermore, it was reported that power saving options caused the screen of their devices to go to lock mode. Another challenge was the difficulty to select more than one file to download. At the post notes menu, it was not possible to upload contents. However, the menu items of the CBEMET application were found suitable. It was thus agreed in the workshop that all the challenges observed be rectified before the following workshop scheduled for June 2018.

Outcomes of the co-designing iterations

In a nutshell, all participants were largely satisfied with the outlook and the running of CBEMET prototype. The lecturers were excited in accessing CBEMET prototype online – they likened the application with the WhatsApp, but said the good thing with CBEMET prototype is that they owned it and are thus able to suggest further modifications they feel appropriate. In a nutshell, they felt really empowered in their work as lecturers. The lesson learnt by the researchers, the developer and lecturers during and after the re-designing sessions was that each participant learnt different ways to access, upload and download documents from and unto the CBEMET prototype.

Few suggestions for improvement raised were keenly recorded for the re-designing the CBEMET prototype so that if fully meets the requirements of the lecturers. Such suggestions were such as:

- in the registration part of the MET, the title should include Prof, and Dr. Initials, not only Mr., Mrs., Miss as the CBE institutions is ever expanding, and had 3 professors, 6 Ph.D. staff, and about 20 staff in Ph.D. programmes
- the function for changing the password received through email needs to work properly to enable lecturers to change their passwords for security reasons
- after logging in, a name of the logged in person should appear in the window
- the main menu or the login menu or both should have a logo that clearly indicates that the application belongs to CBE to ascertain copyright and visibility issues. This is because the application is will be accessed online through the Google Play Store.

At a discussion part, a name and photograph of the lecturer who is posting should also appear.

Re-designing CBEMET

The re-designing CBEMET prototype was done in consideration of feedback from the workshops. The re-designing involved the addition of a provision for each department to share their own notes. There was also the insertion of a CBE logo in the main menu window. Another improvement was the inclusion of titles of Dr. and Prof. in the registration window – as it was recommended by participants of the earlier workshops. Further, there was the inclusion of “News and updates” icon on the main menu, instead of inside one of the menus. The news and updates will remind users of important announcements on shared resources especially new modern technology and innovation inventions.

The third objective was to demonstrate the use of the CBE mobile education tool to CBE teachers after its improvement. In line with this objective, a training intended to demonstrate the modified version of the CBEMET prototype to the 25 lecturers was organized at CBE Dar es Salaam Campus for all 25 lecturers from all campuses who had smartphones. The training aimed to make lecturers own the CBEMET prototype, familiarize themselves with the application and providing feedback for improvement. The researchers and the developer were closely monitoring the process to make sure that CBEMET prototype is working properly and that lecturers

do not get stuck at any point. The activities that took place in the demonstration phase are summarized as follows:

Accessing CBEMET Prototype – the participants of these training would access CBEMET prototype through their smartphones using a provided domain. The process started by visiting the website **meducbe.ac.tz** and pressing "**Enter**" key. This opened a log in Window as shown in Figure 4:

Figure 4. The screenshot for login

With a registered e-mail (CBE e-mail) and a correct password one can log in and access the MET prototype.

Grouping lecturers – 25 lecturers were grouped into 5 groups consisting of 5 lecturers each. The objective was to get them collectively check how the CBEMET prototype works and thereafter give feedback for improvement.

FINDINGS

Focus group discussions – the FGDs were conducted after the demonstration phase to solicit the views of lecturers on the running of MET and to explore their suggestions for improvement. Major outcomes of the FGDs was a proposal to include video conferencing function into the system to enable lecturers to converse online. For example, one participant said, *"even the meetings can be done online between members of the management, instead of members of the management team traveling all the way from Mwanza, Dodoma, and Mbeya to Dar es Salaam just for a 2 hr meeting."* This was taken up for further improvement of the system. also, the lecturers during the discussion revealed that training program should be prepared for all the lecturers of CBE to start using the prototype immediately.

Interviews–interviews were also held to solicit views of lecturers after the demonstration of CBEMET prototype phase. The interviews equally realized fruitful feedback which were taken on board in the improvement of CBEMET so that it enhances the teaching and learning in HEIs. One of the participants who had an issue with the security said, "*I am worried about sharing my documents online, what about if someone accesses them and use it in another institution*?"

Observation of lecturers' reaction to CBEMET Prototype

The developer and the researchers simultaneously observed the reaction of lecturers to CBEMET. Generally, they were happy about the design of the MET prototype, especially because it enabled them to transfer experiences of using other social media contents to the system.

Agreements – to make sure that CBEMET is owned by all parties involved in its design, it was agreed that every suggestion on the improvement of the design and modifications of the CBEMET is dully checked by all the participants and the final agreement documented thereof was produced.

Documentation of how the system works, what were observed and resolved during the demonstration of the MET was done for future reference and maintenance of the application.

This section presents the features and functionalities of the version of CBEMET prototype which considered the requirements of 25 lecturers from all the four campuses of CBE. We start the presentation with the technical description of the CBEMET prototype and ends with the observed challenges and future plans for the similar works.

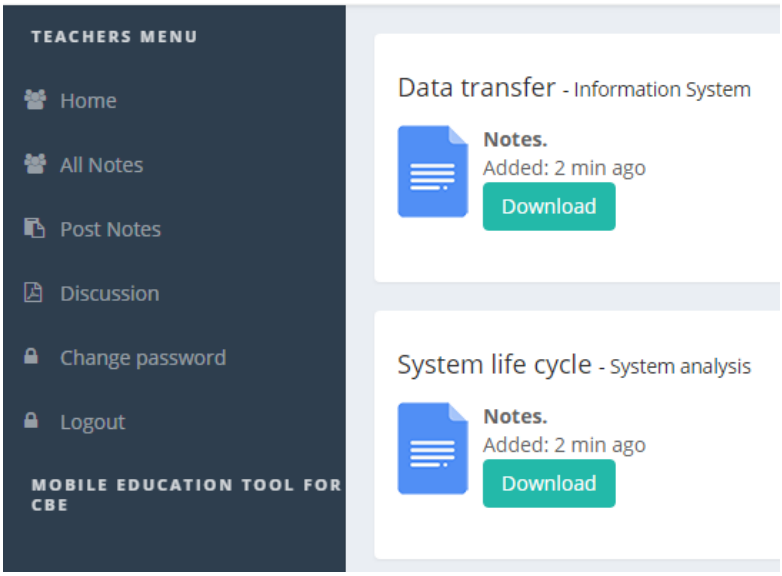

Figure 5. The main menu of the CBEMET prototype

Technical Description of the CBEMET Prototype
The application was developed using the framework Laravel v.5.4, Bootstrap 4. The front-end interface was developed using the HTML, CSS. The Server-side script being PHP (Object-oriented Programming). On the part of the Client-side Script, JavaScript, Ajax, and JQuery were used. This was done purposely due to their efficiency in developing applications. User's data is stored in an SQL database using MySQL for Android App and Java, JSON API for data retrieval. The MET prototype has 3000 lines of code.

A brief explanation of the CBEMET Prototype characteristics
The development of CBEMET prototype comes at a time when HEIs in Tanzania needs changes in the teaching and learning to match the technological changes that are taking place in world. Briefly, the characteristics of the CBEMET prototype is that it can run in mobile devices (smartphones, tablets, PDAs), laptops, and desktops as long as there is an internet connection. It is an application that is mobile in nature, it can be applied anywhere, anytime. Also, the CBEMET prototype involves only those who have CBE's email that is, members of staff in the emailing system of CBE.

The initial observations on the impact of the features of the CBEMET prototype have shown that teachers have abundant academic resources at their disposal which were not known and can now share them very easily through CBEMET prototype. Secondly, MET prototype has opened chances to teachers to collaborate in different projects. For example, one lecturer from the Business Administration department has shared his new project named "*Entrepreneurship sensitization for entrepreneurs doing business around the College of Business Education*" and has called for teachers to join and collaborate with him in writing project proposals. This suggest that the interaction among the teachers has tremendously increased through CBEMET.

Brief explanations of the functionalities of the CBEMET

The MET prototype starts with:

i. registering by entering details such as title (Mr., Mrs., Prof, Miss. Ms., and Dr.), first name, surname, telephone number, and an email address
ii. Login to CBEMET using an email address as a username and a password that is automatically brought to an email address the user registered. This automatic password enables the user of the CBEMET prototype to access the application and can be changed after accessing.

iii. After logging in the system, the user will automatically be directed to a window with menus such as *Home page, All notes, Post Notes, Discussions, Change Password and Logout.*
iv. On this page, users have an option to select the function they want.

A brief explanation of the menu items
Home- provides information about the MET prototype and a starting point to different menu items **All Notes** - is designed for viewing and downloading notes shared by lecturers for enhancing the shared experience in innovative teaching and learning. It thus enables lecturers to teach and learn at the same time
Post-Notes - this is designed for posting notes, innovations, PowerPoint presentations, multimedia resources, etc. It is designed to meet the requirements of the lectures as stipulated in (Mwandosya & Suero Montero, 2017).

Discussion - at the discussion menu, it is expected that lecturers will be able to post issues and interact online on issues that need quick responses ubiquitously. That is why the MET prototype is known as a mobile education tool!

Change Password – this is a feature for changing a temporary password supplied during the registration through the registered email of the user. The feature is meant to ensure the security of the users and content in the system.

Logout - after using the CBEMET the features allow user to leave the system safely.

DISCUSSIONS
The first objective of this paper was to identify mobile education tool's design features and functionalities for innovative teaching and learning at CBE. This objective was clearly realized because the 25 lecturers were able to give feedback and suggest a number of design features during the workshops held at different times.

The second objective was to co-design and co-develop a mobile education tool prototype incorporating CBE lecturers' requirements. Interesting design skills were observed during this stage, lecturers were able to pinpoint some design suggestions as if they were real application developers. They felt they own the prototype and were satisfied by the involvement. The third objective was to demonstrate the use of the mobile education tool to the CBE teachers after its development for feedback and suggestion for improvement before it was taken to the whole community of 161 lecturers. This objective was clearly met through focus group discussions, observations, workshops and interviews whereby a number of constructive feedbacks was collected to improve the working of the CBEMET prototype.

Earlier activities of the study focused on outlining the artifact and defining its requirements. The requirements were divided into two parts. The first part was about the contents to be included in the CBEMET prototype. The second part was about the functionalities and features of the CBEMET prototype itself. The activities in this stage were successful in the sense that they brought curiosity among lecturers that is, the manner in which they were enthusiastic to discuss how the system can enable them to share their innovative teaching and learning issues, anytime and anywhere. The ability to post notes and hold discussions with fellow lecturers and students online fostered teamwork and trust among themselves, analogous to this is a study by Cheong et al., (2012) who designed a Mobile-app-based Collaborative Learning System known as *myVote,* which was designed to support social interaction in order to promote higher-order thinking skills an objective that was highly attained whilst CBEMET prototype was primarily meant to promote innovative teaching and learning. The design stage of the CBEMET prototype generated a number of interesting design ideas from the participating lecturers, the researchers, and a developer which were used to improve the system, see for example, (Ford & Leinonen, 2006). The design stage proved that co-designing the CBEMET prototype with the lecturers, developers and researchers result in a technology that suits users' contextual background and needs for example Mramba et al., (2016). Contrary to a study by Oyelere et al., (2016) who in their study designed a mobile learning application for computing education (MobileEdu) which was tested through an experiment with 142 third year undergraduate students mainly for checking if MobileEdu improved their learning experience and not the design of MobileEdu. The main aim of their experiment was therefore to assess if the students who learned through MobileEdu attained improved learning engagement, results, and had better pedagogical experiences than those who learned by following the traditional face-to-face method. The students as users were not involved in the design of MobileEdu, meanwhile in the design of CBEMET prototype teachers as users were involved directly. In using MobileEdu though, the students showed improved learning capabilities. A study by Ford & Leinonen, (2016) who developed a mobile tools and services platform for formal and informal learning (MobilED) showed similar process of a way of testing the functionalities of the tool as the way it was done with CBEMET prototype whereby the ideas of the learners from the first and second pilots were used to improve the MobilED an exercise that was successfully done and attained the objectives set.

Generally, it was established that CBEMET prototype has changed the perception of lecturers on the use of mobile devices for teaching and learning. Lecturers are seen shifting from frequent social media access to using the CBEMET prototype for teaching, learning and coordinating activities. For example, one notable change is that CBEMET prototype has made it possible to implement a project entitled "Introduction of Mobile Learning in Higher Education Institutions in Tanzania". This project is expected to unite members of management teams, teachers, and students from selected higher education institutions in teaching using mobile learning tools. The sharing of projects' activities will be done through the discussion forum of the CBEMET prototype. Furthermore, CBEMET prototype has realized the innovative teaching and learning through the use of educational audio and video tools, access of different shared educational resources, preparation of multimedia learning contents, and presentation skills.

CONCLUSION

The objectives of the study were (1) to identify the mobile education tool's design features and functionalities for innovative teaching and learning at CBE, (2) to co-design design and co-develop a mobile education tool prototype incorporating CBE teachers' requirements, and (3) to demonstrate and use the CBE mobile education tool to the CBE teachers after its development In fulfillment of these objectives, we have demonstrated how mobile application can be co-designed and co-developed by developers and users in the contextual environment. Different features and functionalities of the CBEMET prototype were observed, discussed, and agreed upon for future improvement of the application. Through the workshops, lecturers were able to participate fully to design different items of the CBEMET prototype. With all the challenges that have been recorded as a result of co-designing of the prototype, the study's objectives have been met. That is, a mobile education tool which emphasize interactivity, adaptivity, and instilling a sense of ownership of the application has been developed. The demonstration results were very encouraging and showed the appreciation of the contribution of mobile software features to education. The challenges encountered will be used to improve the CBEMET prototype until it is fully developed into a real integrated system for the entire community of CBE.

The biggest contribution of this paper is therefore using a DSR participatory approach combining lecturers, researchers, and software developers to design and develop a suitable mobile education tool to enhance teaching and learning in a contextualized environment (Muller, 2002). This study has shown how using DSR user participatory approach in designing a mobile education tool application can be done collaboratively and how the end product of such collaborations suits the requirements of users and inform subsequent designs, development of similar products. It underscores that collaborations and sharing of innovative experiences of individual teachers is vital for quality education in higher education institutions. Further, it proves that collaborations can be easily achieved through mobile technologies and the development of mobile education application tools. Moreover, the study stimulates the need to changes from the traditional way of teaching and learning mostly face-to-face to innovative teaching in higher learning institutions to serve the needs of the society in the best way and sustainably.

As a result, the CBEMET prototype has enabled CBE lecturers to share educational resources online, to uploading and downloading educational resources, and to access departmental related documents. It provides uniformity of learning materials across all campuses, and in so doing, increases the quality of education. The CBE lecturers have been positively impacted by the CBEMET prototype and more suggestion has been received as using the MET prototype gaining momentum.

LIMITATIONS OF THE STUDY AND FUTURE WORK

The requirements and the development of the MET prototype only considered CBE environment, which means that some features may not apply in different set of environments. Furthermore, the lack of bandwidth appeared a limitation to the use of the application; by users who cannot afford buying large internet bundles from the internet operators. In addition, the system did not focus on the needs of students who are also the stakeholders of higher education in Tanzania. Therefore, future development of CBEMET should look into integrating students' needs of access notes, recording lectures and other related educational materials to ensure innovative teaching and learning campaign.

The CBEMET prototype also lacks interactive forums that would make it more productive in terms of teaching and learning – compared to similar systems in developed countries such as Finland, Norway, Sweden, United Kingdom, and Turkey just to mention a few. These countries have shown tremendous development in using innovative teaching and learning in HEIs. Other related activities of importance to be considered in future include assessing students' work electronically as suggested by (Alsadoon, 2017) and the importance of online instructional environment where instructors and students share for the innovative teaching and learning (Sarsar & Harmon, 2017).

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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Creativity and Emerging Digital Educational Technologies: A Systematic Review

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ABSTRACT
In order to effectively use emerging digital educational technologies educators should reflect on how these technologies influence student learning, including student creativity. Existing research shows that creativity can be supported by emerging technologies, but recent research in this area has not yet been reviewed. The purpose of our systematic review was to identify and synthesize articles in the field of creativity and education concerning the use of emerging digital educational technologies and systems. To this end, we reduce an initial sample of 267 papers to 37 relevant articles. We assess those articles quantitatively and qualitatively to arrive at a clearer understanding of the state of the research. Our analysis reveals a new division between articles focusing on technologies themselves and articles focusing on curriculum developments in technology-related courses. We conclude that research related to educational technology and creativity has been handled with important issues in the field overall, but certain discrimination deserves to be addressed. Notably, we recommend additional research on the impact of technology on creativity in adult education and lifelong learning. Our synthesis will be of interest to both researchers and practitioners in the field of creativity and education, concerning the use of educational technologies and systems.

Keywords: creativity in education, digital educational technologies, systematic review, digital technologies, emerging educational technologies

INTRODUCTION
Educators must keep track of new educational strategies, methods, and applications, as well as new digital technologies for learning and teaching. To plan, design, and develop effective use of digital educational technologies educators must first reflect on the use and integration of these technologies. One important area for reflection is the effect of such technologies on students' creativity which is considered as being one of the most important characteristics of 21st century learners. The relationship between creativity and technology is well known to educators and noteworthy because both technology and creativity in education are complex areas (Mishra & Henriksen, 2018). In the past few years, there has been an increase in studies on creativity supported by digital technologies (Mishra & The Deep-Play Research Group, 2012). It is important for educators to explore the relationship between technology and creativity in order to discover how creativity can be brought into teaching and learning (Mishra, Henriksen & Mehta, 2015, Yalcinalp & Avci Yucel, 2015).

Creativity in education can be regarded as the ability to apply multiple and new strategies (Mayer, 1989) and the process of formulating, revising, or retesting hypotheses to solve a problem (Torrance, 1988) for both individuals and communities. Creativity can be more broadly defined as "the ability to think in different directions, by modifying an original idea with something new and unique that is useful and appropriate to a given situation" (Amabile, 1983). According to Mayer (1989) creativity is the ability to solve problems that one has not previously learned how to solve. Osche (1990, p.2) indicates that creativity involves "bringing something into being that is original (new, unusual, novel, unexpected) and also valuable (useful, good, adaptive, appropriate)". Creativity is a critical skill that helps look at existing problems from a new perspective, see new opportunities and create new ideas. According to Mishra and Henriksen (2018) the three components (Novel, Effective, Whole) provide a framework for defining creativity: i. Novel, an idea or product that was not available before, ii. Effective, useful, logical, understandable idea or product, iii. Whole, aesthetic, elegant and well-crafted idea or product.

Rutland and Barlex's (2008, p.143) definition of creativity identifies four domains and is important because it clarifies a complex concept. The four domains are technical creativity, the concept, aesthetic creativity, and constructional creativity. Technical creativity was defined as asking the question, "Has the designer made proposals about the way the product will work and the nature of the components and materials required to

achieve this? Is there something about these proposals that is novel or elegant?". In our study, we mainly searched for technical creativity within the scope of the definition above.

Researchers investigated the place of creativity in the national curricula of 27 European Union states and the United Kingdom (Wyse & Ferrari, 2015). Results indicated a need for much greater coherence between general aims for education and the representation of creativity in curriculum texts. Some studies have focused on the effect of various educational technology tools and systems on creativity at different grade levels (e.g., Auttawutikula, Wiwitkunkasemb & Smith, 2014; Lin, Yeh, Hung & Chang, 2013; Lloyd, 2013). However, to our knowledge, these important findings have not yet been synthesized. Therefore there is a need for a review of recent literature on creativity and technology in education, which will enable educators to better reflect on and implement technology in classrooms. According to Hokanson (2017) the most important factor in understanding the relationship between creativity and technology in education is the development of student creativity and how that creativity can be supported and developed by educational technologies. Although educational systems generally focus on the distribution and retention of knowledge, teaching and developing creativity is important for advancing innovation and technology in the field of education.

A systematic review of research can contribute much to the field under study. As Khan, Kunz, Kleijnen and Antes (2003, p.118) state, "A review earns the adjective 'systematic' if it is based on a clearly formulated question, identifies relevant studies, appraises their quality and summarizes the evidence by use of explicit methodology." Also known as research synthesis, "systematic reviews are summaries of past research on a topic of interest. However, unlike the traditional approach to reviewing literature, they utilize the same principles and rigor that is expected of primary research" (Joanna Briggs Institute, 2001, p.2). A clear indication of the methods is crucial in a systematic review, as indicated by the statement that "on completion of the review, the methods used are documented in the review report, as is done with all primary research, to allow users the opportunity to appraise the quality of the systematic review" (Joanna Briggs Institute, 2001, p.2).

Halcomb and Fernandez (2015) define the steps in the systematic review process as: i) planning the review (establishing a review team, formulation of research question, development of a review protocol, development of inclusion/exclusion criteria, ii) data collection (development of a search strategy, selecting included studies, reporting search results), iii) analysis and interpretation (assessing study quality, extracting data, analyzing results) and iv) dissemination of the review. Similarly, Khan et al. (2003) summarize the five steps of systematic review as i) framing the question, ii) identifying relevant work, iii) assessing the quality of studies, iv) summarizing evidence, and v) interpreting results.

The motivation behind this study was to grasp the overall picture in studies in which creativity was handled in environments where digital educational technologies were used. It must be kept in mind that technology itself is nothing in education, but all learning/teaching issues specific to a discipline and pedagogic aspects must be considered carefully in using such technologies in education. Creativity is one of the most important issues among such considerations, since creative thought and innovative problem solving skills are among the most necessary human characteristics in our globally developing century. The purpose of this study is to identify and synthesize articles in the field of creativity and education concerning the use of digital educational technologies and systems between 2013 and 2015 in Web of Science. To define the categories of digital educational technology, the New Media Consortium's Horizon Report (New Media Consortium, 2014) was used to develop a taxonomy illustrating the primary origin and use of technologies. We focused on the following categories: digital strategies, Internet technologies, learning technologies, social media technologies, and visual technologies. There are currently seven categories of technologies in the NMC monitors. "These are not a closed set, but rather are intended to provide a way to illustrate and organize emerging technologies into pathways of development that are or may be relevant to learning and creative inquiry" (NMC Horizon Report, 2014, p.34). Figure 1 shows the seven categories and key emerging technologies in each category.

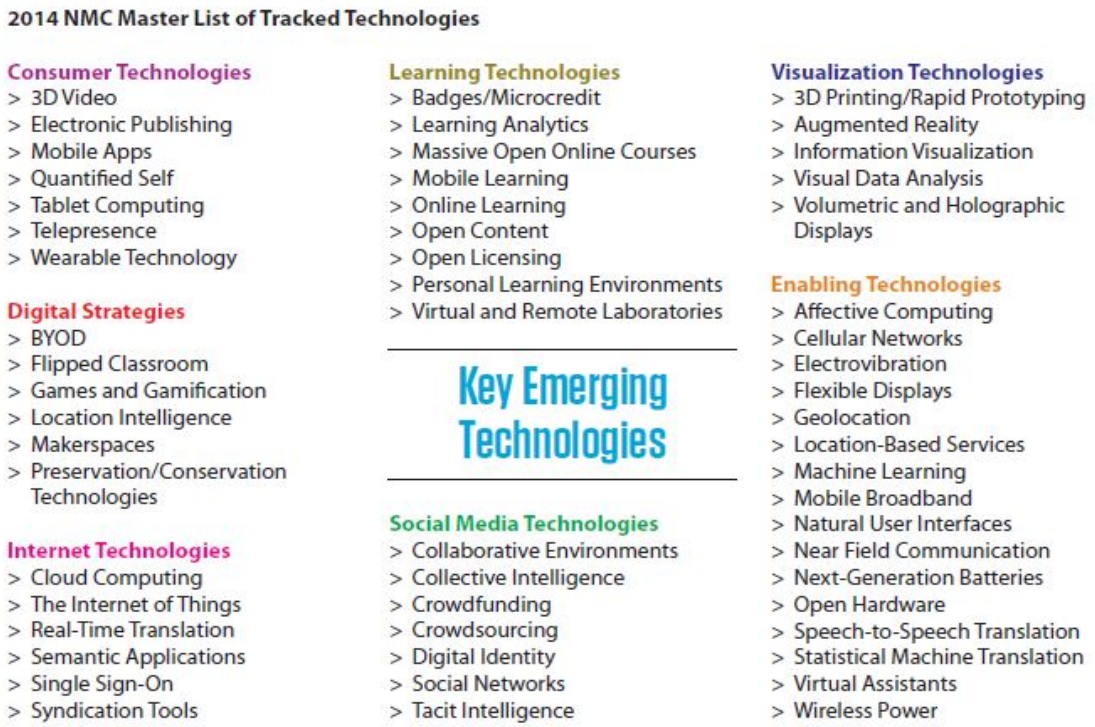

Fig. 1: List of Emerging Digital Technologies in Seven Categories, (NMC Horizon Report, 2014)

METHODOLOGY

We conducted a systematic literature review to synthesize literature related to creativity and education, concerning the use of educational technologies and systems. "How systematic reviews are conducted may vary and the methods used will ultimately depend on the question being asked" (Aromataris & Pearson, 2014, p.55). In this study, the review methodology was based on the five steps of systematic review proposed by Khan et al. (2003). Additionally, the systematic review for this study was conducted within one and a half years of performance.

Framing the Question

Systematic reviews ideally aim to answer specific questions, rather than simply to summarize all literature on a specified topic. It is also important to keep in mind that the main aim of a systematic review is to synthesize existing knowledge rather than to create new knowledge. In this study the main purpose was to identify and synthesize articles in the field of creativity and education concerning the use of digital educational technologies and systems. The main research question that guided this systematic review was: "What are the certain aspects (see section "Assessing the Quality of Work") of studies in the field of digital emerging educational technologies that have focused on a student's creativity?". It also aimed to investigate signs of the impact of digital educational technologies on creativity in light of the selected papers.

Identifying the Relevant Work

As the second step of a systematic review an exhaustive search must be done for related studies, and it must be well documented. "The write up of the search should include information about the databases and interfaces searched (including the dates covered), full detailed search strategies (including any justifications for date or language restrictions) and the number of records retrieved" (Centre for Reviews and Dissemination, 2015, p.22). In the scope of our study, the detailed information regarding these was provided. A large amount of time and performance were devoted to "Assessing the Quality of Work" that started with stage 3. To draw a clear picture of the overall review process that was carried out through five consequent stages, the procedure was summarized in Figure 2.

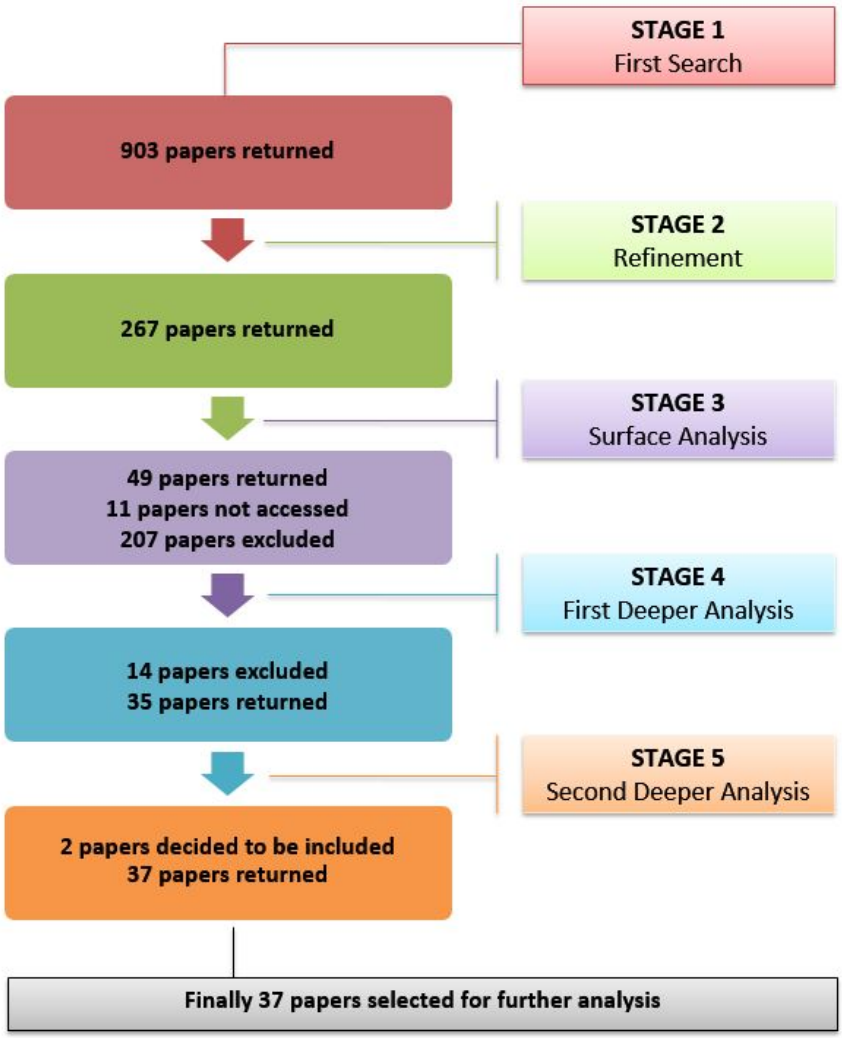

Fig. 2: Summary of all Review Stages and Procedures

In this study, identifying the relevant work started with the first stage; Web of Science was used as the main index, since our intention was to include only SSCI and SCI-expanded articles. The years 2013 to 2015 were covered. We entered the term "creativity and education" in the "topic" search field and selected "English" as the language option. As a result of this search, 903 records were returned. This first broad search was conducted to ensure that no relevant articles were missed. Next, we conducted several keyword searches, independent of the category selection, to verify that all relevant articles were included in the original search. These searches are summarized in Table 1.

Table 1. Keywords used in the review process

Category	Keywords
Creativity and education	• Creativity and educational technology • Creativity and distance education • Creativity and learning technologies • Creativity and e-learning • Creativity and Web 2.0

By comparing the results of the category search with the results of the keyword searches, we observed that the first category search contained all articles from each of the keyword searches, none having been missed out. Therefore, we continued the review using the 903 records obtained by the first search. Next, in the second stage, we refined our search by filtering results using the "social sciences", "education-educational research", and "only articles" options. As indicated in Figure 2, a total of 267 papers were found at the end of this first refinement.

Assessing the Quality of Work

The rest of the work required deeper investigations through analyses on papers. Both authors were involved in all stages of the analysis of papers, and a third colleague helped with the selection criteria. In stage 3, using the results of the first refinement (267 papers), we carefully conducted a surface analysis by reading the abstract, purpose, result, and conclusion of each article. Our main aim was to identify papers in which the existence of educational digital technology was overt and such technology's effects/relations on/with creativity were under investigation. Either such digital technology could be an environment in itself or the digital tools/materials used to enhance teaching and learning. The papers were given classifications in each of four main categories, as follows:

- General: information regarding the title, authors, publication year, journal name, country, number of times cited, keywords, and discipline.
- Methodology: information regarding the methodology, such as research method, number and level (K12, university, adults) of participants, problem and purpose of the study, variables, sampling method, type/category of educational technology used, data collection strategies and tools, analysis methods.
- Context: information regarding the discipline and topic studied and type of educational technology used.
- Results: information regarding the key results.

After this surface analysis eleven papers were excluded, since the full articles were not accessible. Based on the categories above, 49 papers were selected for further analysis (Figure 2 and Table 2).

Table 2. Papers selected to be reviewed as results of first search, refinement and surface analysis

Digital Library	No. of papers	First classification		
		Included	Not Accessed	Excluded
Web of Science	267	49	11	207
Total Percentage (%)	100	18	4	78

In stage 4, 49 papers selected in the third stage underwent a deeper analysis (Table 3). First, the two researchers reviewed the keywords of each paper. The papers were then subjected to another careful analysis, consisting of the abstract, method, and result sections, to verify that each paper was relevant to the scope of our study.

During this deeper analysis (in stage 4), papers having no clear relationship with any of the categories of educational technology mentioned in the NMC Horizon Report (2014) were excluded. Studies that clearly involved such educational technology but were not relevant to the direct effect of the technologies on creativity were also excluded. In total 14 papers were excluded; in 11 because the effect/consequences of digital educational technology or technology curriculum on creativity were not mentioned, and the main theme was not understood in three. The researchers were unable to make a decision about two papers, so a second deeper analysis was required for papers P2 and P43 in stage5. The role of technology in these papers was somewhat confusing. After that review, it was decided to include both Esjeholm's paper (P2) and Kim, Suh and Song's paper (P43). P2 involved technical creativity in the form of basic programming among students completing various projects via various digital tools. P43 was relevant because it reflected the participant-perceived effect of creativity on qualitative results. In total, 37 papers were selected for further analysis. The number of papers returned at stages 4 and 5 of the analysis process is indicated in Table 3. A summary of each selected paper, with its title, authors, source/journal name, and year of publication can be found in reference list which is indicated with"*".

Table 3. Final set of papers at the end of deeper analysis (Stages 4 and 5).

Digital Library	After Refinement	Total Selected	Excluded	Decided After Third Review	Final Exluded	Relevant (Final set of papers)
Web of Science	267	49	14	2	12	37
Total Per. (%)		100	29	4	24	76

At the end of stage 5, we conducted further analysis on each of the 37 identified papers to find an answer to our research question. This further analysis consisted of qualitative and quantitative assessment. Quantitative analysis consisted of descriptive statistics (frequencies and numbers), and qualitative analysis was performed to detail the characteristics of each study. The results of these analyses are presented in the next section.

Summary of the Evidence

Quantitative Analysis

The quantitative analysis that was conducted on selected papers is important since it gives us a general

understanding regarding the general nature and appropriateness of those articles to our aim and enables us to make conclusions on the impact of technology on creativity in those papers. This analysis included determination of the name and distribution of the journals within Web of Science, the distribution of research methodologies used, research type, data collection methods, and type/level of participants. It is important to note that only the articles, which had a clear indication of these above categories were indicated in the tables. Table 4 presents the name and frequencies of each journal in 37 selected papers.

Table 4. Name and Distribution of 37 Returned Journals within Web of Science

Journal name	**F**
International Journal of Technology and Design Education	8
Computers & Education	3
Thinking Skills and Creativity	2
International Journal of Engineering Education	2
Educational Technology Research and Development	2
Innovations in Education and Teaching International	1
Journal of Education for Teaching	1
Eurasia Journal Of Mathematics Science And Technology Education	1
International Association for Research on Textbooks and Educational Media	1
Interactive Learning Environments	1
Music Education Research	1
Educational Technology International	1
Medical Education Online	1
Education and Science	1
Journal of Hospitality, Leisure, Sport & Tourism Education	1
British Journal of Educational Technology	1
Educational Technology & Society	1
Learning, Media and Technology	1
Journal of Computer Assisted Learning	1
The Asia-Pacific Education Researcher	1
BMC Medical Education	1
International Journal of Science Education	1
Cambridge Journal of Education	1
Journal of Geography in Higher Education	1
Australasian Journal of Educational Technology	1

In Table 4, the journal that includes the highest number of the publications within our returned 37 papers was "International Journal of Technology and Design Education". Other articles were distributed almost equally as presented in Table 4.

Knowing the main characteristics of the main research method applied in the selected papers is crucial to understanding how they explain the impact of educational technologies on creativity. Table 5 contains a summary of the papers based on the research method they followed. (In this and all related tables each paper that involved in more than on category were highlighted.

Table 5. Research method

Research method	**Number of papers**	**Paper ID**
Case Study	8	**P2**, P15, **P18**, P19, P20, P30, **P36**, P39
Survey	4	P6, P12 ,P37, P42
Experimental	23	**P2**, P3, P4, P5, P7, P8, P9, P10, P13, P14, P16, P17, P23, P25 ,P28, P29, P33, P34, P35, **P36**, P38, P41, P43
Action Research	1	**P18**

Correlational research	1	P24

Twenty-three of the papers used an experimental method, making this method the most common. In one of the papers, correlational research was conducted, eight of them used case studies, and three were based on surveys. Papers that used more than one method were reflected in related rows. For example, P2 and P36 were experimental case studies, and they are indicated in both rows in Table 5. Most studies followed experimental methods and case study was the second most preferred method. P22, and P40 were opinion/comment and P26 was literature review type articles, so no research method were mentioned in them.

Table 6 indicates the distribution of papers based on their data analysis method. Thirteen of the papers used only quantitative data analysis, nine of them used only qualitative methods, and 12 used both quantitative and qualitative methods. Here again P22, P26 and P40 was not included since they were literature review articles and did not include any analysis.

Table 6. Data analysis method

Data analysis method	**Number of papers**	**Paper ID**
Quantitative	13	P5, P6, P8, P12, P13, P16, P17, P20, P23, P24, P28, P29, P33
Qualitative	9	P2, P10, P14, P15, P18, P19, P37, P39, P43
Quantitative/Qualitative	12	P3, P4, P7, P9, P25, P30, P34, P35 P36, P38, P41, P42

A summary of the papers based on their data collection method is shown in Table 7, with 21 of the papers using questionnaires/scales, two using video tapes as documentation, two using a learner analysis system for log analysis, eight using observation, and five using rubrics to evaluate overall performance/product.

Table 7. Data collection method

Data collection method	**Number of papers**	**Paper ID**
Questionnaire/scale	22	**P3**, P6, P7, P8, **P4**, P12, P13, P16, , P20, P23, P24, **P25**, P28, P29, **P30**, **P33**, **P34, P35**, **P36**, **P37**, **P41**, P42
Video tapes documentation	2	**P2**, P14
Learner analysis system (log analysis)	2	P5, P38
Observation	8	P2, **P4**, P9, P14, P36, **P38**, **P43**
Focus group discussions	3	P10, **P37**, P39
Interviews	4	P10, P15, P19, **P41**
Conversation	1	P14
Achievement test	4	P16, **P25**, **P33**, **P34**
International objective structured clinical examination	1	P17
Structured open ended questions	4	**P3**, P18, **P34**, **P41**
Messages / content analysis	3	P25, **P30**, **P38**
Rubric	5	**P2**, P25, **P35**, **P36**, **P43**
Peer Assessment	1	**P43**

As indicated in Table 7, questionnaire/scale was the most preferred data collection method among all the papers. Interestingly, a wide variety of data collection methods were used. Table 8 presents the level and number of individuals in papers involving participants. Eighteen papers reported that the participants were university students, and 12 papers were focused on K12 students (Figure 3). P12 and P42 as survey studies, had the largest number of participants (n = 1181 and n = 4496).

Table 8. Level of participants

Paper ID	Participants' Level	Number	Type
P3	University	41	Student
P6	University	350	Student
P7	University	107	Student
P2	K12	104	Student
P4	Adults	100	Teacher
P5	K12	92	Student
P8	K12	132	Student
P9	K12	200	Student
P10	University	72	Student
P12	K12	1181	Student
P13	K12	33	Student
P14	University	8	Student
P15	University	9	Student
P16	University	100	Student
P17	University	203	Student
P18	University	16	Student
P19	Adults (mean age 38)	3	Musicians
P20	University	137	Student
P23	University	55	Student
P24	University	597	Student
P25	K12	131	Student
P28	University	104	Student
P29	K12	349	Student
P30	University	93	Student
P33	University	229	Student
P34	K12	167	Student
P35	K12	28	Student
P36	University	Not indicated	Student
P38	K12	229	Student
P39	University	20	Student
P41	University	137	Student
P43	K12	30	Student

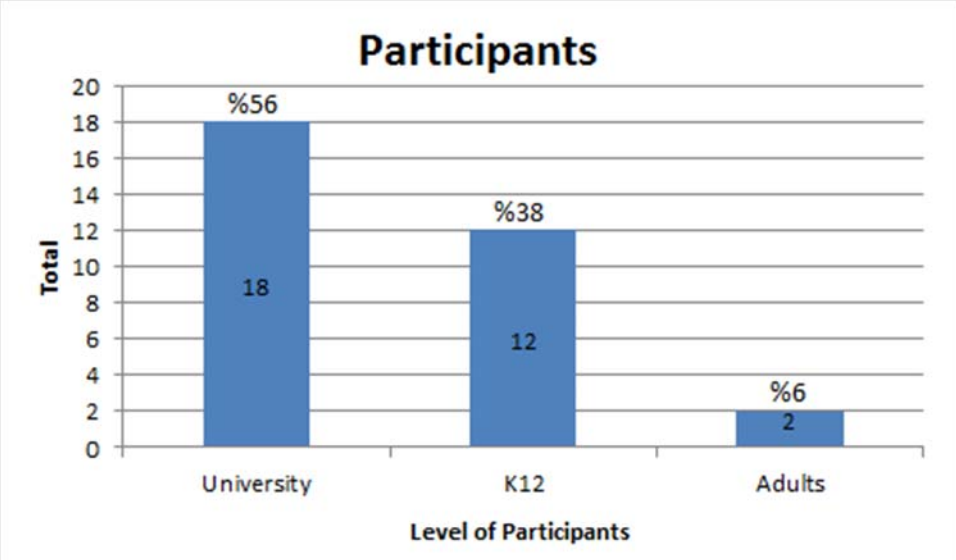

Fig. 3: Level of Participants

Qualitative Analysis

For this process, two researchers were involved in coding independently. Coding agreement was found to be 88% following this procedure. Disagreements between the two coders were resolved through discussions.

Qualitative analysis was based on the content analysis of selected papers and expected to contribute to our research questions. The main intention of such analysis was to discriminate between papers based on predetermined NMC categories and also to build categories and/or subcategories that; i. identify the emerging educational technology used in those papers overtly and ii. investigate the impacts of them on creativity. So, the results of this analysis contributing first part (i) were explained below with references to Table 9.

Besides divisions based on educational technology, "the impact/result of using that technology" was mentioned in Table 10 and Table 11. Those tables mainly serve to reflect the nature of the research papers regarding variables and results/impacts. It must be kept in mind that only papers having a clear indication of their research methodologies were included in all parts.

Emerging Educational Technology Used

In order to discriminate between the main educational technology used in each paper, we used NMC Horizon Report's (2014) categorization of emerging technologies (Figure 1). To do so, we carefully read each paper again to identify the appropriate category for each educational technology. The main difficulty here was identifying the "emerging technology" itself. As an example, computer-aided design (CAD) software was used as a graphic design tool in paper P9, but CAD might not be considered as an emerging tool, because it has been used for many years. We overcame this confusion by referencing Miller, Green and Putland (2005), who stated that a technology is still emerging if it is not a "must have" for the users. Thus, educational technologies that were not must-haves for the studies' participants were regarded as emerging technologies. Results were summarized in Table 9.

Content analysis indicated that papers P2, P4, P12, P22, P26, P35, P37, P40 and P42 studied the effect of technology-driven programs/projects instead of educational digital technology itself. Thus, we divided the papers into two categories: i) Digital Technology/System and ii) Curriculum/Program (Table 9, first column). Our categorization in that direction provided a new and very distinctive framework. In Table 9, the main NMC categorization was given as a subcategorization under these two. Papers addressing this were also indicated in the last column with their ID numbers. It is worth noting that paper P2 was included in both categories.

Under our Curriculum/Program division in Table 9, the main intention of the papers was to study/discuss the contribution of a technology-related curriculum/program in terms of creativity. In that division, the educational technology used was overt in papers P2, P22 and P26. As part of the problem/project approach followed in paper P2, multiple educational technologies, such as Lego robotics and Google SketchUp, were used. The main educational technology discussed in paper P22 was Twitter; the authors considered the effects that using such media technology in curricula had on student creativity. By contrast, the focus of P26 was enabling technologies/machine learning. Here, the chain effect of creativity on neuroscientific development, as well as neuroscience-specific curriculum developments on enhancement of educational tools that support creativity, were discussed. In all other papers under the Curriculum/Program division, the main focus was studying/discussing the contribution of a technology-specific curriculum/program itself to creativity. The Curriculum/Program projects were a professional learning program (in P4), a human being and technology program (in P12), a curriculum containing computer technology-integrated projects (in P35), a project called the Designing Our Tomorrow (Dot) Project (in P37), a technology curriculum (in P40), and a design & technology (D&T) education curriculum (in P42).

Table 9. Results of qualitative analysis of educational technology used

Main	NMC Categorization of Technology	Technology Used/Content	Paper ID
EMERGING DIGITAL TECHNOLOGY/SYSTEM	Enabling Technologies /Machine Learning-Robotics	Lego-Robotics	**P2**
	Total		1
	Social Media Technologies/Social Networks	Weblogs	P3
	Social Media Technologies/Social Networks	Podcast	P15
	Social Media Technologies/Collaborative Environments	Knowledge Forum-A Knowledge Building Environment	P30
	Total		3
	Learning Technologies/Learner Analysis	Data Mining-Learner Analytics	P5
	Learning Technologies/Online Learning	Web 2.0 Learning Environment	P6
	Learning Technologies/Personal Learning Environments	Web-Based Creative Problem Solving (CPS v3.)	P7
	Learning Technologies/Open Content	Open Ended Materials	P18
	Learning Technologies/Personal Learning Environments (Courseware and storyboarding)	CFD (Computational Fluid Dynamics), CAM (Computer Aided Manufacturing), FEM (Finite Element Method), CAD (Computer Aided Design) software	P36
	Learning Technologies	Concept Map Knowledge Management System	P38
	Learning Technologies	Film	P39
	Learning Technologies	Mindtools, Mind Mapping Tool	P41
	Total		8
	Visualization Technologies/Information Visualization	Science Fiction Film	P8
	Visualization Technologies/Information Visualization	Simulated Virtual Reality, Simulations, Virtual Reality Teams	P14, P17, P19, P20
	Visualization Technologies/Information Visualization	Virtual Microscope (VM) System	P33
	Visualization Technologies/Visual Data Analysis	Google SketchUp	**P2**
	Visualization Technologies/Visual Data Analysis	Computer Aided Design (CAD) Tools	P9, P24
	Visualization Technologies/Visual Data Analysis	Three-Dimensional Computer-Assisted Drawing (3D-CAD)	P29
	Visualization Technologies/Augmented reality	3D Modeling Software	P13
	Total		11
	Internet Technologies	Learner-Created Digital Storytelling	P16
	Internet Technologies	Storyboard	P28
	Total		2
	Digital Strategies/Games and Gamification	Simulation games	P10
	Digital Strategies/Flipped Classroom	Web 2.0 Tools	P23
	Digital Strategies/Games and Gamification	Minecraft Edu: Video Games	P25
	Digital Strategies/Games and Gamification	Educational Computer Games	P34
	Total		4
	Consumer Technologies/Mobile Apps	Mobile Phones	P43
	Total		1

Main	Intend for Creativity/NMC Category of Tech.	Curriculum/Program/Content	Paper ID
CURRICULUM / PROGRAM	Enabling technologies/Machine learning-robotics Visualization technologies/Visual data analysis	Problem/Project Based Approaches	**P2**
	Effects of program including development of innovative science learning and assessment activities	Professional Learning Program	P4
	Program evaluation-Including creativity dimension	Human Being and Technology	P12
	Social media technologies/Twitter	Twitter-Curriculum-Activity Suggestions for Sport Management	P22
	Enabling technologies/Machine learning	Technology-Enhanced Learning-Neuroscientific Concepts	P26
	Comparison effect of analog/computer tools on creativity	Computer Technology-Integrated Projects	P35
	Student opinions on effect of program on their creativity	The Designing Our Tomorrow (Dot) Project (Inclusive Design Materials & Principles)	P37
	Discussions on technology curriculum. vs creativity	Effective Design Thinking For Technological Literacy-Technology Curriculum	P40
	Teacher and student views on contributions of curriculum to creativity	Design & Technology (D&T) Education Curriculum	P42
	Total		9

Under the main Digital Technology division in Table 9, papers P2, P3, P5, P6, P7, P8, P9, P10, P13, P14, P15, P16, P17, P18, P19, P20, P23, P24, P25, P28, P29, P30, P33, P34, P36, P38, P39, P41 and P43 all focused on the effect of the digital technology/system itself. Here, each paper was summarized using the NMC categories (Figure 1) for convenience and clarity of the results. In the Digital Technology/System category, we faced a little difficulty in identifying NMC Categorization of technology, since the appropriate subcategory was not always clear. Those cases were placed only under the main category of Digital Technology in Table 9. We observed that sometimes more than one category could apply to a single technology, depending on how the technology was used. Thus, there could be variations in our categorization resulting from an inability to determine from the papers how a technology was used. Not all possible subcategories are indicated in the table.

In addition to being placed in two divisions in Table 9, paper P2 was also placed under two different subcategories within the Digital Technology division. Two educational technologies in the categories of Enabling Technologies/Machine Learning-Robotics and Visualization Technologies/Visual Data Analysis were used in this paper. The aim of paper P2 was to study the effect of students' technology knowledge on creativity. In that paper, Bjorn-Tore Esjeholm (2015) studied the effect of the technology knowledge that students already had to use in their projects. In their projects, students used various educational technologies, hence the multiple categorization was realized.

Social media technologies were identified in papers P3, P15, and P30. In P3, Auttawutikula, Wiwitkunkasemb and Smith (2014) studied the effect of using weblogs as a social network on university students' attitudes toward weblogs, their achievement, and their creativity. They indicated a significant improvement in assessed creativity among students using weblogs. In this study, weblogs were perceived as enhancing both group learning and creativity, allowing students to more freely show individual creativity within an enhanced peer collectivism structure. In P15, Bolden and Nahachewsky (2015) qualitatively studied students' experiences of creating podcasts in an undergraduate music education course. Nine participants were interviewed about their experiences of podcast creation. Their results indicated the potential of podcast creation to enable learners to exercise creativity. Paper P30, by Hong (2014), was placed in the Social Media Technologies category with a Collaborative Environments subcategory. Hong, among 93 prospective teachers, investigated perceptions of a collaborative learning environment in which a knowledge form was used. The results of that study indicated that students saw the environment not only as supporting knowledge acquisition, but also as providing knowledge creation.

Educational technologies under the Learning Technologies category were studied in papers P5, P6, P7, P18, P36, P38, P39, and P41. In their study (P5), Lin, Yeh, Hung and Chang (2013) developed a personalized creativity learning system (PCLS) based on the data mining technique. Their system provided personalized learning paths for optimizing the performance of creativity in students. Among the 92 college student participants, the data mining technique was a good vehicle for providing adaptive learning, which is related to creativity. In a survey study (P6), emphasizing the effect of Web 2.0 online learning systems, Lloyd (2013) studied the elements of an online learning environment and reflected on students' perceptions regarding its effects, including on creativity. In paper P7, Chang (2013) investigated the effects of online (web-based) creative problem-solving (CPS) activities on student technological creativity and examined the characteristics of student creativity in the context of online CPS among 107 fourth-grade students. The results of the quantitative analysis revealed that the technological creativity of the students using online CPS was better than that of the traditional group. Mirzaoglu (2015) concluded that classroom teacher candidates defined the open-ended materials as developing creativity, but also as confusing (P18). In their study (P36), Rivera-Solorio, Alejandro, Cuellar and Flores (2014) declared that a project based engineering university course which supported with computational tools increased students' creativity. Liu and Lee (2013) in paper P38 aimed to observe changes in students' understanding of biological concepts over time. Their study revealed that use of Concept Map Management System had a positive influence in promoting students' creativity. In P39, (Anderson, 2013), the strategies that students used were investigated to capture creativity during a digital film production by students. Wu, Hwang, Kuo and Huang's (2013) study (P41) related to the effect of a Mindtool-based collaborative learning approach on students' innovative performance. The results of this experimental study indicated that use of such digital technology and approach significantly enhanced students' innovative performance in a project based learning task.

Educational technologies under the Visualization Technologies category were studied in papers P2, P8, P9, P13, P14, P17, P19, P20, P24, P29, and P33. Interestingly, in paper P8, Lin, Tsai, Chien and Chang (2013) focused on the effects of a learning activity based on a science fiction film on the technological creativity of middle-school students. A quasi-experimental design was employed, and 132 middle school students were included in this study. It was found that science fiction films could stimulate middle-school students' technological creativity. Similarly, Laisney and Brandt-Pomares (2014), in paper P9, sought to determine the influence of a CAD tool on technological creativity among students on a technology course. The results showed that using traditional drawing before CAD tools allowed the pupils to develop quantitatively more solutions. Wong Lau and Yuen Lee (2015) discussed the roles of simulation in creativity education and discussed on how to apply immersive virtual environments to enhance students' learning experiences in university (P14). The results of this study showed that virtual reality could possibly enhance students' learning experiences and encourage creativity. As the digital technology was simulations in P17, the results were mentioned mainly for the effect of using such technology on clinical skills. In that paper, although the creativity component was not very clear, Zhang, Cheng, Xu, Luo and Yang (2015) found that the use of digital simulative training could significantly enhance the graduate score of medical students. In paper P19, Biasutti (2015) aimed to define how creativity was expressed and supported during the collaborative online composition of a new music piece employed by adult musicians. Their findings indicated that collaborative creativity involved musical and social practices. Čok, Fain, Vukašinovic and Zavbi (2015) investigated the influence of the (multi-) cultural background of virtual team members on the team's creativity and design features, and they developed a conceptual framework to test such an influence (P20). The results showed significant differences within such factors based on cultural variations. In their correlational research design in paper P20, Dawoud, Al-Samarraie and Zaqout (2015) studied the relationship between flow experience and creative behavior in design using CAD. They concluded that flow experiences partially mediate the relationship between the interactivity of CAD and creative behavior in design. In their experimental study (P33), Tian, Xiao, Li, Liu, Qin, Wu, Xio and Li (2014) analyzed the effect of using virtual microscop-VR on medical students' active learning, problem solving skills and creativity. While no significant differences were observed between achievement of VR and traditional groups based on their mean scores from multiple choice and short essay questions, the questionnaire results indicated that the VM system improves students' productivity and promotes learning efficiency. In paper P29, the main theme was based around the three dimensional computer assisted drawing tool in which the results showed that 3D-CAD applications enhanced K12 students' creative performance (Chang, 2014).

Educational technologies under the Internet Technologies category were studied in papers P16 and P28. In an experimental study by Kim (2016), the results indicated that there was a significant difference between the groups using digital storytelling (DST) and those using expository instruction on behalf of the DST group (in P16). The main digital technology under study was storyboards in the experimental study of Teng, Cai and Yu (2014).

Educational technologies under the Digital Strategies/Games and Gamification category were studied in papers

P10, P25 and P34. Mažeikienė and Gerulaitienė (2015) in P10 suggested that simulation games encourage the development of students' ability to create multimodal texts. In P25, Sáez-López et.al (2015) stated that the majority of K12 students found video games to be enhancing their creativity. Hwang, Hung and Chen (2013) in their study (P34) indicated that most of their participants as K12 students perceived peer assessment-based game development helped them to improve creativity.

Educational technologies under the Consumer Technologies category were studied in paper P43. In their study, Kim, Suh and Song (2015) investigated the consequences of team game developments with the support of mobile phones. The results of this experimental study proposed that most of the participant K12 students (in an experimental group) perceived that peer assessment-based game development improved their creativity.

Variables and Impacts/results of studies

Here, signs of the impact of digital educational technologies on creativity in scope of those selected papers were re-studied and summarized. In addition to the results above, here we mainly intended to reflect the results of our content analysis based on research characteristics such as variables and impacts. In doing so, papers indicated in Table 6 underwent such analysis. Paper P6, which is indicated as a quantitative study in Table 6, was a survey study, but its variables and impact could not be clearly identified. Therefore, we omitted that paper in Table 10 (on the other hand, P22, P26 and P40 were theoretical studies and they were also eliminated in both tables). Regarding our qualitative analysis based on ***"quantitative"*** papers, we presented dependent (we took mainly creativity-related ones) and independent variables, and the impact of the digital educational technology/program on creativity for each study in Table 10. On the other hand, same procedure for ***"qualitative"*** papers was reflected in Table 11. P2 were placed under three different categories in Table 11 and highlighted.

Table 10. Results of qualitative analysis for variables and impact of digital educ. tech/program in quantitative studies

Paper	Dependent Variable/s	Independent Variable/s	Result-Impact ↑ means positive impacts ↓ means negative impacts
SOCIAL MEDIA			
P3	-Group learning Creativity	Use of weblogs	↑"Results showed a significant improvement in assessed creativity at the end of the trial period with weblogs being perceived as enhancing both group learning and creativity"
P30	-Knowledge building and creation (Construct creativity)	Use of knowledge forms	↑There was a significant difference between notes-built on before and after the treatment.
LEARNING TECHNOLOGIES			
P5	-Creativity	Use data mining technique to provide personalized learning	↑ "The experimental results show that, when the learning path suggested by a hybrid decision tree is employed, the learners have a 90% probability of obtaining an above-average creativity score"
P7	-Technological creativity	Use of online problem solving activities	↑ "The quantitative analysis revealed that the technological creativity of the online-problem solving students was better than that of the traditional group."
P36	-Design creativity	Use of computational tools (CFD, FEM, CAM and CAD)	↑"Student creativity was challenged appropriately through CFD,FEM,CAM and CAD tools"
P41	-Creativity-students' innovative performance	Use of Mindtool based collaborative approach	↑The experimental results that use of that approach significantly enhanced the students' innovative performance in a project-based learning task.
VISUALIZATION TECHNOLOGIES			
P8	-Technological creativity	Use of science fiction films in a lesson	↑Students creativity were higher at experimental group

P13	-Creativity -Learner motivation -Achievement as basic knowledge and skills	Use of augmented reality	↑Students creativity were higher at experimental group
P17	-Clinic skills including clinic innovations-creativity	Use of simulations in clinical training of medical students	↑ "The results revealed that simulative training could significantly enhance the graduate score of medical students compared with the control"
P20	-Team's creativity -Design Process	1.Cultural background of virtual team members. 2. Creativity	↑Background-Working in virtual teams has a positive effect on creativity in new product development.
P33	-Students' productivity	Use of visual microscope system.	↑Results from the questionnaire indicated that VM system improves student's productivity.
P9	-Student's performance -Creativity as finding new ways to solutions	Use of graphic tools	↑Control group's solutions were more creative
P24	-Creative behavior in design	Flow experience	↑Both the characteristics of a design task and the interactivity of CAD were positively predicted the experience of flow
P29	-Creativity	1.Use of 3D CAD applications 2.Spatial ability	↑Results indicated that "students' spatial abilities were moderately correlated with their creative performance, especially their functional creativity; (2) the 3D-CAD applications enhanced students' creative performance, particularly with regard to aesthetics; and (3) in 3D-CAD applications, students with better spatial abilities were superior to those with relatively poor spatial abilities with regard to creative performance."
INTERNET TECHNOLOGIES			
P16	-Creativity -Achievement -Flow State	Use of digital story in "Introduction to Special Education" course	↑Students creativity were higher at experimental group
P28	-Creativity -Structure -Drawing skills	Gender Use of storyboards	↑Results show that larger numbers of words and images correlate with good word and image ideas and that analytic females exhibited the greatest level of ideation and intuitive males exhibited the least.
DIGITAL STRATEGIES			
P25	-Creativity -Attitudes	Use of video games	↑Experimental group's rating for the effectiveness of video games to enhance creativity was higher than control group.
P23	-Creative thinking	Use of flipped classroom	↑The findings suggest that the flipped classroom may promote students' creativity, especially with regard to fluency, flexibility and novelty.
P34	-Achievement, -Motivation, -Problem solving skills	Effects of peer assessment based game development approach.	↑Beside other findings, it was also found that most of the students perceived "peer assessment-based game development" as an effective learning strategy that helped them improve their deep learning in terms of ''in-depth thinking,'' ''*creativity*,'' and ''motivation.
CURRICULUM/PROGRAM/CONTENT			

P4	-Creativity at Design for Learning Activities	Impact of "Professional Learning Programme"	↑The study found that the participants made substantial progress towards the development of innovative science learning and assessment activities.
P12	-Activity know-how of technology" including new ideas	Applying a national curriculum with theme "Human Being and Technology"	↑As the part of the results of evaluation of curriculum theme "Human Being and Technology", majority of students declared that this programme would encourage them towards innovativeness and creativity.
P35	-Creativity	Effects of computer technology integrated curriculum	↑Findings indicate student products were more creative after analogy-based instruction and when made using technology.
P42	-Creativity	Use of practices in "Creativity in Design & Techology"	↓Findings indicated that did not perceive that practices in their classrooms as conducive for creativity. Teachers' perceptions differed somewhat as they indicated that they can change their practice to enable creativity to flourish

Table 11. Results of qualitative analysis for impact of digital educ. tech/program on creativity in qualitative studies

Paper	**Category/Themes**	**Phenomenon/ Case studied**	**Result** ↑ means positive impacts ↓ means negative impacts
SOCIAL MEDIA			
P15	Creativity meaningful knowledge construction self-expression collaboratively developing knowledge combining text and music	Applying podcast creation activities	↑ Findings include the potential of podcast creation to enable learners to exercise creativity
LEARNING TECHNOLOGIES			
P18	Open ended materials enhancing creativity	Use of open ended materials in prospective teachers' training	↑ "The results showed that classroom teacher candidates defined the open-ended materials as developing creativity, are useful, easy to find, safe/harmless but also as confusing. "
P38	Creativity in collaborative groups	Use of the concept map knowledge management system	↑ "The concept map knowledge management system also was useful in promoting the student's thought processing, creativity, and ability to judge"
P39	Creativity in communication	Integrating film production into the assessment of undergraduate modules	↑ Students' opinions presented that reflecting on their experience of producing films as part of an assessment strategy contributed to their own development including creativity
ENABLING TECHNOLOGIES			
P2	Creativity (Conceptual, aesthetical, technical and constructional creativity each)	Degree of prior design knowledge	↑ "Students' limited conceptual technological knowledge constrains their ability to be creative and to produce genuine solutions." "The results also reveal that the projects showing less student creativity tend to be more controlled by the teacher and less open-ended than presupposed."
VISUALIZATION TECHNOLOGIES			
P2	Creativity (Conceptual, aesthetical, technical and	Degree of prior design knowledge	↑"Students' limited conceptual technological knowledge constrains their ability to be creative

	constructional creativity each)		and to produce genuine solutions." "The results also reveal that the projects showing less student creativity tend to be more controlled by the teacher and less open-ended than presupposed."
P14	QUALITATIVE CATEGORY: Creativity	Virtual reality-integration of interactive simulations	↑ "Being explorative and fun were essential parts of the students' learning experience in the virtual reality in this research."
P19	The study's aim is to analyze the collaborative creativity and peer collaboration employed during the online music composition.	Use of online music composition for musicians	↑ Creative processes were expressed effectively in online collaborative activities.
DIGITAL STRATEGIES			
P10	Ability to create multimodal texts	Use of simulation games	↑ Additionally, "simulation games provide a multimodal platform, encouraging the development of students' ability to create, read and interpret multimodal texts."
CONSUMER TECHNOLOGIES			
P43	Design Creativity	Use of mobile phones in science classroom	↑ "Mobile technology can be used as a scaffolding tool for students' imagination, creativity, and finally improved designs"
CURRICULUM/PROGRAM/CONTENT			
P2	Creativity (Conceptual, aesthetical, technical and constructional creativity each)	Degree of prior design knowledge	↑ "Students' limited conceptual technological knowledge constrains their ability to be creative and to produce genuine solutions." "The results also reveal that the projects showing less student creativity tend to be more controlled by the teacher and less open-ended than presupposed."
P37	Creativity	Students' views on "Designing our Tomorrow-DOT" approach	↑ Students indicated that their creativity and empathy were enhanced following their engagement with the intervention materials.

As seen from Table 11, categories regarding the definitions of creativity varied through conceptual, aesthetic and technical domains. We found in articles the tracks of such domains through explained situations in them, such as meaningful knowledge construction (P15), creativity in collaborative groups (P38, P19), creativity in communication (P39), and again creativity in design (P43). Interestingly P2 studied conceptual, aesthetic, technical and constructional creativities at the same time. It is important to note that discriminating between those domains of creativity was not so easy and the definitions in articles greatly enabled comprehension. Impacts have been reported mostly in terms of the achievements, attitudes and opinions of students.

Interpretation of the Results

In this section, interpretation of results was performed in two ways: procedural self-criticism of our systematic review itself and as conclusions based on the overall characteristics and results of the investigated papers.

The purpose of this systematic review was to synthesize literature related to creativity and education concerning the use of educational technologies and systems. The results revealed some interesting findings relevant to this field of research. First, the search that was conducted using only the topic "creativity and education" returned a wide range of papers, in which it was difficult to locate those papers emphasizing educational technology and creativity. Using sub-keywords was successful in narrowing the search to related papers. We believe that limiting the search only to papers written in English was a handicap, since otherwise we might have covered many more quality papers.

It was difficult to identify the research method in some studies. For such papers, repeated readings by multiple researchers were required. It was observed that, in the majority of papers, experimental methods were used, with

more variety pertaining to qualitative versus quantitative research and the specific data collection tools used. This variety was somehow a good indication of the quality of the work in selected papers. As noted earlier, studies that focused on the effect of educational tools on creativity were almost equally distributed among K2 and university levels. However, the number of studies focusing on adults in lifelong learning to enhance creativity was very limited.

The educational technologies used in selected studies were overtly identified. Since our main focus was educational technology and creativity-related studies, our analysis focused first on papers describing the effect of an educational tool or system on creativity. Our effort to categorize technologies in terms of NMC categories of emerging technologies yielded a clear picture of the distribution of studies among those categories. However, we also examined studies using the curriculum/program approach. Thus, our qualitative analysis revealed a new way of categorizing educational technology and creativity-related papers. Specifically, we categorized papers as related to i) Digital Technology or ii) Curriculum/Program. This division resulted in a more detailed understanding of current research. This supported a better grasp of the main phenomena in that field of study. A further review of the studies in the Curriculum/Program division revealed the effects of new designs or approaches in technology-related subjects on creativity, yielding more insight into the field of study under review.

It is interesting to note our progress in locating papers using specific educational technologies under specific categories defined by NMC. Although the titles of papers made it easy to determine the technology that each paper was focused on, finding an appropriate sub category was confusing in some cases. We had previously predicted that situation would be faced, as it would arise when dealing with various digital educational technologies especially in an effort to categorize them.

Qualitative analysis results show that “creativity” was taken as the dependent variable or categorization/theme of the search in almost all those studies. Through our analysis, there were some clear distinctions regarding the domain of creativity. Technical and design creativity was the most common variable. It is important to note that collaborative creativity, knowledge creation, innovative performance and new ideas for solutions were important attributes in related studies. New dimensions based on those attributes in future studies are expected.

IMPLICATIONS OF THIS STUDY FOR THEORY AND PRACTICE

In this study, first of all the systematic analysis provided a deeper understanding of the literature in that area in that time span. Analysis has revealed that the majority of the studies were either empirical and/or descriptive ones (using qualitative, quantitative and triangular methods). This in turn indicated that the results of such collected work attributed to the area to suggest a general overview of creativity in the use of educational technology in learning/teaching environments. According to the qualitative and quantitative analysis results of this study, it has been observed that the results of almost all of the papers indicated positive effects/improvements of using educational technology in students’ creativity and attitudes towards the subject of study (Tables 10 and 11).

On the other hand, the results of this study would appear to be also an indication of the shift in the use of certain educational technologies between certain time spans and in the focus of researchers’ attention on studies in the field of creativity and education concerning the use of digital educational technologies and systems in those years. The mostly investigated educational technology (in terms of its contribution to creativity) within the specified time span in this study was visual technologies such as visual reality tools and 3D modeling software. The second investigated educational technology in terms of its contributions to creativity was learning technologies including learning analytics and knowledge management systems. As a summary:

- The systematic analysis in the field of creativity and use of digital educational technologies provides a deeper understanding of the literature in that area.
- The categorization as i. the digital technologies themselves and, ii. Curriculum/Program provides a new framework in the area.
- The discussion of the articles within the scope of this systematic analysis helps to gain perspectives on the contributions of using digital educational technologies on creativity.

On the other hand, as implications for practice and/or policy

- The application of both technology and curriculum perspectives provided in our study, should be used for further analysis of future developments in the field of emerging digital educational technologies and learning.
- Finally, conducting meta-analysis on that aspect of the papers would contribute much to the area of study

and reveal direction for future research.

- Additional research on the impact of digital technology on creativity in adult education and lifelong learning is required.

LIMITATIONS

One of the major limitations of this study is the selection of papers based on time scope between 2013 and 2015. Another major limitation was the selection of papers based on Web of Science Index (SSCI and SCI indexed ones). It is not the intention of systematic review studies to include all or many databases. Rather a detailed investigation on the selected collection was realized in this study. It is suggested that future studies could be conducted to include larger databases. The use of keywords was another limitation. Also, this systematic research is only limited to the 25 journals. These journals' language was only in English, so this does not represent the articles that were written in other languages. Another limitation of this study lies in the qualitative analysis based on NMC categories of educational technologies. Here, our suggestion is to include other possible digital educational technology categories in that theme for further studies.

CONCLUSION

This systematic review resulted in a good indication of the state of research related to educational technology and creativity published from 2013 to 2015. Both quantitative and qualitative analyses presented interesting findings related to the topic of creativity and educational technology. Based on the data collected, it was possible to make the following conclusions. First, this systematic analysis in the field of creativity and use of digital educational technologies would help for a deeper understanding of the literature in that area. Also, the categorization in this study as; i. digital technologies themselves and, ii. Curriculum/Program would provide a new framework in the area. The discussion of articles within the scope of this systematic analysis helps to gain perspectives on the contributions of using digital educational technologies on creativity. Additionally, this systematic review indicates that research related to educational technology and creativity is of a good quality overall. The results of this study indicate that "technical creativity" was the most common variable within the domains of creativity. We conclude that whatever the domain is, the impact of using the above-mentioned digital educational technology was positive in all investigated papers. As suggestions:

1. There is a need for more studies addressing the effect of educational technology on creativity among various levels of participants, especially adults.
2. There is a need for more studies addressing the effect on creativity of technology-related curricula/programs or approaches.
3. There is a need for more studies comparing the effect on creativity of using various teaching methods with the same technology.
4. There is a need for more systematic review studies involving detailed analyses based on the quantitative results of papers, as well as data collection tools. This also calls for meta-analysis studies.
5. There is a need for more systematic review studies focused on the same research theme as addressed in this study, with emphasis on other categorizations of digital educational technology, such as those updated reports of NMC higher education and K12.

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Inservice Teachers' Perceptions of a Professional Development Plan Based on SAMR Model: A Case Study

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ABSTRACT
Technology integration is an important skill that teachers need to acquire to deepen students' learning and support achievement of instructional objectives. Selecting the best technology tool can be challenging however, teachers face more difficulties to effectively integrate technology into their classrooms. Providing one-time workshops is ineffective as it is based on the idea that the only challenge facing teachers is the lack of knowledge of effective teaching practices. This paper presents a case study of a professional training program that was planned and implemented as an initiative to meet the national reform and improvement goals and enhance teachers' performance and practices. The Smart Teachers 2030 initiative was planned to encourage teachers' integration of innovative instructional strategies using technology by educating and supporting them to substitute traditional educational strategies with a variety of Web 2.0 tools and applications.

INTRODUCTION
Teachers' professional development programs are critical to sharpen their knowledge, skills, attitudes, and self-efficacy for transformative practice. These programs are one of the most important investments of time and money national leaders can make in education. Technology integration is an important skill that teachers need to acquire to deepen students' learning and support achievement of instructional objectives. Selecting the best technology tool can be challenging however, teachers face more difficulties to effectively integrate technology into their classrooms. Providing one-time workshops is ineffective as it is based on the idea that the only challenge facing teachers is the lack of knowledge of effective teaching practices (Richard & Neil, 2011).

Research shows that teachers' greatest challenge comes when they attempt to implement newly learned methods into their classrooms (Fullan,2001). Fullan, (2001, p. 71) referred to this problem as the "implementation dip." This is particularly true in teachers' professional development programs in Saudi Arabia because they are normally planned to provide teachers with knowledge without implementation skills or strategies (Buteal, 2009; Meemar, 2007). Such programs provide teachers with new information on specific skills but fail to provide application approaches. Moreover, current training programs are not planned to provide teachers with continuous and just-in-time support as they implement technology into their classrooms. Thus, reform is needed for effective professional development in typical Saudi classrooms. With the ubiquity of technology in today's interconnected world, it is imperative for teachers to exploit technology to optimize student learning. Teachers must be knowledgeable of the interrelated aspects of teaching, technology, and learning to support positive pedagogical outcomes (Koehler, Mishra , Kereluik, Shin, & Graham, 2014).
The problem is that current teachers' development plans to support teachers' integration of technology into their instruction have not resulted in the effective transformation of instructional practices to adopt technology as part of the teaching and learning processes (Laferriére, Lamon, & Chan, 2006). Professional development plans should be planned and applied to enhance instruction and ensure all students are afforded the opportunity to learn effectively using technology as it is considered as key in high quality education (Ertmer & Ottenbreit-Leftwich, 2010). This study discusses a case study of an iteration during professional development plan that aims to move teachers toward meaningful technology integration using SAMR model through ample, structured, and focused time for professional learning to develop teachers' attitudes, self-efficacy, knowledge, and skills for transformative practice using technology.

LITERATURE REVIEW
Professional development frameworks. Herold (2015) discusses that while technological tools and applications are widely spread in today's classrooms, there is a growing evidence that teachers have not transformed their teaching methods. The technology use is planned for students to perform traditional tasks as completing homework and drill and practice (Ertmer & Ottenbreit-Leftwich, 2010). Several frameworks for moving teachers toward more learner-centered levels of technology integration in the classroom are evident in the literature. The Technological Pedagogical Content Knowledge (TPACK), the Substitution Augmentation

Modification Redefinition(SAMR) model, and the Technology Integration Matrix(TIM) are among the most frequently referenced frameworks in the literature to drive professional development and measure the levels of technology integration in schools by teachers.

The Technological Pedagogical Content Knowledge(TPACK)

The Technological Pedagogical Content Knowledge(TPACK) is based on Shulman's pedagogical content (1986). This framework adds the technology knowledge dimension and extends Shulma's framework to integrate technology into the intersection of teachers' pedagogical and content knowledge. The framework support teachers' practice and serves as a guide in how to effectively integrate technology into the curriculum (Wong, Chai, Zhang, & King, 2015). The TPACK is based on the intersection of technology, pedagogy, and content knowledge and they should be linked together for the technology integration to occur (Kimmons, 2015). Baran, Chuang, and Thompson (2011) note that when teachers are able to navigate the intersections between all types of knowledge (technology, pedagogy, and content) they develop different type of expertise than one solely in a particular knowledge area. The (TPACK) framework is being adopted in the design of teachers' professional development for technology integration to scaffold their understanding as they prepare lessons integrating technology (Wong, Chai, Zhang, & King, 2015). Kimmons (2015) discussed that (TPACK) is an effective model for evaluating teachers' level of proficiency as they prepare technology integration into their classrooms.

The Technology Integration Matrices (TIM) is a framework and a descriptive tool that assess teachers' levels of technology integration toward transformative teaching. It begins with entry level and moves through adoption, infusion, and transformation. The literature categorizes external and internal additional factors impacting technology adoption by teachers (Wachira & Keengwe, 2011). The external factors are typically school level factors related to infrastructure such as, lack of computers with internet access, computer labs, and connectivity concerns. Time is another external factor identified in the literature as time is required to plan lessons and learn the hardware and software. External factors are mostly technology support and leadership. Another proposed model for technology integration is the SAMR model (Puentadura, 2012). The SAMR model is a technology integration framework that has two enhancement stages, substitution and augmentation and two transformation stages, modification and redefinition.

SAMR Model

The SAMR model by Dr.Ruben Puentedura gained popularity in late 2012 and it provides teachers with a framework meant to enhance integration of emerging technologies into their classrooms (Hilton, 2016). SAMR is designed to "…facilitate the acquisitions of proficiency in modern consumer technologies and software for both staff and students with the hope of promoting 21st century skills..." (Cummings 2014). Through the SAMR model, the use of technology is approached as four hierarchal different tasks: Substitution, Augmentation, Modification, and Redefinition. These tasks are grouped under two different areas, enhancement and transformation created by Ruben Puentedura (2013) (See Figure 1.)

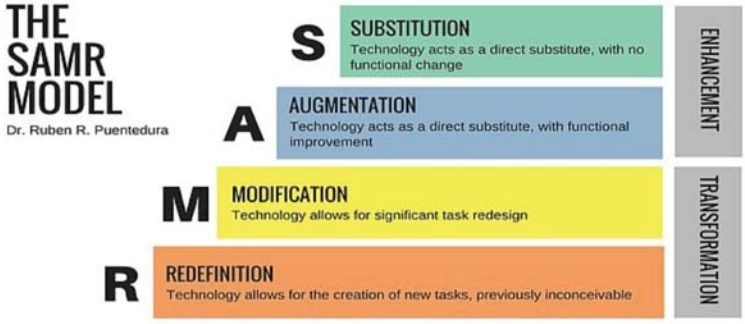

Figure 1. by Lefflerd, 2016. Creative Commons license CC BY-SA 4.0.

The tasks of Substitution and Augmentation processes are presented as "Enhancement" first stage meant to leverage technology to substitute and/or enhance existing tools in the learning task, while tasks of Modification and Redefinition are assigned under "Transformation", the second stage of the model planned to present new ways and opportunities for learning that are not easily accomplished without technology (Kirkland, 2014). Substitution is the use of technology with the possibility for the learning task to be completed without technology. Augmentation enhances the learning task that can be accomplished without technology. Modification supports the alteration of a previous task in a way not possible without technology. Finally,

redefinition, is the final stage where the creation of new task cannot be accomplished without the use of technology (Hilton, 2016 &Kirkland, 2014). As Kirkland (2014) discusses, "the key to using the SAMR model is not to think of it as a progression to work through. Really using technology effectively means creating the kind of rich tasks that redesign traditional ways of learning and create opportunities that do not exist without the use of technology" (16). The SAMR model presents a framework for the depth and complexity of technology integration of each stage (Kirkland, 2014). SAMR model serves as a roadmap for teachers to gradually enhance their instruction with technology and more importantly, their teaching and learning classroom strategies.

Classroom strategies. The classroom is a dynamic learning environment bringing together students from different backgrounds with various abilities and personalities. This requires teachers to implement creative and innovative teaching strategies in order to meet students' individual needs. teachers carefully consider their students' current levels of learning, strengths, goals and interests and choose the strategies that focus on the development of knowledge, understanding, and skills for the purpose of assisting their engagement with the content, extending their learning, and enabling them to make progress, and achieve educational standards.

The teaching and learning strategies teachers apply in their classrooms can be categorized under the basic elements of inquiry processes; first there are the turning in strategies which are methods implemented to help students both individually and collaboratively to explore their current knowledge, attitudes and values using graphic organizers to record and share information. Second, is the finding out strategies that help students to identify and bridge gaps in their existing knowledge and understand key concepts through self-directed investigation. The third category is the sorting out strategies that help students analyze, organize, review, compare, and contrast information to deduce conclusions and apply their comprehension. The fourth group of teaching and learning strategies are the reflecting strategies that encourage students to identify, discuss, and consider changes in their knowledge, skills, attitudes, and values. These categories of educational strategies are generic entities of a number of activities that teachers usually use in a regular basis such as, games, brainstorming, role-play, shared reading, decision-making model, story map, values continuum, quizzes, mind map, think-pair- share, puppet role-play and etc.

SAMR for classroom teaching strategies

As the role and functioning of schools are in constant change and progress, this change is also expected in teachers' skills and competencies. Teachers are expected to teach in an increasingly changing educational trends and policies with a greater emphasis on integrating technology to make more effective use of information and communication technologies for teaching. In-service professional development plans prepare teachers to maintain high standard of teaching. As OECD's comparative review on teachers explained (OECD,2006) "effective professional development is on-going, includes training, practice and feedback, and provides adequate time and follow-up support. Successful programs involve teachers in learning activities that are similar to ones they will use with their students, and encourage the development of teachers' learning communities". There are multiple advantages for teachers' development programs. They are intended to update teachers' knowledge of the subject matter, update teachers' skills, attitudes, and teaching approaches according to the latest teaching techniques and standards according to new educational policies. Among the most important and basic skills is understanding of technology (Lawless& Pellegrino, 2007) and the teacher is considered as the facilitator of successful integration of technology in the classroom (Inan& Lowther, 2010). While the availability of technology has significantly increased in recent years, teachers' instructional methods has not noticeably changed (Herold, 2015). Therefore, professional development programs should be designed and implemented to enhance instruction to support students' learning using technology as the current programs have not supported the effective transformation of instructional practices to integrate technology as part of the teaching and learning process (Herold, 2015, Mishra & Koehler, 2006). Previous research discussed that teachers have little understanding of how technology should be implemented into the classroom and constructivist teaching strategies based on technology can be a challenge for teachers (Chen, 2008, Herold, 2015).

Herold (2015) discusses that even though technology has increasingly entered schools and classrooms, teachers' adoption of technology and change of traditional teaching methods seemed challenging and teachers have not transformed the ways they are teaching. According to Herold (2105), teachers use of technology is to support traditional instructional strategies which can be a promising starting point for professional development programs to increase teachers' integration of technology. Most teachers need more understanding of how technology should be implemented into teaching and learning to transform their classrooms into student-centered and enhanced with technology (Chen, 2008).

Saudi teachers' context. Knowing that every teaching context is unique, Hamilton, Rosenberg, & Akcaoglu, (2016) highlighted the importance of context for teachers' professional programs to direct and guide teachers in

how to use technology. Opfer and Pedder (2011) discussed that the complex system of teachers' context has an impact on teachers decisions and their learning. Teachers' instructional practices and students' learning experiences are situated within complex systems (Opfer and Pedder2011). Additionally, Kihoza, Zlotnikova, Bada, & Kalegele (2016) stated that teachers' ICT competences, knowledge, skills, understanding and attitudes are critical and has to be situated within the context of classroom and pedagogy.

As Saudi Arabia pursue economy diversification and sustainable development, the Saudi Vision (2030) set out an ambitious road-map for reformed educational system in the Kingdom of Saudi Arabia to progress on these two fronts. Among the strategic objectives and fundamental building blocks of the Vision for education, is to improve the learning environment to stimulate creativity and innovation, improve curricula and teaching methods, shift to digital education to support teacher and students' progress and success, and provide a comprehensive framework for the professional development of teachers as the most important element in the educational process who can support meeting the target goals set for education by the year 2030. The transformation can be accomplished only by leveraging a broad range of skills and competencies and this depends on the success of education.

Saudi teachers are encouraged by the Ministry of Education to use variety of instructional strategies in their classrooms to improve their instruction to be more learner-centered and learning-based and for the teacher to be the facilitator of learning. Therefore, they utilize different teaching and learning strategies to promote students' critical and reflective thinking, research and evaluation skills that will enable students to be active participants in the teaching and learning processes. Students are encouraged to use their personal and social capabilities to work collaboratively with others in learning activities to realize their own strengths and abilities and those of their peers that will support the development of a number of important skills such as, communication, negotiation, team work, and leadership. The main goal of the professional program planned for Saudi teachers discussed in the following case study, stemmed from the necessity of supporting teachers' understanding of technology as an important step that should precede technology use (Inserra and Short 2012).

SAMR Model in Teachers' Development Programs: A Case Study

One of the most effective strategies in teachers' development programs is to involve teachers in learning activities that are similar to the ones they will use with their students. Although teachers attend and participate in different professional development programs in how to successfully integrate technology, they still struggle in how to integrate technology in their classrooms. Additionally, the Saudi Vision 2030 required a reform in education including teachers' instructional strategies and methods and a transform towards digital education to enhance innovation and creativity into their classrooms. The Smart Teachers 2030 initiative was planned and implemented by the In-Service Teachers' Professional Development Unit at college of education in one of the universities in the central region of Saudi Arabia as an initiative to meet and achieve the reform and improvement goals by Ministry of Education to enhance teachers' performance and practice as one of Vision 2030 objectives and goals to reform education. The Smart Teachers2030 initiative was planned to encourage teachers' integration of innovative instructional strategies using technology through educating and supporting them to substitute traditional educational technologies with a variety of Web 2.0 tools and applications. The following section present an example of such SAMR based professional development program supported with community of practice discussions and exchange of expertise and knowledge as a case study for teachers' development program based on SAMR model. The case study of the SAMR-based training program illustrates how SAMR model can be adapted and used in different contexts enhancing technology integration in classrooms.

Context of the case study. The teachers' professional development program, Smart Teachers 2030, provides an example of following SAMR model to improve teachers' performance through a systematic training plan to encourage them to substitute their traditional teaching strategies with a Web 2.0-based teaching strategies. Most Saudi teachers' use traditional educational technologies in their classrooms and they mostly lack knowledge and skills of available Web 2.0 applications that can support their teaching and enhance student's achievement of educational objectives. Although some teachers have the knowledge of some educational Web 2.0 applications and tools, they lack the knowledge of possible implementation strategies. This training program was initiated as a response to Ministry of Education demand for colleges of education among the country to participate in improving teachers' professional development programs to improve their skills and raise their awareness of available educational technologies. The college of education in this case study has six programs that provide bachelor of education degrees and prepare preservice teachers with multiple teaching skills of different subject matters to be fully prepared to apply their knowledge in their future classrooms. In addition, there is an established unit for improving in-service teachers' skills and capabilities. The college provides professional development workshops on a regular-basis in different areas and skills.

Design and implementation. The training program was designed to include six training sessions of three hours for each respective session. The total program's time lasted for 18 hours. The first session was planned to provide teachers with introduction of learner-centered teaching and learning methods, procedures, educational videos explaining the teaching strategy, its positive outcomes, core principles, learning and teaching tools, teacher and students' role, classroom setting, learning outcomes and assessment. Each session was concluded with questions, answers, and discussion ideas mostly about compare and contrast each entity with the teacher-centered approach. The second session's topics were planned around teaching and learning strategies, definition of each strategy, application ideas, and concluded with discussion questions and exchange of ideas in how teachers are using these strategies in their teaching. The third and fourth sessions were dedicated for educating teachers about a variety of Web 2.0 tools that are useful in improving teaching and learning processes. Teachers were taught how to download, use, and implement these tools in their classrooms and the sessions were concluded with a discussion and application ideas in their classrooms. Teachers were given the time to use and navigate the features of each application. The fifth and sixth sessions were dedicated for the introduction of SAMR model and TPACK and how each model can be used to encourage and guide technology integration in teaching. Finally, teachers were asked to write their reflections and answer the 20-items questionnaire on the professional training program.

Study design and results. A survey research design was selected for this study to investigate the perceptions of teachers regarding the effectiveness of the professional training program based on the first stage of SAMR model. The teachers' questionnaire with open-ended questions has been implemented as a primary survey instrument. In-depth interviews, teachers and supervisors' questionnaire and qualitative analysis of teachers' usage of Web 2.0 tools are further data collection methods planned for the second phase of the professional development program during which, teachers will be invited to the second workshop for the Augmentation stage following this initial substitution stage. Workshop announcement and invitations were sent to 35 teachers across the district schools and a number of 33 teachers attended the workshop. The participating teachers represented different subject matters such as, math, religion, English, and social studies. Teachers were asked to bring their own tablets or laptops. All teachers submitted complete questionnaires with return rate 100%. All items were assessed on a 5-point Likert scale from 1 "very high" to 5 "very low". The preliminary descriptive results based on learners' responses show that 90% rated their positive experience as very high, 90% rated the adoption of SAMR model as a training framework is very effective improving their knowledge of possible technological tools for teaching strategies. Teachers also strongly agreed that the workshop materials and training portfolios were effective in providing them with ample knowledge in how to use the discussed Web2.0 tools. Additionally, 56% agreed that workshop improved their skills in how to use the Web 2.0 applications and 91% rated the workshop in general as excellent training program with effective resources. Most teachers (93%) found the invested time in learning as appropriate.

	https://www.powtoon.com	PowToon	Cartooned Concepts
	http://popplet.com	popplet	Concept Maps
	https://getkahoot.com	Kahoot!	Learning through Games
	https://www.pixton.com	Pixton	Comics

Quick Access	Website	E-learning Application Substitute	Educational Strategy
	www.edmodo.com	edmodo	Collaborative Learning
	https://padlet.com	padlet	Brainstorming
	www.sutori.com/education	Sutori	Adapted Lecture
	http://kidblog.org/home/	Kidblog	Group Discussion

	http://zunal.com	Webquest	Self-learning
	http://edu.glogster.com	Glogster	Case Study
	http://www.livebinders.com	LiveBinders	Supported Activity
	http://web.seesaw.me	Seesaw	Learning Contract

The content was informative for them and 89% enjoyed learning and having discussion and exchange of application ideas with other teachers in the group. The majority of teachers (90%) believed that the content was

important for preparing them to integrate technology in their classrooms. All participating teachers stated that they felt well supported by moderators, had the opportunity to express their ideas, share information from their expertise, and stated that they would recommend this type of workshops to their peers. **Responses to open-ended question.** Teachers provided their answers to the three open-ended questions that were planned to qualitatively explore teachers' opinions regarding the acquired knowledge, skills, their suggestions, and recommendations for better future application.

Acquired Knowledge

For the first question regarding knowledge acquisition, 30 teachers reported that they gained knowledge of learner-centered teaching strategies, how to use Web 2.0 tools in education, learned design strategies, and how to transfer face to face teaching strategies to the web. One teacher expressed that she was surprised by the variety of Web 2,0 tools that can be applied in different classes. Another teacher expressed that she found the discussed web 2.0 tools as easy to use. Two teachers expressed that they gained more knowledge of application strategies of previously known applications. One teacher expressed that she thought about using the programs for other classroom activities such as, preparing lessons and following up with students. Another teacher discussed that she learned how to integrate, substitute, and make effective a number of different strategies by using one application. Another wrote that it can also be used as a communication tools to stay connected with students outside classroom. Another teacher explained that utilizing such tools make learning and class activities more effective for students. Another discussed that she liked the tools very much and saw that it is highly supportive for both teachers and learners and she felt very motivated to use in her classroom. Additionally, six teachers expressed that they gained the benefit of exchanging expertise, implementation ideas, and effectiveness of the web strategies with other teachers. They also expressed that the discussion enriched their knowledge of educational technology. Finally, one teacher expressed that she gained knowledge of the availability of multiple educational applications and how she liked their simplicity and their potential to transform education. Additionally, she mentioned that she learned about how technology can save teachers' time and efforts. She added that she gained a rich conceptual knowledge of web applications, technology integration into curriculum and how they can facilitate teaching and learning to be more effective. Another teacher added that she created a general understanding of teaching skills through the web and gained knowledge of available educational applications

Acquired Skills

Regarding acquired skills, three teachers expressed that the workshop improved their ability of using the technology, two stated that they gained the skill of how to design, plan, and apply educational technologies. One teacher stated that she learned how to apply face- to- face strategies through the web. Another expressed that she gained technical skills and technological literacy. She reported that she was trained on important teaching strategies using technology and multiple application strategies. Another expressed that the discussed web applications support diversifying teaching methods and add both fun and learning to the classroom. One teacher stated that she learned how some applications can solve teaching challenges in the class such as, time limitedness with intensive curricular content and other extra-curricular activities.

Suggestions and Recommendations

The participating teachers provided a number of suggestions and recommendations to improve the next training workshops. For example, two teachers suggested that planning the training to be around one tool at a time. One suggested making a specific workshop for each subject and give examples of lessons for this subject. In addition, 12 teachers suggested providing trainees with computers, network connection, and technical equipment for immediate application time during the workshop time and 10 recommended assigning the next day for one-on-one application time. Another suggested extending the training hours and add more application and discussion time. Additionally, 32 teachers suggested providing more workshops in the future on educational technologies that can substitute traditional teaching strategies. One teacher suggested providing more training time to be spent on certain applications such as, Edmodo. Finally, 31 teachers expressed that they benefited from the workshop in general and expressed that it raised their awareness of available educational technology tools and will apply them in their classrooms.

CONCLUSION

The goal of this professional training program is to transform teacher's instructional practices to use technology in a more student-centered manner and apply constructivist method of teaching. The training program was planned and applied as an initiative for change in teachers' training programs according to national transformation plans. The program focused on the substitution stage of SAMR model to examine teachers' perspective of the substitution of traditional instructional strategies in the classroom with Web applications to add technological variety and transform their teaching into learner-centered method. This framework impacted

teachers' attitudes, self-efficacy, and knowledge and skills for transformative practice using technology and they generally rated their experience as positive and informative training experience. The next stages of SAMR levels should be examined by surveying participating teachers' perceptions of the impact of the training program on their teaching with technology skills and how they are modifying or redefining the use of Web apps in their classrooms.

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Instagram as an Education Platform for EFL Learners

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ABSTRACT
Social media platforms have gained an exceptional popularity especially in the last ten years and become an important part of human lives. Among the popular social media platforms, Instagram is used by millions of people every day especially by the young adults. Given this significance, social media platforms have been used for educational purposes, too. Thus, this study aimed at exploring university students' opinions about Instagram as an educational platform with respect to educational and language learning purposes and its effect on students' language learning process supplementary to formal classes. Using mixed methodology, 219 university students learning English were included in the survey, and 80 students took part in the experimental part of the study which was designed to explore the impact of Instagram on students' language learning process. Six students from the experimental group were also interviewed for their opinions about the Instagram use during the experimental part of the study. Carrying out quantitative and qualitative analyses, the findings show that Instagram is the most frequently used social media platform among the participants and they favor using it for educational and language learning purposes. Additionally, it was found that Instagram had a positive impact on students' language learning based on the achievement scores. Thus, it is concluded that Instagram can be used to enhance learning of English supplementary to formal teaching by exposing the students to language while they are using this platform as part of their every day practices.

Keywords: Instagram, language learning, student achievement, education, social media

INTRODUCTION

Due to increasing popularity and use of social media or social network sites as well as their mobile applications in education, educators tend to use them as a source for educational purposes, since such popular social media platforms as Facebook, Instagram, Twitter, Google+, Flickr, and so on provide considerable potential for education (Aydin, 2012; Deaves, Trainor, & Grant, 2017; Faizi, Afia, & Chiheb, 2013; Hsieh, 2017; Manca & Ranieri, 2016; Rosell-Aguilar, 2018; Taskiran, Bozkurt, & Aydin, 2016; Taskiran, Koral Gumusoglu & Aydin, 2018). According to a Pew Report (2018) published recently, a total of 4 billion people are active users of the internet, 53% of the total population of the world (7.593 billion), while 3.196 billion people are social media users (42% of the world population). Thus, given the huge number of active users of both the internet and social media platforms, the use of such social media platforms for educational purposes or as an educational environment allows the users to create, share and comment on a definite content (Manca & Ranieri, 2016) through a socially bounded system in which users of specific social network sites view the connections of others by creating their own profiles (Boyd & Ellison, 2008).

In fact, flourishing after the introduction and support of Web 2.0 technologies (Alsharidi, 2018; Chawinga, 2017a; Faizi et al., 2013; Kolokytha, Loutrouki, Valsamidis, & Florou, 2015; Krutka & Carpenter, 2016; Lim & Richardson, 2016; Manca & Ranieri, 2016), social media networks attracted the attentions of educators due to the popularity and use of these networks among young adults especially with the increase of internet connected smart phones (Aydin, 2012; Bal & Bicen, 2017). The awareness of educators towards exploiting the potentials of social network sites and their smart phone applications stems from the fact that a great majority of the educators are themselves active users of social media, for individual as well as professional purposes (Hsieh, 2017).

Given the high popularity of social media use, several studies have been carried out to demystify the use of social media platforms for educational purposes, in particular within the field of foreign language teaching and learning (Chawinga, 2017a, 2017b; Krutka & Carpenter, 2016; Manca & Ranieri, 2016; O'Keeffe, 2016; Tang & Hew, 2017). It has been shown that social media, despite having multifaceted functions not specifically designed for educational purposes, is utilized as a powerful tool (Alsharidi, 2018) to drive participation and communication in educational contexts (Chawinga, 2017b). Indeed, high visibility social media platforms enable both the teachers and the students to create and participate in online communities customized for sharing the specific content and promote learning. Additionally, one other reason why social media is utilized as an education tool is that students, as digital natives, demand innovative ways of learning outside of classical modes

of learning (Taskiran et al., 2018). Although literature is replete with studies regarding the use of such social media platforms as Facebook and Twitter for educational purposes (Alsharidi, 2018; Aydin, 2012; Benko, Guise, Earl, & Witny, 2016; Chawinga, 2017b; Deaves, Trainor, & Grant, 2017b; Kalelioglu, 2016; McArthur & Kristen, 2012; O'Keeffe, 2016; Rosell-Aguilar, 2018; Taskiran et al., 2018), Instagram has not been studied in detail in terms of its use for language learning purposes in higher education, despite being a popular social media platform among university students. This study therefore will try to unveil the opinions of university students' opinions about Instagram as an educational platform and its effect on student achievement in language learning process.

LITERATURE REVIEW

Social media platforms are regarded as powerful tools for teaching and learning practices through their nature of openness, interactivity and sociability (Manca & Ranieri, 2016). Replacing the conventional teaching practices, these platforms have become virtual environments for educational purposes especially suitable to enable learners to create, share and receive user generated content by virtue of their interactive features (Vivakaran & Neelamalar, 2018). In fact, Facebook and Twitter are among the most intensively investigated social media platforms for their credibility in education and various aspects of social media were examined in this research, focusing on such platforms because of their widespread and ever increasing use across all age groups around the world, in particular among the younger generation. Additionally, these platforms were also incorporated into formal classrooms with the efforts of educators primarily aiming for student engagement (Abney, Cook, Fox, & Stevens, 2018).

In terms of language education, dependence on technological tools and their incorporation into classroom settings not just for student engagement but for interaction in and beyond the classroom (Lomicka & Lord, 2016) have paved the way for using social media to maximize the student exposure to the language in addition to providing authentic language learning, by means of socialization, contextualization and utilization (Wong, Chai & Poh Aw, 2017). In addition, having no time and space limit features (Ali, Yaacob, Al-Amin Bin Endut, & Langove, 2017; Bal & Bicen, 2017; Boateng & Amankwaa, 2016; Chawinga, 2017a), social media platforms provide authentic and learner generated language content enhancing student learning, confidence and motivation through collaboration (Badri, Nuaimi, Guang, & Rashedi, 2017; Derakhshan & Hasanabbasi, 2015; Lomicka & Lord, 2016). Thus, social media platforms create enjoyable and stress free learning spaces tackled by educators to turn students' social media enthusiasm into a learning opportunity (McCarroll & Curran, 2013).

Among social media platforms, Facebook attracts the attention of most educators and researchers for its potential in education; thus, a considerable number of studies were carried out to investigate the use of Facebook as an educational platform in terms of language teaching and learning. Being the most popular social media platform ever (Smith & Anderson, 2018), Facebook is reported to have features contributing to communication skills with peers and school or faculty members, participation, collaboration, peer support, commitment in educational activities (Tiryakioglu & Erzurum, 2011). As an educational tool, it also enhances language teaching and learning and offers advantages not only for students but also for educators in that Facebook provides opportunities for engaging learners on tasks, for improving all four skills in English and increasing student motivation; however, it should be noted that educators need to have pre-planned objectives for Facebook to be utilized as an educational environment (Aydin, 2012; Lim & Richardson, 2016; Rios & Campos, 2015).

The Twitter social media platform is also utilized as an online space, and following Facebook, several studies were carried out to investigate the use of Twitter for educational purposes (Abney et al., 2018; Bista, 2015; Bozkurt & Aydin, 2016; Evans, 2014; Kalelioglu, 2016; Lomicka & Lord, 2016; O'Keeffe, 2016; Tang & Hew, 2017). Various aspects of Twitter from micro-teaching (Aitchanov et al., 2013), positive student attitudes and increase in student engagement, interpersonal relations and class participation in higher education (Bista, 2015; Boateng & Amankwaa, 2016; Evans, 2014), pre-service teacher education (Kalelioglu, 2016), professional development of practicing teachers (Rosell-Aguilar, 2018) to increasing learner autonomy in language learning (Solmaz, 2017) have all been investigated and found Twitter to be a valuable learning and teaching space. Additionally, regarding the language learning and teaching practices, it was shown that Twitter, with its microblogging feature, holds various uses at different language levels and settings with varying tasks in addition to offering interaction and communication with native users of the target language, as well as creating an awareness on noticing and exchange of the meaning (Hattem & Lomicka, 2016). Additionally, Twitter as an authentic and dynamic education platform particularly for L2 learning contributes to cultural and socio-pragmatic awareness of the learners, apart from improving their language skills while learning the language (Blattner & Dalola, 2018). Thus, Twitter accommodates a number of unique language learning opportunities for learners of language by offering interaction possibilities for practicing the language with native users.

Instagram, which first appeared in 2010, was launched as a photo sharing platform and over the time other new features such as video, texting, and story sharing have been added which contributed to its growth greatly (Ellison, 2017). In terms of language learning, Handayani (2016) argues that Instagram can be used as a source for applying a number of activities in language classrooms like digital storytelling, grammar activities through photos, role plays, reading, speaking activities through videos etc. Thus, Instagram addresses to four language skills to practice the language in and outside the classroom. Additionally, some studies were conducted on Instagram for developing writing skill (Soviyah & Etikaningsih, 2018). These studies show that Instagram was an effective tool in improving students' writing skill. Additionally, it was found that Instagram increases students' motivation to learn and their participation to classroom activities (Purnama, 2018). Among the studies conducted on Instagram regarding its use for language learning, Mansor and Rahim (2017) found that it is an effective platform in that it encourages students to interact with their peers in the group works related to videos they shot on the teacher led tasks.

Social media has been growing at unprecedented rates with an ever increasing number of users particularly among the young people (Mansor & Rahim, 2017; Sheldon, Rauschnabel, Antony, & Car, 2017; Smith & Anderson, 2018). Instagram, which is gaining more popularity across the world (Smith & Anderson, 2018), is a social media platform where its users can share self-generated content in the form of photos or videos (Abney et al., 2018), yet given the potential role of Instagram, considering the exploitation of Facebook and Twitter, in language learning and teaching setting (not limited to, though), it is surprising that little scientific attention has been given to Instagram except for quite a few studies (Handayani, 2016; Mansor & Rahim, 2017; Purnama, 2018; Soviyah & Etikaningsih, 2018). Aiming to fill this gap in literature, this study seeks to exploit university students' opinions regarding Instagram both as an educational and language learning platform and its effect on students' language learning by answering the following research questions:

1- What are students' opinions regarding Instagram use
   a) for educational purposes?
   b) for language learning purposes?
2- What is the impact of Instagram on students 'language learning process in an EFL context?
3- What are students' opinions regarding their experiences of Instagram use for language learning purposes?

METHODOLOGY

This study was conducted adopting mixed method approach. Initially, a survey study making use of quantitative approach was utilized and an experimental study with a pre-test and post-test design was followed by an interview with the students from the experimental group. Thus, this study makes use of a number of data collection tools; a scale in survey study to unveil students' opinions regarding Instagram use for educational and language learning purposes, student achievement scores in the experimental study and finally interview protocol to understand students' opinions regarding their experiences of Instagram following the experimental study.

Context and Participants

The first part of the study aimed at finding out the students' opinions about Instagram use for educational and language learning purposes. For this part of the study, the data were gathered from 219 students receiving intensive English education run by a language teaching program at a state university in Turkey. The intensive English education, a one-year-program, aims at equipping students with the necessary academic language skills to follow their departmental courses in English and an approximate of 800 students are enrolled in this program with an increasing number each year. Among the participants, students were enrolled into such various programs as the Department of English Language Teaching in Education Faculty and departments of Engineering, Food Engineering, Machinery, Computer Sciences, Management Engineering, Genetics and Bioengineering and Electrical and Electronical Engineering from Engineering Faculty.

For the second part of the study, the experimental part, a total of 80 students studying in the Department of English Language Teaching were randomly grouped as an experimental and a control group each of which consisted of 40 students. Following the experimental study, a total of six voluntary participants all of whom were females were interviewed as shown in Table 1 below. Thus, this study is limited to the participants and the experiment conducted in the provided data collection process.

Table 1. Participants of the study

Study	Frequency	Percent
Survey	219 (n)	
Gender		
Female	105	48
Male	114	52
Age		
17	6	2.3
18	83	37.4
19	85	38
20	31	14
21	10	4.6
22-25	2	1
25 and over	2	1
Language Level		
A1-A2	105	48
B1	38	17.4
B2	50	22.8
C1	22	10
Department		
English Language Teaching	88	40
Computer Engineering	35	16
Genetic Engineering	21	9.5
Food Engineering	20	9.1
Machinery Engineering	22	10
Electric-Electronic Engineering	12	5.4
Administrative Engineering	21	9.5
Experimental Study	80	
Experimental Group	40	
Gender		
Female	17	42.5
Male	23	57.5
Control Group	40	
Gender		
Female	13	32.5
Male	27	67.5
Interview	6	

Data Collection Tools and Process

The survey part of the study was completed by gathering the data regarding the students' opinions about Instagram use for educational and language learning purposes. To this end, an Instagram Use Survey adapted from The Social Networking Use Survey (Lim & Richardson, 2016) and Twitter Use for Language Learning Questionnaire (Alsharidi, 2018) was used. During the adaptation process, items in the Social Networking Use Survey (Lim & Richardson, 2016) and Twitter Use for Language Learning Questionnaire (Alsharidi, 2018) were transformed into Instagram use items. The Instagram Use Survey had two major sections as demographic information (Items 1-13) and survey part (a total of 28 items) having three dimensions to explore students' perceptions and use of Instagram as "Intensity of Using Instagram" (Items 14-17), perceptions regarding "Using Instagram for educational purposes" (Items 18-27), "Using Instagram for language learning purposes"(Items 29-42) –item 28 was left blank for reliability test. Structured from general Instagram use to English learning perceptions of the students, the survey items adapted were sent to experts in the fields of educational sciences and English language teaching and following the feedback and comments on items, the necessary corrections were made for the accuracy, clarity as well as the organization of the subscales to ensure content and face validity. Further, the adapted survey form with 5 Likert-scale items was piloted and the constructed-ready-to-use form was applied by collecting data from the students.

To answer the second research question, an experimental study was carried out to investigate the likely effects of Instagram use on the students' language learning process. To this end, randomly selected B2 level Turkish EFL students learning English were grouped for experimental part of the study and equal groups of forty students were assigned as the experimental and the control group in a random way. Creating an Instagram account as "LearnEnglishAlku" (Alku as the abbreviation of the university), the students in the experimental group were invited to join the Instagram account specified. For a period of ten weeks, the experimental group students were systematically exposed to Instagram posts structured around the content and syllabus of the course book they followed in their formal classes and asked to participate in the assignments posted or comment on the posts while the control group continued their formal language instructions. The use of Instagram for the experimental study was designed as supplementary to formal classes. Following a meticulous preparation period, the Instagram posts targeting four language skills and language areas together with pronunciation activities were created and shared. At the same time, a number of well-known official language learning accounts (e.g. BBC English) were followed and the posts shared by such accounts were re-shared. Extra-curricular skill and grammar based posts together with vocabulary items were shared which required the students to comment on the content or participate in the discussions.

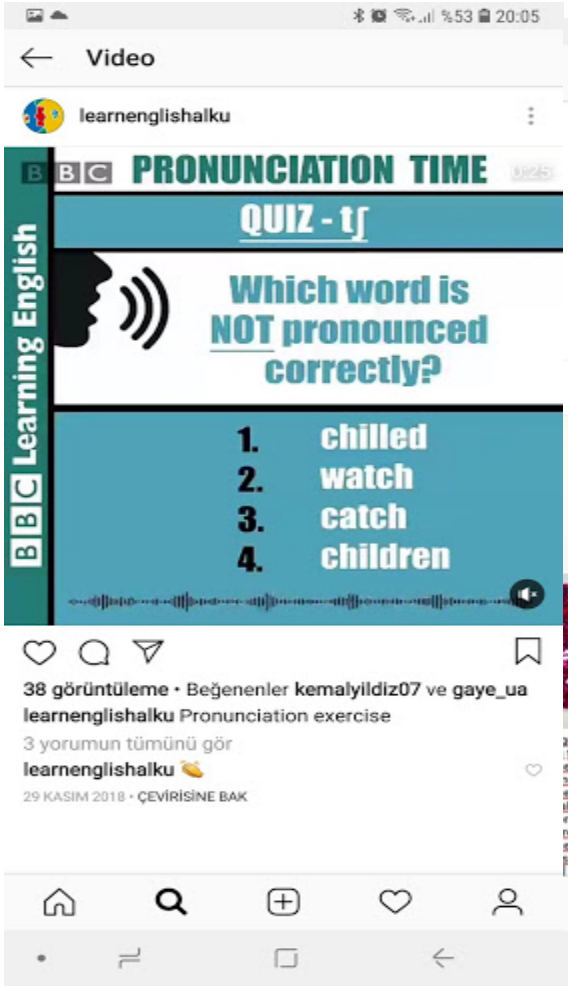

Figure 1

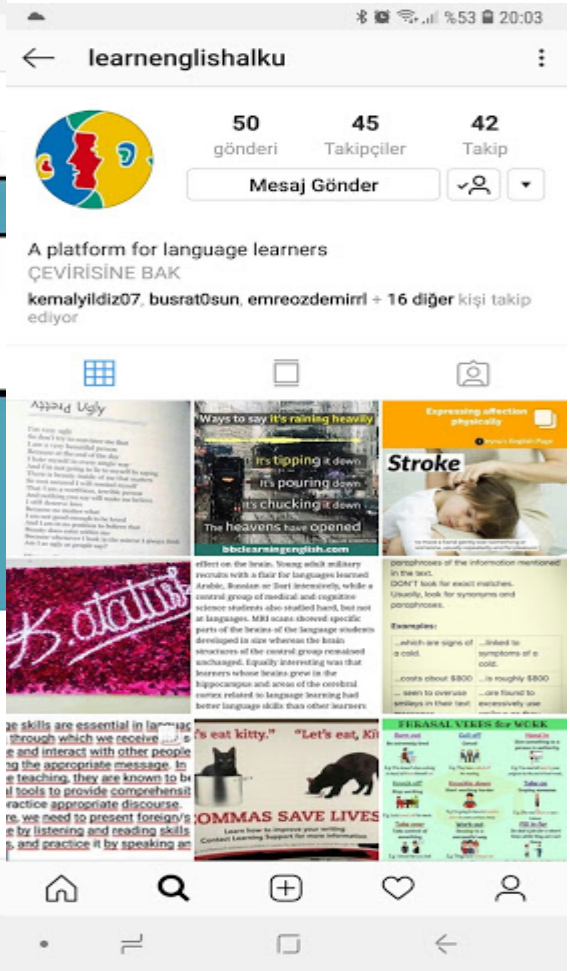

Figure 2

During the experimental study, the posts and Instagram stories were designed based on four skills and language areas in line with the course book. For listening purposes, the short videos and pronunciation exercises were posted regularly with questions in the comments part. Additionally, to improve students' speaking skill in addition to developing their listening skill the posts required them to conduct the certain tasks (such as the ones to complete a job interview with two peers) through videos. Also, they needed to shoot videos on certain tasks taken from their course books in the form of role-plays with their peers or they needed to upload videos using the hashtag specified previously. For reading skill, academic reading texts were posted and under each text, the students were asked to find out the topic, main idea, paragraph title or apply reading sub-skills such as skimming, scanning paraphrasing, deducing the meaning from the context or defining the key words in the texts where they needed to write their answers and comment on their peers' responses.

Figure 3

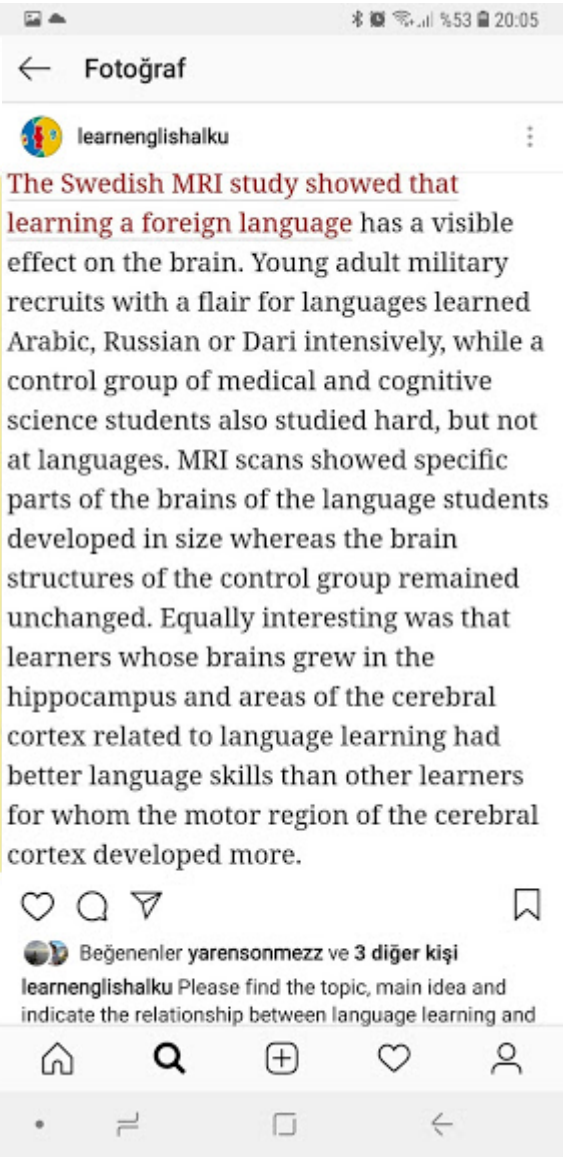

Figure 4

In the pre and post-tests, both the experimental and the control group students were administered achievement tests for comparison and the effectiveness of Instagram on students' language learning was then tested statistically. The achievement tests were taken from the assessment book provided by the publisher given only to classroom teachers. Thus, the students had no chance to reach these tests previously.

Data Analysis

The data collected in the two studies were analyzed in both quantitative and qualitative manner. In the quantitative analysis of the data collected using the scale, an initial reliability measurement was made and the scale was found to be reliable for the further analysis. In the analyses, the data in scale form where the participants responded the blank question (Item 28) were not utilized. Following the reliability check, mean scores and percentages were utilized in addition to t-test computation for dependent and independent variables. In the analysis, the missing parts were removed.

Table 2. Reliability Measurement of Survey Tool

Cronbach's Alpha	N of Items
.89	28

In the analysis of the survey items, responses given were evaluated using participation levels based on the percentages and participation levels for the statements were found as Strongly Agree 3.21 – 4.00, Agree 2.41 – 3.20, Neutral 1.61 – 2.40, Disagree 0.81 – 1.60, Strongly Disagree 0 – 0.80.

Data gathered through the interviews with the students about the use of Instagram for educational purposes in language learning were initially transcribed and analysed using content analysis. The data were analysed by two co-raters and the most recurring categories and themes were identified. To ensure an agreement between the raters, Cohen's κ was utilized and the agreement between the raters' analysis was found as $\kappa = 0.76$, $p < .005$.

For the experimental study, the students' both pre and post-test results gathered by the achievement tests were also analyzed quantitatively, using SPSS 24.

FINDINGS

Findings for the Research Question 1

Aiming to reveal the students' opinions about Instagram for educational and language learning purposes, the scale used for data gathering had two parts: a demographic part which included items containing the participants' personal information as well as social media use routines, and a survey part with statements to gather data related to their opinions about the "Intensity of Using Instagram", "Using Instagram for educational purposes" and "Using Instagram for language learning purposes"; thus, the findings were presented in line with these aspects.

Table 3. Participants' Responses to Demographic Part of the Survey

Categories		**Frequency**	**%**
Having internet connected personal computer/mobile phone	Yes	217	99
	No	2	1
Having social media account(s)	Yes	202	92
	No	17	8
Time spent on internet	1-2 hours	38	17.4
	3-5 hours	110	50.2
	6-7 hours	28	12.8
	7+ hours	26	11.9
	Less than an hour	15	7.7
Using social media for educational purposes	Yes	168	76.7
	No	51	21

The demographic part of the survey was aimed at finding out whether the participants' owned a personal computer or a mobile phone with which they can access the internet and social media accounts, as well as the amount of time spent online and whether they used social media platforms for educational purposes. To begin with, almost all the participants (99%) reported that they had internet connected personal computers or mobile phones, and 92 % of them had social media accounts. Half of the participants spent 3-5 hours, and 11.9% spent more than seven hours on the net every day. Only 7.7 % of the participants spent less than one hour on internet. The findings also show that a majority of them (76.7%) used their social media accounts for educational purposes. Apart from these, they were also asked which social media platforms they used (choosing more than one option was possible in the survey form).

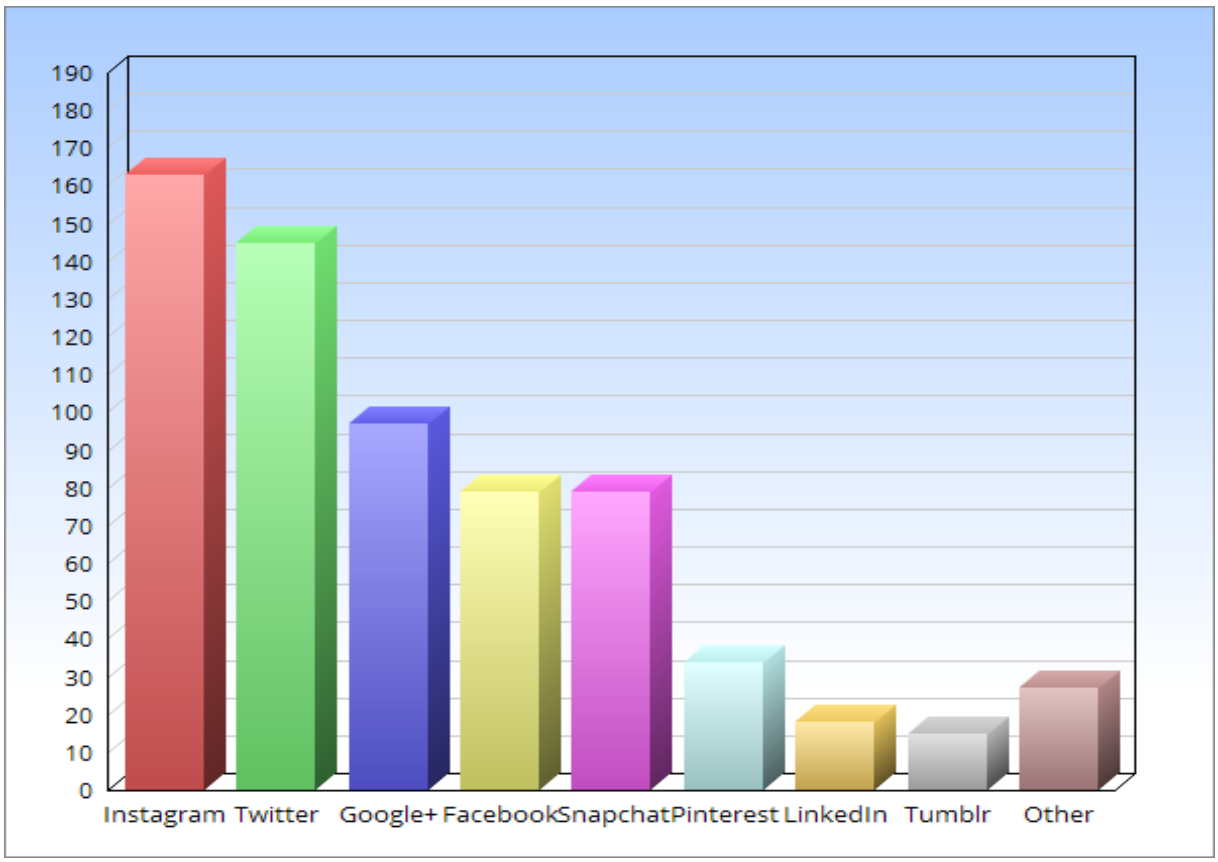

Figure 5. Social media platforms used by the participants

The most popular social media platform among the participants of this study was Instagram followed by Twitter and another popular platform, Google+, was ranked third. A great majority of the participants (n=163) had an Instagram account and this was a significant finding of the study. Despite the popularity of Facebook, the gathered data showed that participants used it less than the other platforms and it is worth noticing that Snapchat was equal to Facebook in terms of use among by them. Other platforms such as Pinterest, LinkedIn and Tumblr were among the least frequently used social media platforms.

The participants' opinions regarding Instagram for educational and language learning purposes were scrutinized under three main categories seeking to find out their intensity of Instagram use, use of Instagram for educational purposes and use of Instagram for learning English.

Table 4. Findings related to Use of Instagram as an Educational Tool

	N	Minimum	Maximum	Mean	Std. Deviation
Total Score	219	1.00	5.00	3.07	.66
Intensity of Instagram Use	219	1.00	5.00	2.78	1.15
Educational Purpose	219	1.00	5.00	2.99	.74
English Learning Purpose	219	1.00	5.00	3.45	.79

The participants' responses in the survey yielded that they had positive opinions, with a mean score of 3.07, regarding the use of Instagram as a learning tool in general. In order to have in-depth understanding of their opinions, the students' responses to the scale were evaluated in detail focusing on the most salient items representing each sub-scale.

Table 5. Intensity of Instagram Use

	N	Mean	Std. Deviation
Instagram is part of my everyday activities	219	3.56	1.37
I feel out of touch if I do not log into Instagram for a while	219	2.36	1.33
I see myself as a part of Instagram community	219	2.61	1.36
I would be sorry if my Instagram account were shut down	219	2.59	1.53

Regarding the intensity of Instagram use, findings show that the students strongly agreed Instagram being a part of their everyday activities. They also agreed that they considered themselves as a member of the Instagram community and that they would feel sorry if their Instagram accounts were shut down. On the other hand, they partly agreed that they felt out of touch when they did not log into Instagram for a period of time. Thus, it seems clear that the participants intensely use Instagram in their daily routine, and they regard themselves as part of the Instagram community leading them to feel sorry and out of touch when they do not log into their accounts.

a) Students' opinions regarding Instagram use for educational purposes

As for the second sub-scale of the survey, the students held the opinion that Instagram could be used for various purposes as an educational environment and the mean score for this aspect was found to be 2.99 indicating the positive perceptions of the participants for this sub-scale.

Table 6. Using Instagram for educational purposes

	N	Mean	Std. Deviation
Using Instagram for educational purposes would be convenient	219	3.15	1.30
Instagram could be used to support face to face learning	219	2.88	1.31
Using Instagram for class could promote motivation for learning	219	2.79	1.35
Using Instagram for class could make me feel more connected to my learning community	219	2.81	1.36
Instagram could be used effectively to share class materials	219	3.41	1.25
Using Instagram as an educational platform could promote better rapport with peers	219	2.91	1.30
Instagram could be an effective way to collaborate with peers	219	3.36	1.22
Instagram could be an effective way to communicate with peers	219	3.57	1.21
I feel that my privacy would be invaded against my class mates if Instagram is used for class	219	2.54	1.24
I don't care one way or the other about Instagram's being used for educational purposes	219	2.47	1.41

Beginning with the highest score items, Instagram was regarded as a useful educational tool to communicate (M=3.57), to collaborate (M=3.36) and to increase rapport with peers (M=2.91), in addition to its effectiveness in sharing the class materials (M=3.41). In fact, these findings indicate that students had the opinion that Instagram could be an auxiliary learning tool in aiding face to face learning by creating a positive learning community. As another notable finding, the participants were of the opinion that it could be a motivating learning tool when utilized effectively for class (M=2.79).

b) Students' opinions regarding Instagram use for language learning purposes

As the final sub-scale of the survey, the highest mean score was about the aspect of Instagram for learning and practising English (M=3.45) indicating the students in the study agreed and favoured this use of Instagram.

Table 7. Instagram for a language learning purposes

	N	Mean	Std. Deviation
I learn new vocabulary when I interact in English with other people.	219	3.89	1.19
I see that my English has improved since I started interacting with people on Instagram	219	3.44	1.21
I believe using Instagram helps me learn new English language structures.	219	3.31	1.27
I prefer Instagram because I can communicate with different people from all over the world	219	3.59	1.32
I am exposed to real language when I interact in English on Instagram.	219	3.39	1.26
I feel no pressure when I make mistakes on Instagram.	219	3.52	1.32
I feel that Instagram is a natural place in which to practise English because there is meaningful interaction amongst people	219	3.27	1.23
I feel discouraged thinking my peers see my mistakes in English on Instagram for educational purposes	219	2.31	1.28

I feel that Instagram is an encouraging place to practise English because no one judges my mistakes.	219	3.24	1.20
I follow people with whom I can interact on Instagram to practice English.	219	3.43	1.46
Using Instagram offers new ways for me to practise English.	219	3.53	1.17
I feel good when I practise English on Instagram.	219	3.96	1.11
I am more internationally connected when I interact in English on Instagram.	219	3.76	1.19
I am more comfortable communicating in English on Instagram.	219	3.62	1.17

When the items in this sub-scale of the survey are closely examined, they reveal that Instagram made students feel good when they practiced English on this platform (M=3.96) and they could learn new vocabulary items upon interacting on Instagram (M=3.89). Also, Instagram enabled the students to become internationally connected (M= 3.76), and students felt more comfortable communicating in English on Instagram (M=3.62). Obviously, one of the reasons why Instagram was a preferred social media platform was because students could communicate with people across the globe (M=3.59), which meant that they were offered new ways to practice the language (M=3.58), and they felt no pressure for their language related mistakes when communicating with other people (M=3.52). Additionally, the students reported that they felt their English improved on Instagram (M=3.44) and they followed the people with whom they could interact on Instagram (M=3.43) since they also reported that they were exposed to authentic language (M=3.39) in which a meaningful interaction among people was created (M=3.27). Finally, findings show that Instagram was considered as an encouraging place for students to practice English (M= 3.24) helping them also to acquire new structures (M=3.31).

Findings for Research Question 2

In order to investigate whether Instagram influenced students' language learning, an experimental study was conducted for a period of ten weeks, and both the experimental and the control groups were administered an achievement test, taken from the assessment book of the main course book, in the pre and the post test. For the analysis of the data gathered through the achievement tests in the pre and the post test, a Shapiro-Wilk's test (p>.05) and a visual histogram inspection as well as Normal Q-Q Plot tests were carried out to check the distribution of normality; these tests showed that the achievement scores were normally distributed (p= .288).

To check the effect of Instagram on students' learning English, mean values for pre and post test scores were compared for each group and independent samples *t*-tests were performed for both the pre-test and the post-tests.

Table 8. Pre-test results for Control and Experimental Groups

		N	*Mean*	*Std. Deviation*	*Std. Error Mean*	*t*	*df*	*Sig. (2-tailed)*
Pre-test	Control Group	40	57.70	9.47	1.49	1.76	78	.08
	Experimental Group	40	61.60	10.26	1.62			

Findings indicate that the control and the experimental groups had similar achievement scores prior to taking experiment. In the pre-test, the mean value for the control group was 57.7 (SD= 1.49) while it was 61.6 for the experimental group (SD=1.62). The independent samples t-test analysis shows that the control and the experimental groups did not differ significantly in terms of their level of English based on their achievement scores; $t(78)=1.76$, p=.08.

Following the Instagram intervention, the students were administered the same achievement exam both in the control and the experimental groups. The test the effect of the Instagram use as a language learning environment, an independent samples *t*-test was conducted for the post-test.

Table 9. Post-test results for Control and Experimental Groups

		N	*Mean*	*Std. Deviation*	*Std. Error Mean*	*t*	*df*	*Sig. (2-tailed)*
Post-test	Control Group	40	62.45	8.85	1.39	-8.07	78	.000
	Experimental Group	40	78.30	8.70	1.37			

The findings based on the t-test analysis of the post-test show that there was a statistically meaningful difference between those who were exposed to language related content through Instagram, and those who were not (t=-8.07; p=.000). The mean scores showed a considerable increase on the part of experimental group (M=78.3) while the control group had lower mean scores in the post-test (M=62.45).

In order to have a detailed analysis for the effect of Instagram use for language learning purposes as an educational environment, paired-samples *t*-test was performed to investigate the correlations and the averages of the two tests for experimental group.

Table 10. Paired Samples *t*-test results

			r	*Sig*	*Mean*	*Std. Deviation*	*Std. Error Mean*	*t*	*df*	*Sig. (2-tailed)*
Experimental Group	Pair1	Pretest - PostTest	-.026	.873	-16.70	13.63	2.15	-7.74	39	.000

The paired-samples t-test results show that there was a negative correlation for the experimental group (r=-026) indicating that the Instagram intervention contributed significantly to students language learning based on the achievement tests as seen in the post test. Although the findings show that both groups had an increased post test results, the effect of Instagram on experimental group is evident as Table 10 shows.

Thus, the experimental findings of the Study 2 suggest that the students' progress in language learning can be supported through Instagram and it has a statistically significant impact as an educational tool for language learning purposes.

Findings for Research Question 3

The findings from qualitative data gathered through in-depth interviews with the voluntary participants from the experimental group following the Instagram intervention were presented based on the recurring themes.

Table 11. Recurring Themes of the Student Interviews

Themes	**Participants**
Exposure to Language	S5, S1
Enjoyment & Motivation	S2, S1, S4
Decreasing Social Media Barriers	S3, S2
Contribution to Developing Language Skills and Areas	S1, S3, S4, S5, S6
Eliminating the classroom barriers	S1, S4
Miscellaneous	S2, S6

One of the major findings of the interviews with the participant students is that Instagram use was an integral part of their daily lives and its use for language learning purposes increased their exposure to language out of the formal classes. For this theme, for example, one of the students (S5) stated that "…*out of the school, I spend most of my time on Instagram following the posts of my friends; since we started using out Instagram account for our class, I have started checking the posts for our lessons and spend time on checking my friends' replies to posts*". Similarly, S1 also said that "*I always check my mobile for Instagram or other social media accounts in the bus, at café or at dormitory. That is my habit anyway; but now I also check or come across the posts from the Instagram and I learn a lot because I see these posts almost every day.*"

Regarding the theme of "enjoyment", the participants stated that they had fun checking the posts and get motivated doing the tasks especially when they were required to shoot videos to tag their answers. Within this theme, the other dimension the students indicated was about the nature of the content. Focusing on these aspects, S2 explained that "*When I need to answer a question to a question on the post in speaking, I really spend time and take videos over and over and finally choose the best captured one. I love these activities and I feel motivated.*" Likewise, S1 stated "*I enjoy reading the posts after classes, because I work on these posts and remember the content better.*" One of the students (S4) said that "*I think, when the content of the posts is interesting, it is more motivating for me and I enjoy reading such posts more.*"

One of the striking findings of the interviews is that the students reported that using Instagram for language learning purposes prevented them from spending time for free and made them focused on their courses through exposure. They claimed that the habit of checking the updates or following the posts of their friends was the main factor preventing them from sparing time for studying. However, the use of Instagram with linguistic content for language learning purposes kept them on track in terms of language learning. Regarding this, S3 stated:

"I always spend time switching between my social media accounts, so I have difficulty in sparing time for studying. Now I spend my time on Instagram to overcome this difficulty; I can revise what I learned at school". Adding to this, another student (S2) claimed that *"While studying, I use my mobile to check my Instagram and get distracted. But now, I continue learning my subjects from Instagram."*

In relation to the effectiveness of Instagram on developing students' language skills and areas, almost all the participants (S1, S3, S4, S5, S6) expressed that the short videos and pronunciation exercises improved their listening skills in addition to developing their speaking. Also, they reported to have developed their reading especially finding out the topic and key words. To clarify, S6 explained that *"In Instagram, I especially benefitted from the vocabulary posts like idioms and phrasal verbs. Also, synonym words posted for the following courses made the courses understandable for reading texts."* Similarly, two of the students (S2 and S4) reported that they improved their speaking skills due to the video shooting as the post requirements by saying "*in class, I sometimes do not want to involve in speaking tasks, but it is quite enjoyable to post short videos for speaking and I posted several videos which I believe to have contributed my speaking."* Also, S5 stated *"Pronunciation related posts and exercises were particularly useful for me, so I purposefully worked on them."*

In terms of eliminating the classroom barriers, the findings showed that one of the effects of Instagram as an educational platform for language learning purposes was about removing the inhibition factors in students' participation in formal classroom settings. In relation to this, S6 explained that "*Normally, I feel shy in participating in the classroom activities or hesitate speaking for fear of making mistakes; however, in participating in Instagram posts while commenting, writing answers to questions or sending speaking videos I do not feel any pressure on me*." Likewise two other students (S1 and S4) stated they felt free for making mistakes while using Instagram for learning English by *saying "Unlike school lessons, it is more motivating for me to check our class posts and participate in the tasks because I do not feel inhibited"* (S1).

Additional findings of the study were related to the high level of preparedness to learn and the retention of the linguistic knowledge thanks to exposure. The participants stated that the posts shared following the formal classes increased their level of retention. In relation to this aspect, S2 said that *"…because I have difficulty in studying regularly, but the posts shared which included the course content enable me to remember them better."* One of the participants (S6) explained that the posts shared prior to courses increased her readiness level by saying *"sometimes, the Instagram posts included the content of the following courses of the next days, so I understood my lessons better because I was already familiar with them and I was ready for the lessons."*

DISCUSSION AND CONCLUSION

Together with the high popularity of social media platforms and their use in educational contexts for delivering and sharing information, a great body of research has focused on their effectiveness as educational platforms (Álvarez Valencia, 2016; Aydin, 2012; Derakhshan & Hasanabbasi, 2015; Jovanovic, Chiong, & Weise, 2012; Kalelioglu, 2016; Lomicka & Lord, 2016; McCarroll & Curran, 2013; Rios & Campos, 2015). On the other hand, as one of the most commonly used social media platforms, Instagram has gained more popularity especially in recent years although there are quite scant studies investigating its efficacy as an educational platform for language learning purposes (Mansor & Rahim, 2017); thus, the discussion of the findings of this study was based on the findings of other social media platforms. Aiming to fulfill the gap in the literature and to explore the effects of Instagram use for language learning purposes, this study found that social media is part of students' everyday life, which several other studies also supported (Boateng & Amankwaa, 2016; Boyd & Ellison, 2008; Lim & Richardson, 2016; McCarroll & Curran, 2013; Nicolai et al., 2017; Solmaz, 2017). Thus, it is evident that social media platforms have become an integral part of students' everyday practices as also found within this study. From this perspective, it is argued that the intensive use of social media as part of students' everyday lives (which in fact began with the introduction of Web 2.0 technology) could effectively be utilized for educational purposes particularly in higher education contexts (Hemmi, Bayne & Land, 2009).

The young generation's increasing tendency to use social media for various purposes, to communicate with their peers and others as part of a global community, to share their ideas and opinions, has increased pressure on educational institutions to use such social media platforms to connect with these students and to eradicate the barriers of the traditional classrooms for these students, with the utilization of these technologies for learning and teaching activities (Boateng & Amankwaa, 2016).

As it was also revealed in this study, the students themselves believe that social media platforms, Instagram in this particular context, can be used for specifically for educational purposes, as also explained by Wong et al.(2017). They state that social media platforms especially those with student-generated content or the social

media enhanced learning environment and the learning community, serve a base for autonomous and social learning in the daily lives of the learners. This study has also revealed that students specifically focus on the peer-related concerns (cooperation, collaboration, sharing of the knowledge, and being in rapport with each other) for the use of Instagram for educational purposes. In spite of not being conducted specifically for Instagram, this finding is also found in other studies related to Twitter (Krutka & Carpenter, 2016; Taskiran et al., 2016, 2018), Facebook (Aydin, 2012; Lomicka & Lord, 2016; Rios & Campos, 2015) and social networking sites in general (Alabdulkareem, 2015; Badri et al., 2017).

Thus, it is possible to claim that social media platforms and Instagram in particular for the purpose of this study, enable students to create a cooperative, collaborative and sharing atmosphere, supporting the formal classroom setting in addition to sharing class materials. One of the significant additional findings of our study which was also found in a number of other studies conducted for Twitter and Facebook is that the participants agreed Instagram could be used to support face-to-face learning. Chawinga(2017), for example, found that Twitter use played a supplementary role to formal classes while increasing the students' interaction time out of classroom. Similarly, Lim and Richardson (2016) recommended in their studies based on the findings that social media networks could be beneficially used to enhance face-to-face learning. Regarding this, some other authors also emphasize the supplementary use of social media platforms to support traditional classroom learning (see Abney et al., 2018; Aydin, 2012; Lomicka & Lord, 2016; Taskiran et al., 2018). It was also found in this current study that students regarded Instagram as a motivating tool fostering learning. As O'Keeffe(2016) states in her study that modern networking technologies enable the social media communities to share knowledge and create learning environments with students who are motivated to involve in learning activities in online spaces (p.4).

In terms of language learning purposes, Instagram was found to be an effective tool. Supporting this, Bista (2015) reports that the use of Twitter for educational purposes contributed to language learning by enhancing the social presence of the students. As Faizi et al.(2013) recommend the use of Facebook for language learning purposes in the forms of distant education, blended or face-to-face learning. Regarding this, Brick(2012) conducted a study to investigate the potential of social networking sites, in particular Busuu, for language learning in higher education context and concluded that these networking sites give chance to learners improve their communicative skills through practice opportunities. Similarly, Wong et al. (2017) also claim that social media platforms are appropriate to develop the learners' communicative skills in L2; however, they emphasize the significance of balancing the activities in the form of formal and informal, individual and social, meaning and form and input vs output instruction.

In the survey, it was found that being an authentic platform to practice the language or to interact with people, the learners did not feel stressed about making mistakes on Instagram in terms of showing up in discussions or contributing to comments. Specifically, Chawinga (2017) also found that the use of Twitter increased to response rates of the students with an encouraging effect on them unlike the total silence which was occasionally observable on the part of the shy students hesitating to participate in class activities. Thus, Chawinga (2017) stated that social media enabled the students to express themselves without inhibition. This finding was also consistent with the findings of Faizi et al.(2013) who, similarly, asserted that social media are beneficial for intimidated students to share their opinions and thoughts.

Because of the quite limited number of studies conducted on Instagram, the efficacy of this social media platform was previously unknown for educational purposes, in particular for language learning. Thus, to unveil the potential of Instagram for these purposes, the experimental part conducted for this study also showed that the students performed better in the post-test following the Instagram intervention supplementary to face-to face, traditional classroom. Though the findings of this study were compared with the findings of other social media related studies, a study conducted for Instagram for language learning purposes similarly supports the findings of this study. Mansor and Rahim (2017) highlighted in their studies that Instagram provided educational opportunities to students for language learning purposes since the students felt relaxed and spontaneous and they also stated that through Instagram tasks, learners were able improve their communicative skills as well as writing and reading skills. As both the survey and the experimental findings as well as interview findings of this current study show, it is evident that Instagram could be utilized to support students' language learning as it provides opportunities for them to practice the language with their peers and people around the world, by exposing them to language content out of the classroom in addition to improving their language skills as well as language areas.

Limitations of the Study

This study has a number of limitations in terms of the context and the participants. Initially, this study is limited to the EFL learners; thus, how Instagram use may affect the ESL learners may need a new study. Also, this study

is limited to the data collected from the participants of the study. Finally, the study also has limitations in terms of the content and skills shared with the participants during the experimental part.

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Perceptions of School Principals Working at Science and Social Sciences High Schools on the Characteristics of Innovative Teachers

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ABSTRACT
A school principal's perceptions of the definition of innovation in education, the teacher's role in providing innovation in the classroom, and the willingness to adapt to meet the needs of the modern student are important in the professional development of teachers. Teachers have a major role in educating future generations and principals are critical for it's implementation. As a result of scientific and technological advancements, society and students' needs differ. Teachers who will respond to these differences also need to have new approaches to teaching. In this context, research on the attitude of school principals toward the importance of teacher innovation is critical. The aim of this research is to determine the views of school principals working in the science and social sciences high schools towards innovation, innovative teachers, and practices of innovative teachers. School principals' views often vary on what is required to have a productive innovative classroom. A school principal's support and encouragement of teachers implementing innovative strategies in the classroom is essential. School principals have identified that teachers who follow the innovative approaches, are open to innovation, information technology, learning, development and collaboration. School principals expressed different views on the relationship between the teacher training at the university and the applications of innovative practices in the classroom.

KEYWORDS: Innovative, Innovative Teacher, Teacher Characteristics, School Principals, Qualitative Method.

INTRODUCTION
In the changing and developing world, rapid changes are taking place in the field of science and technology. These advancements effect educational processes. The effects of radical and rapid developments and changes on social and institutional structures in the field of technology in the 21st century, including education systems, appear in almost every field. (Uşun, 2000). In this context, the targets of the countries are: to educate citizens in the context of changes in science and technology, and to prepare them for the information society. Another responsibility of the countries is to create an environment open to changes in the information society that will allow teachers to better prepare their citizens for the future. In the changing world conditions, it is necessary to teach the ways of accessing information rather than mere knowledge. Additional responsibilities of the countries are to prepare individuals in problem solving, communication, cooperation, creativity, information and technology literacy. In other words, it is of great importance that the learners and thinkers adapt to change and make those changes sustainable. Innovation is defined as using concepts of creativity, originality, change and development. Innovation is the use of creativity to solve problems and inspire new technological developments. The relationship between innovation and technological developments has an important place in the development of societies, solving problems related to society, and increasing the quality of life of individuals. As a result of these developments and changes in science and technology, the expectations of societies and individuals are changing. In this context, education systems that can meet the changing expectations should be open to innovation, change, and transformation.

The importance of the concept of innovation in education has been emphasized by the European Union (EU) and the Organization for Economic Development and Cooperation (OECD) in the last decade. In addition, education and training, education reforms, excellence, innovation and competitiveness are determining factors in the studies on innovation in education (Shapiro et al, 2007). Within the scope of innovative education, EU countries aim to become information societies. Economic and technological changes in the 21st century have brought about educational changes for these countries. Because of these changes, it has become a necessity to reconstruct and redesign education (Catts, Falk and Wallace, 2011). This situational analysis necessitated the search and use of new teaching methods and techniques to develop the student skills required by the information society. Taking into

account the individual differences of the students in the educational processes has led to the creation of demands for innovative teaching and learning methods, and required more guidance for the students. (Baroncelli, Ioan Horga and Vanhoonacker, 2014). In traditional approaches, while the student takes on a passive role in acquiring knowledge, students acquire a more active and participatory role in the acquisition of knowledge in the sense of innovative education. The students who are actively involved in the acquisition of knowledge build knowledge in an activity-centered active process. The information age is changing not only the education systems but also the demands of the labor market. It is necessary to design innovative and knowledge-based learning-teaching processes to ensure the qualified and equipped manpower needed by the labor market. As can be seen, the meaning attached to the concept of innovative education varies according to the educational needs of the countries and their expectations for the future. Iceland, for example, began to implement innovative education in 1991 in the education system by teachers to develop children's creative skills as it sees innovation as important for its future and wealth. (Shavinina, 2013: p. 17). In the 21st century, the world is changing rapidly, depending on the rate of change, the countries' education, industry and sector expectations and qualified labor needs also change. In order to meet the changing workforce needs of the countries, individuals can be trained within the scope of innovative education. In the context of innovative education, the teacher has an important role in raising the generations that will meet the changing needs of the society.

It is now a necessity that teachers who serve as driving forces in the development of society and are highly qualified, lifelong learners, and innovative individuals, have a high stake in shaping the future generations (Kılıçer, 2011). In the last decade, the expectations of the society for teachers have differentiated and increased significantly. These high expectations necessitate additional training of teachers. Since the performance of the teacher is highly correlated with the academic success of the student, the quality of the teacher will have a profound effect on the academic success of the student. The teacher's mastery of new teaching methods encourages the student to take more responsibility in achieving academic success. In this context, it is necessary for teachers to enhance their own professional development and to integrate technology effectively in educational environments, and therefore, to be educated with a new understanding of teaching and learning (Cohan and Honigsfeld, 2011). At this point, a teacher need to be trained to be an innovative teacher.

The perception of the principal on the concept of innovation and the innovative teaching approaches is important for the development of the education system. Scientific and technological developments in the world require teachers to have innovative strategies. In this context, the school principals' perceptions and attitudes about innovation are seen as important for teachers to gain innovative teacher approaches In Turkey, science and social sciences high schools are perceived as high quality school education by society. When Science and Social Sciences High Schools are considered to be open to innovative learning, it is vital to explore the collaboration between the principals' perceptions and attitudes towards this approach to education and the degree teachers implement innovation in the classroom.

PURPOSE

The aim of this study is to determine the perspectives of the school administrators working in the high schools of science and social sciences. For this purpose, how do school administrators evaluate innovation and teachers' innovative teacher characteristics? The question has been sought.

METHOD

Research Design

The qualitative method was used in this study, which aims to determine the general situation of teachers working in the high schools of science and social sciences according to the opinions of the school principals. One of the qualitative research methods of the research is designed in the science (Phenomenology) pattern. The most basic feature of the phenomenology pattern is to reveal and interpret the individual's experience, perspective or perceptions related to a particular phenomenon. (Yıldırım and Şimşek, 2011). In other words, phenomenology is to make it clearer by understanding the meaning, structure and essence of the experience of the individual or group related to a case. (Patton, 2014). The aim in science is the meaning that the individual creates in the world. The life of the individual and the environment in which the experience passes are important. It is important to present in the depth of the literature both in the literature, in the literature, in terms of the subjects in the literature, in the cases and dimensions of the patients, in terms of the cases they live, feel and feel. (Aydın, 2014). In this study, semi-structured interview forms about the levels of teachers' innovative teacher traits were used according to the opinions of the school principals.

Study Group

Maximum diversity sampling which is one of the purposive sampling methods was used in obtaining qualitative data. The purposeful sampling method is used to examine a subject in more depth or detail. In order to discover

and explain the events and facts, a purposeful sampling method is used (Yıldırım and Şimşek, 2011; Akarsu, 2014). The purposeful sampling method is preferred when it is desired to work in one or more specific situations that meet certain criteria or have specific characteristics (Koç Başaran, 2017: pp.480-495). In this sampling method, the researcher selects the participants who can best respond to their goals until they reach a certain number of samples. The researcher's judgments and abilities are in the foreground in the election (Aziz, 2014; Creswell; 2016). In the maximum diversity sampling, which is one of the purposive sampling methods, the aim is to find out whether there are any common or shared phenomena between the different situations and to reveal the different dimensions of the problem according to this diversity. In order to obtain the data of the study, the preferred sample (a) seniority, (b) gender, (c) school type, such as the kind of school principals who show differences. As a result, it was decided to consist of 19 school principals in public / private science and social sciences high schools in Ankara.

Data Collection and Analysis Process

In order to collect the data of the research, a semi-structured interview form was developed to be applied to the school principals in the context of innovative teacher characteristics. The interview form developed was examined and the expert opinion was obtained from eight academicians working in Yıldız Technical University, Gazi University and Muğla Sıtkı Koçman University Curriculum and Instruction and Computer and Instructional Technologies Education departments. The opinions and suggestions of the experts about the interview form were evaluated and an arrangement was made. The developed executive form was shared with 5 school principals working in high schools of science and social sciences. In line with the opinions received from the school principals, the interviewer was re-shared with the academician who took the field and reconstructed and prepared for trial application. The interview form was applied to 14 school principals. After the preliminary experiment, the final form of the interview form consisting of 10 questions is given.

In order to collect the data of the research, the schools were visited on different dates and interviews were conducted with the school principals in the environments where school principals could feel comfortable. The interviews were conducted with the permission of the school principals on the basis of voluntariness. During the implementation of the interview form, 19 interviewers in the high schools of science and social sciences were interviewed. The answers of questions that did not allow an administrator voice recording were transferred to the text. After receiving permission from the school principals, the interview questions were asked in the same tone. Voice recorders and school principals' opinions have been recorded. The management interviews lasted 15 minutes on average. During the interviews, a total of 270 minutes of interviews were made with the voice recorder. The data was checked by an expert.

The data of the study were analyzed by thematic content analysis (Burnard, 1991). Content analysis is the search for some terms and expressions in the text by searching and analyzing them by categorizing within a system (Neuman, 2008, Böke, 2014). Thematic analysis involves conducting research to reveal the issues that are important in describing a phenomenon, identifying the patterns of relationship within the data and re-reading the data and identifying the themes (Fereday and Muir-Cochrane, 2006). Thematic analysis is a process for investigating and identifying common themes mentioned in the interviews (DeSantis and Noel Ugarriza, 2000).

In the research, both the codes were determined and the thematic analyzes of the data were made in detail and the frequencies of the codes and codes were described by determining the frequency of mentioning these themes by the participants. Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8, Y9, Y10, Y11, Y12, Y13, Y14, Y15, Y16, Y17, Y18, Y19 are given for the school principals. The main themes, themes and codes were created for each question in the interview forms. In the data analysis, inductive and deductive approach are used together. Inductive approach in questions 1 and 7 asked during the interview process, 2. 3. 4. 5.6. and 8, the inductive approach was used as the main approach. The themes determined as a result of qualitative data analysis are shown in Figure 1.

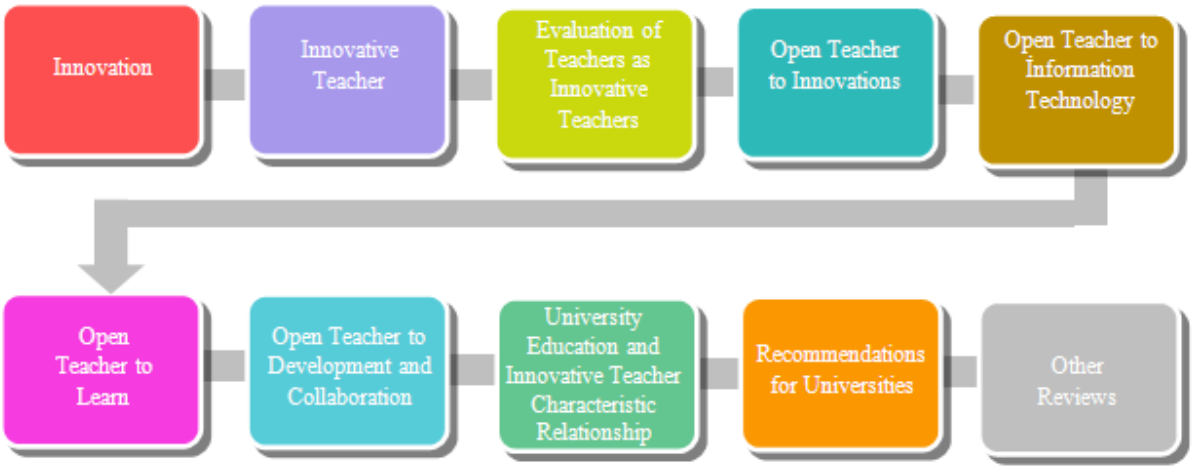

Figure 1. Themes Based on Data Analysis

The validity and reliability study of the interview form was conducted. Within the scope of the research, information about how data is collected and analyzed is explained in detail. The validity of the research was carried out in two stages (1): The data analysis process is explained in detail (2). Interviews of school principals were used as the main data source in the processing and interpretation of the findings. In order to ensure the reliability of the study, two different expert opinions were consulted in Educational Programs and Teaching Science in order to confirm whether the sub-themes determined in the research represent a theme under conceptual themes.

FINDINGS

1. Theme: Innovation

In this theme, it has been tried to determine how the concept of innovation is perceived by school principals. The meaning that school principals attach to the concept of innovation; It is important for the evaluation of teachers' innovativeness. The question of "What do you think innovation means?" As shown in Table 1, the opinions of the school principals about innovation are gathered around two sub-themes, individual innovation and innovation in education.

Table 1. School Principals' Opinions on Innovation

What do you mean by innovation?			*School*
Theme	Subthemes	Codes	*f*
Innovation	Individual Innovation	To adapt to the requirements of the era / new	5
		Self-renewal	4
		Following developments in science and technology	2
		Open to innovation	3
		Self-development	1
		Being willing to learn	1
		Open to developments	1
		Total	17
	Innovation in Education	Improving system / existing	4
		Following the developments	4
		Guiding the student / developing the student	2
		Following and applying to daily	1
		Keeping up with the times / adapting to change	2
		Preparing students for the future / life	2
		Total	15
Final Total			32

Individual innovation: According to Table 1, the frequency of talking about the main theme of individual innovation is f = 17. With the frequency of f = 9, the most common themes have become the most important

themes. Other themes mentioned by the school principals have been to follow developments in science and technology, to be open to innovations, to develop themselves, to be willing to learn and to be open to developments. One of the statements of the school principals regarding this theme is given below:

" Innovation means being open to new things ... willing to learn new knowledge and skills " **Y2**

On the other hand, it has been emphasized that every innovation should not be accepted, that innovation must be in accordance with our own conditions and culture, and that innovation should continue to develop the existing one. One of the participant school principals expressed this as follows:

" For me, innovation means to follow the age without losing our beliefs without losing our traditions and customs without losing some of our values. " **Y13**

Innovativeness in education: School principals have expressed the importance of innovation in education, preparing students for the future / life, guiding the student / developing the student, following the developments, following and applying to daily, keeping up with the times / adapting to change. One of the statements of the school principals regarding this theme is given below:

"Anything that can help children in adapting to the changing world, can guide, integrate them with the world and facilitate the learning of children can be evaluated within the scope of innovation. " **Y6**

2. Theme: Innovative Teacher

In this theme, it was tried to be determine how the concept of innovative teacher is perceived by school principals. The meaning of the school principals to the concept of innovative teachers is important for the evaluation of teachers' innovativeness. The question of "What do you think the definition of innovative teacher means?" school principals' views on the innovative teacher coincide with three of the four competencies (Learning, Educational, Technology, and Social) identified by Zhu, Wang, Cai and Engels (2013). Participants' views on the innovative teacher are grouped under three main themes: learning competence, educational competence, knowledge and technology competence. The opinions of school principals are presented in Table 2.

Table 2.Views of the School Principals on the Innovative Teacher

What do you think the innovative teacher means?			School
Theme	Subthemes	Codes	f
Innovative Teacher	Learning Competence	Self-renewal / development	7
		Keeping current with change	4
		Open to change / innovations	6
		Keeping up with developments / innovations	4
		Tracking developments / innovations	1
		Open to learning	1
		Total	23
	Educational Competence	Using methods and techniques according to student's characteristics	4
		Using new teaching methods and techniques	2
		Using different teaching methods	3
		Adapting innovations to the system	2
		Risk taking (in the process of education)	1
		Total	12
	Knowledge and Technology Competence	Using technology	7
		Following and applying current information	2
		Access and using information	2
		Total	11
Final Total			46

Learning Competence: According to the school principals who participated in the research, self-renewal and development, keeping current with change, being open to change and innovations, adapting to developments and innovations, being open to learning, being open to research and having goals for the future, were covered by the learning ability of the innovative teacher. One of the statements of school principals about the theme of learning competence is given below:

"... constantly renewing them self..." Y1

Educational Competence: The educational competence for the school principals is explained under five subjects, by using the methods and techniques, using different teaching methods, using new teaching methods

and techniques, taking risks and adapting the innovations to the system by understanding student characteristics. One of the statements of the school principals on the theme of educational competence is given below:

"The innovative teacher is a teacher who can take risks, is not afraid of changes, and can use new teaching methods and techniques." **Y5**

Knowledge and Technology Competence: According to the school principals, the knowledge and technology competence of the innovative teacher includes using technology, accessing and using information, keeping up to date and practices and changes / behaving according to the requirements of the times. One of the statements of school principals about the theme of information and technology competence is given below:

" Innovative teachers are called teachers who are open to new knowledge in their field and who can use the technology. Independently from old." **Y2**

3. Theme: Evaluation of School Principals as Teachers' Innovative Teachers

The school principals were asked the question 'Can you evaluate your teachers as being an innovative teacher?' 17 of the school principals were able to evaluate whether the teachers were innovative or not, and the two school principals did not comment on this issue. The opinions of the school principals are presented in Table 3.

Table 3.Distribution of School Principals' Evaluation of Teachers as Innovative by Themes

Can you evaluate your teachers as an innovative teacher?			Yes All	Yes Some	Yes Diligent	No	Total
Theme	Subthemes	Codes	f	f	f	f	f
Evaluation of Teachers as Innovative Teachers		General	6	8	2	1	17
	Discovering innovations and presenting innovations to students	Open to innovation	1	1	-	-	2
		Using different teaching methods	1	1	-	-	2
		Developing professional knowledge and skills	1	1	-	-	2
		Preparing students for the future	1	0	-	-	1
		Following students to research	1	0	-	-	1
		Respecting other ideas	0	1	-	-	1
		Guiding students	1	0	-	-	1
		Total	6	4	-	-	10
	Access to information and monitoring of information technologies	Access to information	0	1	-	-	1
		Information technology monitoring and using in lessons	0	1	-	-	1
		Total	0	2	-	-	2
	Open to development and cooperation	Follow scientific developments	1	0	-	-	1
		Total	1	0	-	-	1
		Final Total	13	14	2	1	30

As seen in Table 3, the comments of the school principals are shaped under the theme of discovering innovations and introducing innovations to the students. It was seen that teachers who stated that some of the teachers were innovative also were referring to the themes of accessing information, using information technologies, and using them in lectures. From the statements made by the school principals on this subject, the first statement below is given for those who think that all are innovative, and the second one is for the second one is for those who think that they are innovative:

"I can evaluate our teachers as an innovative teacher. They want to use different teaching methods ... They are also trying to guide the children in preparing for the future and doing research. We are trying to follow the latest developments for him to say that my teachers" **Y14**

"I cannot evaluate the teachers we work with as an innovative teacher. Maybe half the innovative teacher. 50% of them are innovative teachers. He must respect other ideas to be an innovative teacher. He / she needs to

improve his / her professional knowledge and be open to different teaching methods and techniques. I can say that half of the teachers we work with are in accordance with the innovative understanding." **Y10**

4. Theme: Open Teacher to Innovations

Within the scope of this theme, "*How do you evaluate your teachers in terms of discovering innovations and providing innovations to students?*" question was asked. In Table 4, The answers of the school principals on this question are shown thematically.

Table 4. School Principals Teachers Discovering Innovations and Evaluating Students in terms of Presenting Innovations: Frequency of Thought by Themes

How do you evaluate your teachers in terms of discovering innovations and providing innovations to students?			Yes All	Yes Some	No	Total	Unanswered
Theme	Subthemes	Codes	*f*	*f*	*f*	*f*	*f*
Open Teacher to Innovations	Open to	General	10	4	1	15	3
	Using Different Teaching Methods	General	3	5	0	8	
		Smart board	3	0	0	3	
		Constructivist	3	0	0	3	
	Preparing Students for the Future	General	15	1	0	16	2
		Social and spiritual	5	0	0	5	
		Academically	3	0	0	3	
	Directing Students to Research	General	12	3	1	16	2
		Olympics, projects, homework	6	1	0	7	
	Respecting Other Ideas	General	13	1	0	14	4
		From teacher to	1	0	0	1	
		From teacher to	2	0	0	2	
	Using Teamwork in Lessons	General	13	1	0	14	4
		Among students	4	0	0	4	
		Among teachers	9	0	0	9	
	Developing Professional Knowledge and Skills	General	11	2	1	14	4
		Course, seminar in-service training participation	3	0	0	3	
		Final Total	74	17	3	97	19

Open to innovation: Of the 18 school principals participating in the study, 15 evaluated the teachers in terms of being open to innovation and three of them did not. Among the evaluators, 10 school principals stated that teachers are generally open to innovations, 4 school principals are open to some, and one school principal is not open to innovations.

"teachers open to innovations." **Y1, Y2, Y3**

The school principals who think that some of the teachers are open to innovations said:

"... we don't have a very old staff if we think of the staff we work for, so most of our staff are young or a little below middle age. of course, young teachers may be more open, but there can be extreme examples. There are also teachers who are over 40-45 years old and who can apply all kinds of innovations, new and beautiful, of course, who are able to implement them and who are aware of the developments that are related to them. In addition to him, we have teachers who are young and in the mood for learning his profession at the moment. We also have teachers who try to be aware of everything, trying to learn what they are aware of and trying to convey what they have learned to their students." **Y4**

Using different teaching methods: 10 of the school principals stated that teachers used different teaching methods, 5 teachers used some of them, and 4 school principals did not address this theme. Teachers who use different teaching methods to make a theme-based explanation of the school principals use smart boards and constructivist approach to homework, project, and laboratory activities.. Here are two examples of school principals who reported using different teaching methods:

" Our teachers use different teaching methods and techniques they used the chalkboard and question-answer methods. Now, with a constructivist approach, new textbooks were created with smart boards." **Y7**

Below is an example of how different teaching methods are used by many:
"Our teachers use different teaching methods and techniques in part." **Y17**

Preparing Students for the Future: 16 of the school principals stated that preparing students for the future was done by all the teachers and one of the teachers prepared some of the students. 2 school principals did not address this issue. The theme of preparing the student for the future was discussed by the school principals regards to two areas, academic and social.
"If we evaluate the students in terms of preparing for the future, they prepare their academic self-confidence as a social skill. In this sense, our teachers are in an effort to express themselves, to read the world, to follow developments and to make them realize how important they are in their lives." Y8
An administrator who believes that some of the teachers are working to prepare students for the future, said:
"Some people are aware of it, some are only responsible for teaching and transferring their subjects. Some of them both teach them and a little bit of colloquially trying to open the eyes of the future forward-looking business courses, whether his activities, whether or not his assignments always direct students towards this type of research, there are teachers directing." **Y4**

Directing Students to Research: Twelve of the school principals mentioned that teachers were directing the students to research, 3 of them were directing some of the students and 1 stated that the teachers had difficulty in using research so did not assist students in learning to use research. Teachers who direct students to research stated that they did this through projects and class assignments. A school principal said:
"They're directing our students to research. Science festivals are held every year in our school. Our children are learning to do projects at this age. They're learning to write a thesis. They are learning academic honesty. " **Y3**
One school principal believes that directing students to research is hardly possible, The reason for this is the burden of the curriculum.
"'This is unlikely because of the secondary education success point. Students do not have to give extensive research topics. Our teachers have a serious curriculum load. Our teachers need to finish this. Our teachers do not direct research because of their curricular burden." **Y9**

Respecting Other Ideas: 14 of the school principals who participated in the study showed that teachers respected other ideas, 1 of them respected some of ideas. Three school principals used more general expressions such as the importance of respect, but did not evaluate teachers about it. Only two of the school principals explained the importance of respecting other ideas, and one addressed both teachers respecting other teachers ideas and for the respect of ideas of their students.
"We have teachers from different perspectives, different values and different unions. Our teachers discuss in a free environment within the framework allowed by law. I had never had a discussion of the fight between my teachers. The development of democracy with tolerance and the friendship of teachers with each other empathic approach, people respect and love each other Human love is among our teachers." **Y7**

Making Teamwork in Lessons: There were a total of 13 school principals who stated that they had teamwork for all of the teachers, detailing the theme by mostly focusing on the teacher's teamwork with the teacher friends. One of the school principals mentioned that some of the teachers used team work and the other four school principals did not mention team work. Here is an example of an executive view:
"... especially in projects, our friends give great importance to team work. This is also happening in preparation for life, especially when the project should have done a few people did not have trouble until now obviously. "**Y14**

Developing Professional Knowledge and Skills: In terms of developing professional knowledge and skills, 11 school principals stated that teachers developed themselves. Only 3 school principals elaborated on the subject and stated that teachers developed their professional knowledge and skills through in-service training. Below is an example view:
"We release our teachers for in-service training. Here the teacher develops itself very well." **Y3**.
The opinion of one of the two school principals who pointed out that only some teachers developed their professional knowledge and skills is as follows:
"Some of them are open to all kinds of innovations in order to develop their professional knowledge and skills. But there are also teachers who are monotonous, who have assigned all of the subjects and works to the task and focused on finishing them somehow." **Y4**
One of the school principals explained that the teachers could not find the time or opportunity to develop themselves and explained the reasons for this.
"Our teachers do not find the opportunity to develop their own knowledge and skills. Teachers develop their professional knowledge and skills if there are improvements in the form of salary increase, either materially or

morally, that the teacher uses in his or her own knowledge and experience in an appropriate environment. This is not happening much.' **Y10**

5. Theme: Open Teacher to Information Technology

Within the scope of this theme, school principal asked the question "How do you evaluate your teachers in terms of accessing information and monitoring information technologies?" In Table 5, the answers of the school principal on this question are shown thematically.

Table 5.Evaluation of Teachers of School Principals in terms of Accessing Information and Monitoring Information Technologies

How do you evaluate teachers in terms of accessing information and monitoring Information technologies?			Doing	Doing But Not enough	Total	Unanswered
Theme	Subthemes	Codes	*f*	*f*	*f*	*f*
Open Teacher to Information Technology	Access to information	General	17	2	19	0
		Using Internet	6	0	6	
		Use of Technological Devices	2	0	2	
	Monitoring websites with educational content	General	16	0	16	3
		Education Information Network (EBA)	8	0	8	
		Other	4	0	4	
	Use technology to investigate and evaluate information	General	2	0	2	17
	Monitoring and using information technologies	General	15	4	19	0
		Smart board	8	0	8	
		Video	3	0	3	
		PowerPoint program	2	0	2	
	Guiding these issues	General	16	0	16	3
		Between teachers	16	0	16	
		Final Total	66	6	72	23

Access to information: *S*chool principals interpreted the concept of access to information as using technology to reach information. The following excerpt is an example:

"They use technology to reach information; they watch websites with educational content." **Y2**

The vast majority of school principals stated that teachers use technology to access information, only two of them stated that teachers use technology to access information but not enough. School principals expressed this idea as follows.

"I think that teachers are insufficient to reach information and use information technologies in lessons. The way teachers grow is preventing them from using information technologies. Today we live in the Internet age, even in small children have Internet. Children can enter everywhere; but my colleagues, including me, have met with the computer too late." **Y1**

Technological devices and internet usage emerged within the scope of the comments of the school principals detailing the use of technology to reach the information. Two of the school principals referred to both, and four only used Internet. For example, a school principal said:

*"If we evaluate teachers in terms of accessing information and monitoring information technologies, we cannot say that they are all not following. The Internet is now accessible to everyone in the area. In terms of access to information, internet is used instead of books." **Y13***

Monitoring websites with educational content: school principals do not monitor educational websites; mentioned the use of web sites with educational content. Among the 19 school principals participating in the study, 16 of them stated that the teachers used educational web sites, three of them did not mention this issue. The school principals who gave details about this issue mentioned frequently on the web of Education

Informatics Network (EBA); four school principals also referred to other web sites (Vitamin, Morpa Campus, Academy, etc.) Here is an example of the statements of school principals on this issue:
"They use EBA in the first place and they use other sites like the Academy." ***Y14***

Use technology to investigate and evaluate information: Only two school principals mentioned this issue, the other 17 school principals did not mention. As can be seen in the quotations given directly below; the statements of these two school principals are quite superficial, just as they are asked. This theme is perceived as very similar with the theme of access to information; may have escaped the attention of the school principals:
"They use technology to investigate and evaluate information." **Y2**

Monitoring and using information Technologies*:* Fifteen of the school principals who participated in the study reported positive opinions about their teachers. four found the teachers insufficient. The school principals detailing this theme mentioned the primary use of smart board and then the use of video and PowerPoint program.
"Teachers use smart boards information technologies tools and equipment in their lessons." **Y9**
"They use PowerPoint presentations and videos in lessons." **Y7**

Guiding these issues: The school principals who participated in the study perceived the guidance as being guidance in the use of information technologies. They approached the use of information technologies as guidance, help, or assistance, and discussed this in the context of the cooperation of teachers. Three of the school principals who participated in the study did not mention this theme, and 16 of them mentioned that teachers helped each other in using information technologies. Here is an example of an executive view on this topic:
"There is some help in using information Technologies.". **Y2**

6. Theme: Teacher open to Learning
Within the scope of this theme, school principals were asked to evaluate teachers in terms of being open to learning. Table 6 presents the evaluation of the school principals in terms of being open to learning of their teachers.

Table 6. Evaluation of School Principals in terms of Being Open to Learning Teachers

How do you evaluate your teachers in terms of being open to learning?		Yes General	Yes Some	Total	Unanswered
Theme	Codes	f	f	f	f
Being open to learning	Applying new developments in school	12	4	16	3
	Search for authenticity in their work	13	1	14	5
	Being open to learning	6	3	9	-
	Devotion to learning	4	3	7	-
	Being willing to learn	4	1	5	-
	Final Total	39	12	51	8

Applying new developments in school: 16 of the school principals participating in the study expressed their opinions on this issue while three left this unanswered. The majority of the school principals who stated their opinions said that teachers implemented new ideas and concepts in the school. Here is an example of a school principals 's statement that teachers are willing to implement innovations:
"If we evaluate the new developments in the school in terms of wishes and desires, it is very high." **Y8**
Some of the school principals' opinions about the willingness of some new teachers to implement new developments in the school are as follows:
"Our teachers are not very interested in new developments in the school. For example, let me give an example of a project that will be launched in our school, we had only 4 teachers applied to this article." **Y18**
A school principal who shared some details on this issue said:
"Our teachers cannot allocate time because of their high time in the application of new developments in the school. Or, he doesn't want to. There is reluctance in these respects. The teacher is interested if new developments are material. Sometimes we have to say forcefully do this." **Y10**

Originality Search: In this regard, five school principals did not share opinions; and the 15 school principals who expressed their opinions said they were looking for originality in the teachers work. Some of the school principals who thought that teachers were looking for originality in their works, stated:

"Our teachers are looking for originality in their work. Here are their egos as well. Our teachers contribute when they are honored or honored in their studies. " ***Y10***
The school principal, who was of the opinion that some of teachers are looking for originality in their work and that some of them do not care to seek, stated:
"If we evaluate the originality search status in their work; we can say that half of you have the status of making some. Some of them are trying to contribute to new self-produced things." **Y5**

Being open to learning: Seven of the school principals participated in the study stated that the teachers were open to learning, and 3 of them were not very open to learning. One of the school principals who stated that following:
"Our teachers are open to learning if they have a need for serious learning, they are doing the necessary work to meet these needs " **Y9**
Two of the three school principals expressed that some of the teachers were open to learning and others of them were not as open to learning new things. The younger teachers appeared to be are more open to learning.
"Being open to learning, our advanced age teachers are also low. Our middle-aged and young teachers explain more to learning." **Y19**

Devotion to learning: The opinion of the school principal who believes that teachers are determined to learn is presented below:
*"Our teachers are determined to learn. "***Y 7**
Some of the teachers are determined to learn, some of them are not determined, said the school principals:
"Some of the financial situations of our teacher's is good economic opportunities to get information from the subjects you are talking about whether you get wonder whether you get ambition whether you can see them. But even in such a feeling that some of them cannot do it." **Y4**
Being willing to learn: Here are two examples of statements from school principals who consider teachers as being willing to learn.
"Our teachers are eager to learn." **Y6**
Some of the teachers are willing to learn, some of them are unwilling an administrator said:
"The desire to learn is changing personally. We also have teachers who are open to innovations, and we have teachers who are stationary." **Y10**

7. Theme: Open Teacher to Development and Collaboration
Within the scope of this theme, in Table 7, school principals are given the opportunity to evaluate teachers in terms of being open to development and cooperation. As shown in Table 7, in the evaluation of teachers in terms of being open to development and open to cooperation, in addition to the three previously given categories, two more categories have added. These categories are being open to development and cooperation, and to find meaningful participation in international projects. Only the pre-determined issues have frequencies of the school principal who mentioned them in their comments

Table 7. Evaluation of Teachers in Terms of Being Open to Development and Cooperation of School Principals

How do you evaluate your teachers in terms of being open to		Yes	No	Some	Total	Unanswered
Theme	Codes	f	f	f	f	f
Open Teacher to Development and Collaboration	Attending in-service trainings	12	2	3	17	2
	Collaborating with other teachers in international projects	3	7	3	13	5
	Follow scientific developments	14	1		15	4
	Finding participation in international projects	11	-	-	11	-
	Open to change and cooperation	3	-	2	5	-
	Final Total	43	10	8	61	11

In-service training: All but one of the school principals evaluated their teachers to participate in in-service training. More than half of the school principals who expressed their opinions stated that the teachers participated in the in-service training, two of them did not participate, three of them participated, some of them did not participate.
A subject emerging in the participation in in-service training has been voluntary or obliged to participate in the training beyond whether or not the teachers participate.

"Our teachers are trying to participate in in-service training within the scope of the possibility of my own will to go there is a conference, there is obviously such a thing does not participate. If the Ministry organizes it as a school management, we do not see much resistance to it. " **Y14**

An school principal who expressed that teachers do not want to participate in in-service training, said::

" They have reservations at the point of attending in-service training. They do not think that in-service training they participate will benefit them. They sometimes consider in-service training as a loss of time. The same things are statically repeated in in-service training courses. Sometimes they think theoretical approach is not practical. They participate in in-service training when they have to." **Y10**

Cooperation with other teachers in international projects: School principals have interpreted cooperation with other teachers in international projects as participation in international projects. Only three of the school principals stated that teachers participated in international projects, seven were not involved, and three were involved in some of them. The other five school principals did not evaluate the teachers. The following are two examples of Executive views that indicate that most or some of their teachers participate in international projects:

"Our teachers participate in international projects and continue their participation. Our teachers provide good sharing within international projects. Our teachers need to be good in English. I think that foreign language education should be increased especially for teachers." **Y11**

Two school principals said that teachers did not participate in international projects.:

"We don't have a teacher who looks very hot at international projects, we don't have a teacher who participates in international projects and develops himself." **Y12**

Another school principal stated that they supported participation in international projects, but there was no interest in participation:

"We support the teachers of different countries to make projects, but the environment and opportunities have not developed." **Y4**

Follow scientific developments: 15 of the 19 school principals, who participated in the study, evaluated whether their teachers followed scientific developments closely; all but one of them expressed that their teachers followed scientific developments. School principals did not elaborate on this issue, they only stated whether, or not,r they followed it. Samples expressions in this topic are listed below:

"*They follow scientific developments."* **Y3, Y6, Y7**

"They don't follow scientific developments very closely." **Y18**

Finding opportunities for participation in international projects: However, 11 school principals, including those who did not evaluate, expressed that international projects contributed to the development of teachers as innovative teachers.

"Our teachers have not participated in any international project. The fact that a teacher has a professional share with teachers of foreign countries within the scope of international projects adds different perspectives to the teacher. Teacher must learn something." **Y9**

Open to development and cooperation: He stated that all or most of the three school principals. Teachers were generally open to development and cooperation and that two school principals were not open.

"They are open to development and cooperation." **Y2, Y5, Y14**

The following is an example of school principal statements that indicate that some of the teachers are open to development and cooperation.

"We have successful teachers in these areas individually. But in general, this remains in the minority." **Y1**

8. Theme: University Education and Innovative Teacher Characteristic

Within the context of this theme, school principals were asked to evaluate the university education of teachers in terms of whether there is a relationship between the education of teachers at the University and the characteristics of innovation to become an innovative teacher. The views of the school principals are presented in Table 8.

Table 8. Innovative Teacher Characteristics with University Education Evaluation of School Principals in Relation to the Relationship

Is there a relationship between the teachers ' education at the University and the characteristics of innovation?	Yes	No	Changing
Theme	f	f	f
Relationship between innovative teacher and University	7	3	9

Seven of the school principals participating in the study stated that there is a relationship between universities and innovative teacher characteristics, 3 of them said there was no relation, and 9 of them said it can differ from university to university and from person to person.

School principals who think that there is a relationship between universities and innovative teacher characteristics, stated the following.

"I think there's a relationship. Teachers' training in universities as individuals with innovative features allows them to achieve success in their professional lives. When we look at our teachers who graduated from different universities, there are differences." **Y7**

According to 2 school principals, there is no relationship between the innovative teacher characteristics and the education received at the university. The statements of these school principals are as follows:

"I don't think he has a relationship with innovative teacher traits. Universities do not train teachers with innovative teachers." **Y1**

"There was no relationship for me. I'm an English teacher. With the training given me at the university, I couldn't teach anything in the classroom. Teaching is not just a profession to do with what you learn from the books." **Y16**

Some of the school principals who participated in the study stated that the relationship between the education received at the university and the teacher's innovative teacher characteristics depend on the university and its characteristics. Some of the statements of the school principals who think that the relationship between the teachers' education in the university and their innovativeness has changed according to the university is as follows:

"You look at some universities, for example, when you train a university student in a department, in line with their needs, you can provide them with courses in terms of business opportunities that they will encounter after they graduate at work or good in the market, while you look at some universities, for example, I graduated from the Department of mathematics. At the same time, a friend of mine was a graduate of Mathematics at METU. When I look at them, for example, when I learned computer programs that are currently being used in the market, the programs we learned were the programs 20 years ago, for example, the computer language I learned was the program 20 years ago. I took a Job Exam. The programs they asked me were the programs I never even saw in my life. You learn some similar programs, but people like them can be open to innovation with the kind of education they see at the University and the positive situation that the university has given them. They can internalize this situation themselves. They gain perspective in their daily lives. But when you learn old things, you're in a state of personal skill and awareness, but when you graduate from college without learning something to improve you, it turns into a state of personal skill and awareness." **Y4**

A few school principals mentioned that the teacher's own personal personality and teaching style, will also be a factor in being an innovative teacher.

"The personality is as important as the important university here. I mean, there are people who come from a bad University and raise themselves too much." **Y2**

9. Theme: Recommendations for Universities

In the context of this theme, the recommendations of the school principals for universities were presented under two sub-themes: proposals for preparing teachers for the teaching profession, and for the universities themselves to be innovative. These recommendations are presented in Table 9.

Table 9.Recommendations of School Principals to Universities

			School
Theme	Subthemes	Codes	f
Recommendations for Universities	Recommendations for Preparing for Teaching	Sufficient amount of applications	7
		Universities are integrated with educational	7
		Practice courses at the University are more	2
	Recommendations for Universities to be Innovative	Towards the direction of Science and innovation	6
		more information and technology courses	4
		more faculty members	0
		Recruit more qualified students to college	2
		To educate individuals for future needs	2
		Total	30

Suggestions for preparing for teaching: As can be seen in Table 9; It has been organized under three sub-subjects: the suggestions that the universities better prepare teachers for the teaching profession, the sufficiency of the practices, and the courses at the university apply more directly to real world life and issues

Sufficient amount of applications: The school principals believe that the university education should not be limited to just theoretical or transfer of knowledge transfer, rather to practical application to the real world.
"*Unfortunately, university education is not a sign of education, but university education is not practical. With the theoretical education at the university, the teachers who are attending the school are experiencing confusion. In particular, universities need to increase practical applications while training teachers. I would very much like to see my students go to practice during my university education."* **Y11**
One school principal stated that the application at the university could be carried out within the framework of a master-apprentice relationship:
"In my opinion, rather than giving information to teacher candidates at university for 4 years, there should be a master-apprentice relationship. One year, the basic information given the next year, a senior teacher, and this profession should be sent to observe how." **Y9**

Universities are integrated with educational institutions and real life: The school principals, who emphasized the need to overcome the gap between universities and practice schools and to be intertwined with educational institutions, stated that these disconnections are both in terms of curriculum and life conditions and should be eliminated. Some of the school principal statements referring to the curriculum are:
"My advice to universities in terms of developing innovative teachers is that universities should be integrated with educational institutions such as primary, secondary and pre-school education institutions, to identify the needs of schools and to educate teachers in line with the needs of schools." **Y12**
Some teachers stated that the education given at the university should relate to every aspect of life. They should help develop skills and prepare the student for the real world.
" Going to an elite school doesn't add anything. Suburban schools need to go. Village schools need to go. Teaching; To be able to burn stoves in the east, to make bread. We need to show the hard part of the job." **Y16**
Implementation of university courses more effectively: Several school principals mentioned that the practice or internship should more controlled and healthier.
"I do not think that the internship choices that are sent to schools by universities are very adequate. Because there's a problem with inspection. It is not clear whether prospective teachers are teachers or students in the classroom. Many of the university students attend the internship in the schools that do not even value their future colleagues. There are even those who don't take the teachers room. This breaks the dignity of a man. Teacher candidates create negativities about teaching. Therefore, I believe that this qualification should be ensured by giving the required value to the teacher candidate before graduating from university. Both information and hardware " **Y9**
For universities to be more initiative: As shown in Table 9, school principals emphasized that universities and academicians should be innovative, focus on science and educate individuals for future needs. Some statements from school principals who emphasize that universities should be more innovative are as follows:
"Universities need to renew themselves. Quotation quoted in the same way every time, it is necessary to produce science in the real sense, not just in projects, but in advertising. I think our university is far from this situation. Our teacher training institutions should produce projects on the ground. They have to go beyond the theoretical knowledge." **Y10**
"Academics are not traditional; have broad vision and use technology in their courses." **Y5**
Two school principals emphasized that universities should also focus on innovation and science, avoiding politics, said:
"I think universities should stay away from politics. I think universities should be science centers". **Y4**
There should be courses in information and technology: Two school principals mentioned the importance of informatics and technology courses at the university level; so, to build skills and innovative characteristics in the students. The school principals stated:
"My advice to universities in terms of innovative teacher training is to take courses of technology classes in informatics. We did not have such classes in our period. Obviously, I saw the smart board after teaching it for the first time. New developments should be explained. Unfortunately, there are teachers who cannot use computers. We have teachers who can't even use a normal Office program ... The teacher who can't use the smart board shouldn't have graduated from the university." **Y13**

Receiving qualified students in education faculties: Two school principals who participated in the study emphasized that faculties of education should be more preferable and students with higher scores should read the teaching branches:

"Higher-rated students should choose faculties of education. In other words, intelligent students need to enter these faculties. This year, a success ranking was brought to the faculties of education. This is not enough. 240 thousand to 250 thousand students will take this is not enough. These need to be corrected. The most successful students from each region should go to the faculty of education, the teacher should be trained very well. He took the best student to the faculty of education and he doesn't give the result if you don't make the necessary investment." **Y3**

Educating individuals for future needs: Emphasizing that the education given in the university should be aligned with the current and future needs of the students. The school principals stated that teachers should be trained to deal with the needs of the future:
"Teachers should be trained according to the needs of the future." ***Y6***

10: Theme: Other Reviews
At the end of the interview, the school principals were asked if they wanted to add something. Other opinions of school principals are presented in Table 10.

Table 10. *Other Opinions That School Principals Want to Add*

Theme	Subthemes		*f*
Other Reviews	Improving the quality of education of teachers		5
	Support teachers		3
	Need to be an innovative and open teacher to innovation		2
	The scope of research questions		1
		Total	11

School principals added their opinions: At the end of the interview, 12 school principals gave a thank you, while 6 school principals expressed additional opinions on the following table. Regarding improving the quality of education and teachers, the school principals said:
"Our universities, ministries, relevant levels, the Council of Ministers of all competent institutions and organizations should work in collaboration with each other in interaction. I think production should be more objective, based on the beautiful things produced. I believe that in our country, these beautiful changes can increase." **Y10**
The statements of the school principals who believe that support should be given to the teachers are as follows:
"Every teacher is not one, but teachers who are open to innovations in science high school, but not in a vocational high school, for example. Teachers do not renew themselves too much. In this context, teachers may be obliged to have in-service trainings or qualifications examinations can be done in branches every three years. I think they should be used." **Y15**
School principals who are open to innovation and need to be an innovative teacher have said:
"We have to be innovative teachers. We teachers have no other choice. Every teacher has to make an effort to become an innovative teacher. Although the conditions are not available, they need to act in a way to raise awareness and not think short-term. The money I buy is what the teacher, I'll spend on time with the approach that only if the teacher saves the day. I think such a teacher cannot be permanent in his profession." **Y10**
One school principal commented on the scope and depth of the research questions.
"Your questions are very comprehensive. There is a long time. But we tried to answer in general." **Y4**

CONCLUSION AND DISCUSSION

School principals' views on the use of innovative concepts in education vary. School principals perceive the concept of innovation as being both individual innovation of the teacher and academic innovation present in the classroom. School principals are a parameter in the success and development of 21st century schools (Fernet, 2011). In this respect, their view on innovation is very important. School principals set the tone for establishing individual innovation along with innovation in education. Among school principals, it is viewed that both individual and educational innovation are of equal importance in the classroom. When examined, innovation, application of new ideas, change, adoption of the new idea, new product and new application are defined as the reaction to innovation (Glor, 2001; Rogers, 2003; Goldsmith and Foxall, 2003; Demirel and Seçkin 2008). Goldsmith and Foxall (2003) are innovative; it is defined as the changing differences between individuals and individuals about the new things (ideas, products and practices) and their reactions to their own success and failures. Innovation in the literature is expressed in different definitions and meanings. The difference in the meanings of "innovation" attribute to the school principals' concept of the term, innovation. It can be said that this differentiation originates from different perceptions, experiences and biases.

The opinions of the school principals about the concepts in innovative teaching are grouped around three sub themes, they are: competency and desire to learn, competency to possess knowledge, and competency in use of technology. These sub-themes coincide with three of the four competencies (Learning, Educational, Technology and Social) identified by Zhu, Wang, Cai and Engels (2013). The school principals recognized the innovative teacher's learning competence as being self-renewal and continuous personal development, following change in innovations, and adapting those changes. The school principals measure instructional competency of the innovative teacher by their use of instructional methodologies and teaching techniques in accordance to the characteristics of the student learner. Teachers are expected to use a variety of teaching methods, incorporating new teaching styles and techniques, taking risks and embedding the innovations into the educational system. School principals perceive the knowledge and technology competency as using technology, accessing new information, applying that information, following-up, and practicing contemporary requirements. School principals describe the innovative teacher as an individual with competencies in learning, education, knowledge, and technology. The innovative teacher is identified as a self-improving individual who is focused on developing the students' life and career skills, and helping the students learn. (MEB, 2010). The innovative teacher has a desire to reinvent himself/herself in his/her profession (Bitnn-Fnedlander, Dreyfus & Milgrong, 2004; Cumming & Owen, 2001). When the literature, as it relates to the definition of an innovative teacher, is examined, there appears to be similar indicators between the different perspectives.

Only one school principal concluded that their teachers were not innovative. The other school principals describe their teachers as being innovative teachers. In this context, it can be thought that the qualifications of the school principals change according to their perspectives.

In the evaluation by the principals of the teachers who are open to innovation working in their institutions, 10 school principals expressed that their teachers were generally open to innovations, 4 principals expressed views that some of their teachers were open to innovation, while a few of their teachers were not open to innovations. As a result, the school principals recognize that teachers generally are open to innovations, however some are less open. Another result of the research is that school principals have varied reactions to the level of teachers being open to innovations.

It has been concluded that the majority of teachers use technology to access information and monitor informational technologies in some manner. In terms of tracing web sites with educational content, it was concluded that teachers used web sites such as EBA, Vitamin, Morpa Campus. In terms of using technology to investigate and evaluate information, teachers' implementations have remained limited and superficial. It was concluded that school principals consider teachers to be sufficient in terms of monitoring and using information technologies. It was also concluded that the majority of teachers collaborate with one another in terms of assisting and guiding the use of information technologies.

According to the findings of the school principals' evaluations in terms of being open to learning; the majority of the school principals described teachers as being open to learning and developing new skills in technology. In addition, according to the principals' evaluation reporting, the majority of the teachers were applying new teaching strategies and approaches into their educational settings. School principals stated that a large number of teachers were looking for originality in their professional work. However, some teachers were not clear about how to implement new ideas into their classrooms. According to the evaluation by the school principals, the status of teachers' being open to learning is not related to the age of the teacher. Several school principals stated that teachers are determined and willing to learn, but not all of them.

The school principals also evaluated teachers in terms of being open to professional growth and development. In general, teachers stated that they participated in some form of teacher in-service training. It was determined that participation by many teachers in in-service trainings was voluntary, while other teachers only attended because it was mandatory. Another result was that teachers were concerned about whether these trainings would benefit them to be stronger teachers. Participation in international projects was identified as another opportunity for professional development. School principals stated that the participation of teachers in international projects contributed to the developing traits of innovative teachers. In conclusion, school principals believed most teachers are open to professional development and educational cooperation.

Seven of the school principals stated there was a relationship between teacher preparation by universities and teachers possessing traits of innovative teachings. Three of them thought there was no relationship, while nine thought it varied from university to university, and from person to person. Based on the evaluations of the school principals, it was concluded that the training of teachers who had innovative teachers at the university level benefit from the experience in their professional lives. School principals also stated that universities do not do a

good job of producing teachers who are skilled in innovative teaching strategies or attitudes. It was the opinion of the principals that innovative teachers would be enriched by practical training at universities in the concept of innovation applications in the classroom. They also noted cooperation of National Education with universities would be beneficial. Revising the teacher training policy to address increasing needs in preparing students for the future in a world of technology and change is essential.

Suggestions by the school principals for the universities are: the sufficient number of applicants to prepare for teaching, the involvement of the universities in educational institutions and real life, and a more affective application of the courses at the university. The other suggestions were to educate individuals who are oriented towards the needs of the future, and provide qualified teachers to the faculties of education, in order to be innovative and to have knowledge and technology courses.

Additional opinions that school principals wanted to suggest are: increase the quality of education and teachers, provide support to teachers, be open to innovations, model innovative teaching, and expand research questions to include those sub-themes used in this research. The results of the school principals' opinions are to improve the quality of education and teaching, to support teachers, to employ innovative teachers who are open to innovation, and to promote comprehensive research.

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Students' Interaction and Perceptions in a Large-Enrolled Blended Seminar Series Course

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ABSTRACT
Seminar series can address cutting-edge topics not covered in existing courses, but it is time-consuming for interaction between students in large-enrolled seminars. To promote student interaction without compromising course goals, a large blended seminar series course was designed by combining traditional offline lectures and online discussions for Educational Technology Frontiers course. The study collected posts from online discussion forums. Social network analysis and descriptive statistics were used to analyze students' interaction. The study also conducted three surveys to investigate students' perceptions of course success on the aspects of subject understanding and active learning. Wilcoxon signed rank test was used to determine significant differences of students' subject understanding before and after class. Descriptive statistics were used to explore students' active learning. The results showed that the course promotes students to participate in interaction and students show a high level of enthusiam in interaction. The study also documented a strong and positive influence on students' perceptions of their subject understanding and active learning.

INTRODUCTION
A seminar course can address topical areas considered essential elements of the curricula that do not easily fit with any existing courses (Romanelli, 2008). Further, research shows that seminars encourage students' development of interpersonal communication skills (Popovich, & Jackson, 2004), improve student satisfaction (Porter & Swing, 2006), and enhance students' development of self-efficacy (Popovich, Katz, Iramaneerat, & Smith, 2007). However, the classroom discussion and interpersonal interactions are a practical challenge for course design. Students' interaction in seminars is a time-consuming task, and it is greatly influenced by the amount of quality time (Popovich, & Jackson, 2004).

Recently, professors have used online discussion forums (ODFs) to supplement classes (Alzahrani, 2017) and to facilitate social interaction among students (Cho, & Tobias, 2016). Online discussion allows time for learners to reflect and respond to issues being discussed (Havard, Du, & Olinzock, 2005), which promotes student understanding of a topic (Cho, & Tobias, 2016). Further supporting the value of ODFs, research shows that most students like the atmosphere of peer discussion outside of class (Dao, & Zhu, 2014) .

Students' interaction in large-enrolled seminar course is limited. BL in seminar course is highly effective (Extavour & Allison, 2018). Combining the advantages of seminars and online discussions, we designed a blended-learning seminar series course (BSSC) to promote interaction among students, which combined large-enrolled offline lectures and online discussions in a seminar series on the course of Educational Technology Frontiers. The stdudy is to explore the interaction among students and the overall perceptions of course success of the students who participated in the BSSC. Three research questions of the study are specified as follows:

- How do students interact in a BSSC?

- What level of enthusiam for participation in interaction do students show in a BSSC?
- Is there a change and if so how do students perceive the BSSC success on the aspects of subject understanding and active learning?

LITERATURE REVIEW

BLENDED LEARNING (BL)

Learning is developed through interactions (Vygotsky, 1978). Online discussion promotes the communication and collaboration among students (Al-Ibrahim & Al-Khalifa, 2015). It provides authentic learning opportunities that are not readily available in a classroom setting. BL refers to the integration of such online communication into courses (Alzahrani, 2017; Extavour & Allison, 2018). BL can improve students' flexibility in learning and encourages interaction among students (Ellaway & Masters, 2008).

Research on BL shows that it promotes student learning, especially facilitating students' interaction with peers (Extavour & Allison, 2018). Course designers have taken several approaches to designing seminars that use BL. Roseth et al. (2013) blended synchronous face-to-face and computer-supported cooperative learning in a doctoral seminar. Meretsky and Woods (2013) designed a seminar combining students, remote experts, and practitioners together via a virtual space, which helped students gain additional insight into their field of practice.

STUDENT- STUDENT INTERACTION

Student-student interaction plays a vital role in learning (Jacobs & Ward, 2000; Sher, 2009), supporting maximal achievement, socialization, and healthy development (Johnson, 1981). They are also significant contributors to student satisfaction (Sher, 2009) and perceptions of course effectiveness (Flottemesch, 2000). Many researchers have found that online discussion enhanced students' learning and facilitated their interaction (An, Shin, & Lim, 2009; Hew & Cheung, 2013; Hrastinski, 2008). Social network analysis (SNA) is often used to analyze the networks of student interaction. It's an effective method to analyze interaction among students in ODFs (eg. Zheng & Warschauer, 2015; Suraj & Roshni, 2016).

STUDENT PERCEPTIONS

Prior research has demonstrated that student perceptions can be both reliable and predictive of learning (Wallace, Kelcey, & Ruzek, 2016). Further, students' perceptions shape their learning motivations (Spearman & Watt, 2013). Research on students' perceptions of different course designs has generally been conducted through surveys.

Brunton et al. (2015), for example, evaluated students' perceptions of seminar and lecture-based teaching in restorative dentistry. Their survey on effectiveness, self-development, and interaction showed that students preferred the seminar format to the lecture format. Gajbhiye et al. (2014) evaluated the perceptions and attitudes of graduate students towards seminars from the aspects of satisfaction, collaboration, and understanding. They concluded that the postgraduate seminar method is effective and well-accepted among postgraduate students. Ruchi et al. (2012) investigated students' perception of seminars of first year medical subjects, and the majority of students felt that their school should continue to offer seminars in the future. Extavour and Allison (2018) assessed students' perceptions of BL in a pharmacy seminar course. Questions addressed the effectiveness of learning resources, course activities, the instructor, and the blended delivery, as well as perceptions of the development of critical-thinking.

COURSE CONTEXT

This study was based on the BSS course, Educational Technology Frontiers, which was offered in the Fall semester in 2017. The purpose of the course was to share cutting-edge research areas in the field of educational technology. The instructors consisted of a professor and an assistant whose responsibility was to contact with guest speakers, record offline attendance, and organize online discussions.

LARGE-ENROLLED OFFLINE LECTURES

In light of research showing that guest speakers bring value to courses (Popovich & Jackson, 2004) in particular in seminar series (Zorek et al., 2011), we invited nine famous guest speakers at home and abroad in the field of educational technology to carry out 14 offline lectures. One lecture shares one subject, so there are 14 subjects included in the course. The course was open to all graduate students in a university in China. There were 106 students enrolled in the course. Course meetings took place once a week with a duration of 90 minutes.

ONLINE DISCUUSION

The online discussion for the course was carried out on Daxia, an online learning platform based on Blackboard. After each offline lecture, the teaching assistant uploaded the lecture slides to Daxia and created an ODF

corresponding to the subject of the lecture. According to Dao and Zhu (2014), imposing a deadline for students to contribute is crucial to maintaining student participation to create an active discussion. Therefore, each ODF was open for a week. A WeChat group was also created by the assistant to release learning materials and course notices to all students.

METHOD

ACTION RESEARCH

According to Butz and Stupnisky (2017), an online discussion intervention in hybrid course can improve students' feelings of relatedness with others, which contributes to increasing interactions among students. To design the intervention, a sequence of events that take place at various time points over the course should be incorporated (Butz & Stupnisky, 2017). Action research emphasizes on intervention (Warden, Stanworth, Ren, & Warden, 2013), and involves important issues over long periods of time (Eden & Huxham, 1996) to improve the cycles of action. Therefore,we conducted an action rearch based on students' performances and feedbacks to promote students' interaction, which included three stages of teaching interventions throughout the course, as follows:

Stage 1 (weeks 1-4):

- In each offline lecture, students are required to fill out the attendance form.
- In each ODF, each student must post at least three times.
- ODF discussion topics are freely created by students, but they should be related to the subjects of that week's lecture.

Problems arising in stage 1 :

- Although almost all students took part in the discussion, most students posted less than three times.
- There was minimal student interaction because students were more inclined to create their own topics than to reply to others' posts.
- Many topics were duplicated.

Stage 2 (weeks 5-8):

- Each student must reply at least twice in each week's ODF.
- Students should contribute comments to existing posts instead of creating new topics that duplicate existing ones.

Students' feedbacks after stage 2:

- There was too little interaction with the guest speakers in offline lectures. Students recommended a question and answer session within the offline lectures to interact with speakers in greater depth.
- There was a lack of guidance from the instructors on how they should engage in the ODFs. They requested that guest speakers participate in the ODFs.

Stage 3 (weeks 9-14):

- The addition of question and answer sessions in offline lectures that would take up the final 20 minutes of the the 90-minute course meeting.
- Before the offline lectures, the assistant uploaded learning materials from the guest speakers to the Daxia and the WeChat group so that the students could study them in advance.

PARTICIPANTS

Participants consisted of the 106 students who participated in the Educational Technology Frontiers course. Of these, 15 were PhD students and 91 were master's students. Educational technology students dominated the course, comprising 85 students in the sample, but nine students were majoring in vocational and technical education, two were majoring in curriculum theory, seven were majoring in pedagogy principle, two were students majoring in optics, and one student was majoring in software engineering.

DATA COLLECTION

To explore student interactions, we collected the posts from the ODFs. When each forum closed, we completed two spreadsheets. The first recorded the topic, title, author, date of release, and full text of each post. The second recorded interactions among students. This consisted of an adjacency matrix, where we assigned each student both a column and a row in the matrix. A row represents a repling student, and a column represents a replied student. If two students interacted, then we entered the positive number representing the total number of comments in the matrix cell representing the intersection of these two students. For example, if student S1 replied to comments by student S9 5 times, we entered a 5 in the cell at the intersection of row S1 and column S9.

Three surveys mainly address two aspects of course success: subject understanding and active learning. Subject understanding was assessed through a 5-point likert scale ranging from 1 (understanding not at all) to 5

(understanding very well). Active learning, was assessed using three items. One asked about respondents' reading of existing learning materials using a 5-point likert scale ranging from 1 (not read at all) to 5 (read all). The other asked about respondent's access of extracurricular learning materials using a 5-point likert scale ranging from 1 (never) to 5 (always). The third one used a 5-point likert scale ranging from 1 (not at all dedicated) to 5 (very dedicated) to assess students' dedication to the course. Open-ended questions were used to allow students to provide recommendations for course improvement. The first author created them and the second author reviewed them. The Cronbach's Alpha of the three questionnaires is 0.857, 0.886, and 0.840 respectively. And prior to activation, the surveys was piloted among eight students who reviewed it for face and content validity (Extavour, & Allison, 2018). Response data was collected with Wenjuanxing, a web-based survey service.

The first questionnaire was conducted at the beginning of the course. All 106 students participated. The second questionnaire was conducted after the second stage of teaching intervention (week 9). 101 students participated. The third questionnaire was conducted at the end of the course. At that time 98 students participated. In order to compare the changes before and after the class, we finally analyzed the data of these 98 students in three surveys. Of the 98 students, 29 were male and 69 were female.

DATA ANALYSIS

Descriptive statistics including the frequency and percentage were used to count the posts, topics and replies in the ODFs. For the topics in each forum, we divided the total number of replies in each topic into five segments: 0-5 (low interaction), 6-10, 11-15, 16-20, >20 (high interaction). We divided the total number of replies by each student in each forum into four segments in two categories: passive interaction (segments 0-1 and 2) and active interaction (segments 3-5 and >5). The line charts below show the changes in student interactions across the 14 forums. SNA software Ucinet 6 were used to reveal the networks of student interaction. First, the spreadsheet including interactions among students was imported into Ucinet 6 to generate the interaction network — two data files which name formats are ".##h" and ".##d," respectively. Then, the density, centralization (Outdegree & Indegree) and isolates of each network were analyzed through Ucinet 6.

For the data collected from questionnaires, Wilcoxon signed rank test was used to determine significant differences of students' perceptions of subject understanding before and after class. Descriptive statistics were used to explore active learing of students. A stacked bar chart was used to show students' access to the existing learning materials. And pie charts show the access to the extracurricular learning materials and course dedication of students. SPSS 20 was used for all statistical analyses.

RESULTS

DESCRIPTIVE STATISTICS OF POSTS AND TOPICS IN ODF

POSTS IN ODF

The total number of posts in each forum is around 350 during the 14 ODFs. The number was highest in the first week, at 380; the 5th and 9th week were also high points, at 370 and 372, respectively. The total number of topics in each forum decreased over time, which was from 165 to 30. This included a dramatic drop off in week 5, to 62 from 127 in week 4. However, the total number of replies showed an upward trend over the semester, increasing from around 200 to around 300. The number of replies peaked in the 5th and 9th week, at 308 and 330, respectively (see Figure 1).

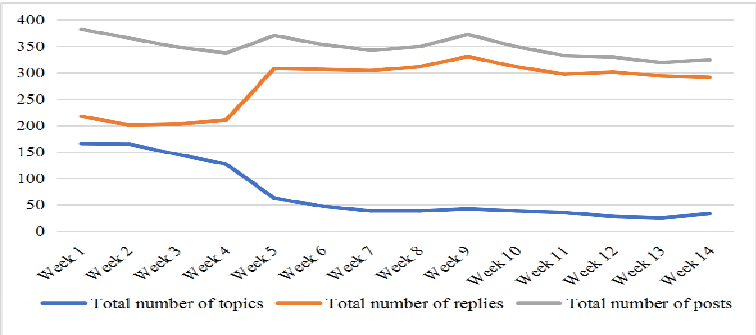

Figure 1. Posts in the forum (14 weeks)

TOPICS IN ODF

Across the 14 ODFs, the proportion of the topics with 0-5 replies remained above 80% in the first 4 weeks. However, this ratio was extremely reduced from ODF 5 to ODF 8. It was only about 30% in ODF 7, then

increased slightly, only to decline slowly but steadily from ODF 9 to ODF 13, when it was about 20%, and only recovered slightly in ODF 14. The number of topics with more than 5 replies was very small in ODFs 2-4, accounting for only about 5% of topics. However, the proportion increased significantly from ODF 5, especially for the topics with 6-10 replies and 11-15 replies, which rose to about 30% and 20% respectively. What's more, the proportion of topics with 15-20 or even more than 20 replies rose from almost 0% to around 15% from ODF 5 (see Figure 2).

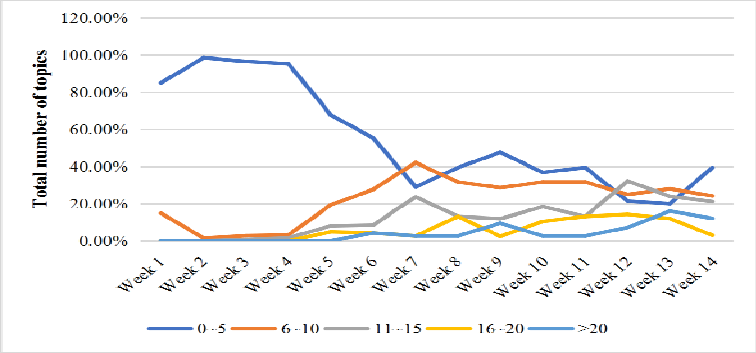

Figure 2. Topics in the forum (14 weeks)

NETWORK OF STUDENT INTERACTION

During the 14 ODFs, the density of the student interaction network was below 0.02 from ODF 1 to ODF 4. Hoever, it increased to more than 0.02 from ODF 5, peaking at 0.0377 in ODF 5. The second highest density was in ODF 9, at 0.0302. The density of ODF 14 suddenly dropped below 0.02. The isolates were no less than 5 from ODF 1 to ODF 4, after which the isolates were never above 3 until ODF 13. At ODF 14, however, the network isolates increased to 10. The outdegree centralization did not change much during the 14 ODFs, and it remained at around 1%. The indegree centralization was below 2% during ODFs 2-5. However, it increased to more than 5% in the ODF 6 and remained that high (see Table 1).

Table 1. The density, centralization (outdegree & indegree) and isolates of 14 ODFs

	Density	Centralization (Outdegree)	Centralization (Indegree)	Isolates
ODF 1	0.0191	1.316%	5.891%	6
ODF 2	0.0173	1.397%	1.397%	5
ODF 3	0.0184	1.672%	1.692%	8
ODF 4	0.0188	1.020%	1.419%	6
ODF 5	0.0377	0.952%	1.019%	0
ODF 6	0.0273	1.994%	5.230%	0
ODF 7	0.0282	1.338%	6.894%	1
ODF 8	0.0300	1.985%	14.484%	1
ODF 9	0.0302	1.599%	8.135%	1
ODF 10	0.0301	1.320%	7.320%	0
ODF 11	0.0263	1.358%	7.447%	3
ODF 12	0.0268	1.039%	8.481%	0
ODF 13	0.0285	0.623%	8.023%	0
ODF 14	0.0176	1.153%	13.907%	10

ENTHUSIAM FOR PARTICIPATION IN INTERACTION

During the 14 ODFs, the number of students with 0 to 1 replies remained at around 40 in ODFs 1-4. However, it reduced dramatically to 1 in ODF 5 and remained below 5 thereafter. The number of students with 3 to 5 replies remained at around 35 in the first 4 weeks. However, it significantly increased to above 65 in ODF 5 and remained high, peaking at 80 in ODF 14. The number of students with 2 replies decreased sightly from 30 to 20 in ODF 5. The number of students with more than 5 replies remained basically unchanged during the 14 ODFs, and remained at around 3 (see Figure 3).

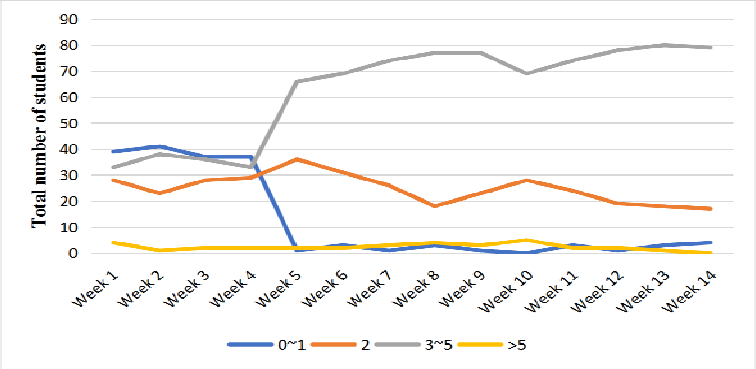

Figure 3. Replies of students (14 weeks)

PERCEPTIONS OF COURSE SUCCESS

For subject understanding, because the lecturers replaced 3 of the 14 subjects after the first survey, we analyzed the remaining 11 subjects. Table 2 shows the results obtained from the test statistics of the 11 subjects understanding before and after class. For the 11 subjects, the Z values are all negative. And the Asymp. Sig. (2-tailed) values are all less than 0.05, espcially less than 0.01 for the subject 1, subject 3, subject 4, subject 6, subject 7, subject 9, subject 12, subject 13, subject 14.

Table 2. Test Statistics[a] of Subject Understanding (after_class - before_class)

	Z	Asymp. Sig. (2-tailed)		Z	Asymp. Sig. (2-tailed)
Subject 1	-6.893[b]	.000	Subject 9	-7.016[b]	.000
Subject 3	-6.224[b]	.000	Subject 10	-3.422[b]	.001
Subject 4	-6.596[b]	.000	Subject 12	-6.927[b]	.000
Subject 6	-5.949[b]	.000	Subject 13	-5.166[b]	.000
Subject 7	-5.365[b]	.000	Subject 14	-4.399[b]	.000
Subject 8	-2.704[b]	.007			

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Accessing learning materials is the most frequently performed online learning activity (Li, & Tsai, 2017). The instructors shared learning materials through Daxia platform and the WeChat group, including lecture slides and relevant references provided by guest lecturers. The posts in the ODF (Daxia platform) and the notices in the WeChat group are also useful learning materials for students. As shown in Figure 4, for the materials on Daxia, 35.24% of students read all; 37.14% of students read most; and less than 1% of students read few or did not read at all. For the posts on Daxia, 12.38% of students read all; 40.00% of students read most; 3.81% of students read few; and less than 1% of students did not read at all. For the materials on WeChat, 19.05% of students read all; 52.38% of students read most; 4.76% of students read few; and none of students did not read at all. For the notices on WeChat, 50.48% of students read all; 35.24% of students read most; 1.90% of students read few; and none of students did not read at all. For the extracurricular learning materials, 50.47% of students always accessed; 39.25% of students sometimes accessed; and less than 2% of students seldom or never accessed (see Figure 5). For course dedication, 80.95% of the students were dedicated or very dedicated to the course; only 1.90% of the students were less dedicated to the course, and no students were not at all dedicated to the course (see Figure 6).

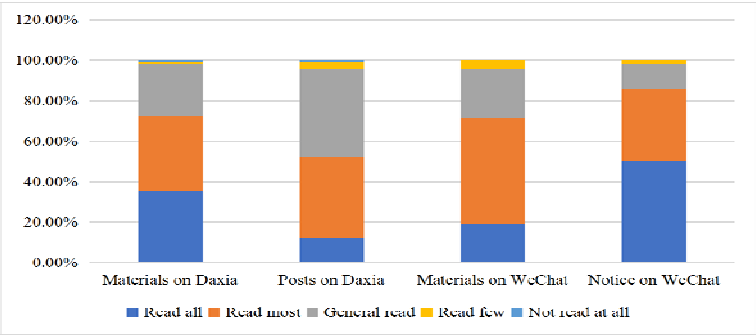

Figure 4. Access to existing learning materials

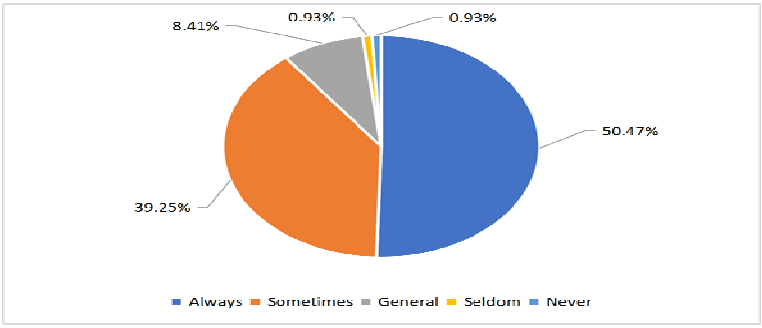

Figure 5. Access to extracurricular learning materials

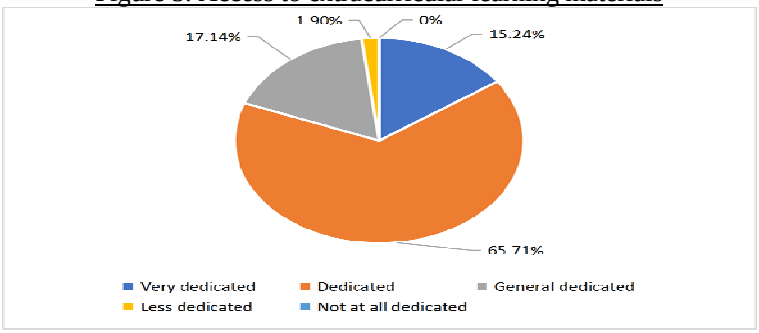

Figure 6. Course dedication

DISCUSSION

Results showed that students interacted through the ODFs. For the descriptive statistics of posts and topics in ODFs, the total number of topics in each forum decreased significantly, and the total account of replies increased greatly in the fifth week. Among the topics in each forum, the proportion of topics with low replies (0 to 5) decreased significantly, and the proportion of topics with high replies (more than 5) had increased greatly beginning from ODF 5. This is because we implemented the second stage of the teaching intervention in the fifth week, which encouraged students to devote more in replying and interacting with others. Moreover, this trend remained basically stable after ODF 8, which suggests that the student interaction was basically stable during the third stage of intervention.

The density of the network increased significantly after the second teaching intervention, and remained stable during the third teaching intervention, which indicates that more and more students were interacting. More students participated into the online discussion, and the interaction between students increased greatly. This corresponds with the finding that BL approach to seminars facilitated student interaction with peers (Extavour, & Allison, 2018). The isolates dropped dramatically after the second teaching intervention, and also remained stable during the third teaching intervention, which means that the students who did not reply to any other students or to whom no student replied decreased after the second teaching intervention. Further, the indegree centralization increased significantly after the second teaching intervention, which indicates that there is a clear concentration trend among the students to whom others replied. That means that most students replied to a small number of students. There are no significant changes in the outdegree centralization, which indicates that the total number of posts per student changed little during the 14 ODFs. However, the density of ODF 14 decreased and the isolates increased unexpectedly, which may be due to the fact that students were not anticipating another class meeting and were preparing for final exams.

The total number of students' replies can be taken as a sign of their enthusiasm for participating in the interaction. After the fourth week, the total number of students with 0-1 reply decreased greatly; the total number of students with 2 replies decreased slightly; However, the total number of students with 3-5 replies increased significantly. Moreover, among the 14 discussions, the total number of students with more than 5 replies was very few and remained stable. It appears that the interventions in the course had little impact on the students with high interaction enthusiasm. However, for those students with low interaction enthusiasm, the teaching interventions made them more involved in replying and interacting with others. Students who had not participated actively (with 2 or fewer replies, which was just in line with or even not complying with the requirements) began to participate actively and exceed the course requirements. This suggests the course enhanced the enthusiasm of students to participate in the interaction. However, it contrasts with the work of

Knowlton (2005), who found that students seek to meet minimum standards rather than actively participate and reflect freely on others' contributions.

Meanwhile, we carried out three stages of teaching interventions in the course and achieved good results. The evidence presented in the Wilcoxon test shows significant difference between students' perceptions of subjects understanding before and after the class. The negative Z values means that there is a strong and positive influence on students' perceptions of understanding after class. This suggests students' perceptions of subject understanding was enhanced significantly through BSS, which corresponds with the finding that students felt attending seminar can help in understanding the topic better (Gajbhiye, Tripathi, Jalgaonkar, & Sarkate, 2014).

Most students learned the materials available in the course and accessed extracurricular learning materials by themselves. The majority of students read most or even all of these learning materials available in the course, except for the posts on the Daxia platform. There were a large number of posts in each forum, yet more than half of the students read most or even all of the posts. What's more, the majority of students always accessed or sometimes accessed other learning materials actively which were not provided in the class. And most students were very dedicated to the course (more than 80%). This suggests that students were learning actively in the course.

CONCLUSIONS

BL in seminars is a novel and valuable approach for engaging students (Extavour, & Allison, 2018). Traditional offline lectures involve a large number of students. This means that, due to time restrictions, students do not interact very much. We designed a new BSSC to teach Educational Technology Frontier course in a university in China, blending traditional offline lectures and online discussions in a seminar series. The BSSC achieved good results. And it promotes students to participate in interaction and students show a high level of enthusiam in interaction. Students were learning actively in the BSSC. The BSSC enhances their perceptions of understanding of course subjects.

The current study has several limitations. Firstly, the questionnaires we used to explore the students' perceptions were created by the teaching assistant. Although all the questionnaires were reviewed by the instructors, and were piloted prior to activation, the reliability and validity of the questionnaires still cannot be confirmed. We tested the Cronbach's Alpha of the questionnaires, which could ensure the reliability of the questionnaires to a certain extent. Secondly, this was an exploratory study of how a BSS affected students' interaction and perceptions. No control group was available to determine the casual effects of the course design on the units of measure. Thirdly, the reporting of students might be biased because they would be primed to say what they think the person grading them wants to hear. Finally, the study heavily relied on quantitative methods. A mixed methods approach could be used in the future. For example, we might conduct content analysis with the posts in ODFs as an alternate way to explore their knowledge level and interaction patterns.

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The Usage of E-Learning Instructional Technologies in Higher Education Institutions in the United Arab Emirates (UAE)

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ABSTRACT
Higher education institutions in the UAE are increasingly incorporating e-learning programs into their curriculum. The large investment spent on these learning systems does not match the slow rate of adoption of e-learning among the faculty of these higher education institutions in the UAE. This autoethnographic study aimed to investigate and identify the factors that affect the adoption of e-learning systems among the faculty in higher education institutions in the UAE. The diffusion of innovation theory was used as a theoretical model and as a lens to guide this autoethnographic study. The purpose of this study was to identify the factors that positively affect the rate of adoption of Blackboard Learn among the faculty of the Computer Information Sciences and how the faculty measured that success. A qualitative autoethnographic research methodology was used and data was collected from personal reflections presented in my personal experiences and from my own recall of discussions with colleague. The findings revealed that the Computer Information Sciences faculty use the four variables of the diffusion of innovation theory to determine the rate of adoption of new e-learning initiatives and to measure their success. This study confirmed the importance of relative advantages, communication channels, time and social system in the diffusion of e-learning. It also revealed the need to increase the level of some attributes of these variables to increase the adoption rate of Blackboard Learn.

INTRODUCTION
Over the last decades, the investments of organizations in Information Technology (IT) have witnessed a continued steady increase (Purnama & Subroto, 2016). Organizations have realized that the key to success in the new digital age is to leverage the benefits from information technology. Similar to other business organizations, higher education institutions realized the importance of information technology on their institutional performance (Dlamini, 2015). The rapid infusion of information technology in higher education institutions resulted in an unprecedented change in the way these institutions conduct their businesses. Reich and Nelson (2003) stated that information technology had direct impact on the way higher education institutions conduct their marketing, admission, instructional delivery, finance, procurement, research services, students' records, and sharing information. Overall, it was argued, information technology changed everything in higher education institutions (Ashrafzadeh & Sayadian, 2015; Hardaker, 2014; Kopcha, Rieber, & Walker, 2016).

The largest impact of information technology was seen on the instructional components of the higher education institutions and particularity on the e-learning systems (Gunn, 2010). E-learning instructional technologies are widely understood as the use of information technology in learning and teaching (Czerniewicz & Brown, 2009; Salmon, 2005). The success of adopting e-learning instructional technologies in higher education institutions has been the subject of studies of many researchers (Abdullah & Ward, 2016; Kassim, Jailani, Hairuddin, & Zamzuri, 2012; Tarhini, Hone, Liu, & Tarhini, 2017; Wang, Wang, & Shee, 2007). However, few studies have focused particularly on the factors that affect the success of adopting e-learning instructional technologies among the faculty in higher education institutions in United Arab Emirates (UAE) (Mirza & Al-Abdulkareem, 2011). Rogers (2003) developed and presented the diffusion of innovation theory as a theoretical framework to study the factors that affect the adoption of new technologies. Diffusion of innovation theory seeks to describe how, why and at what rate new technologies spread out (Rogers, 2003). In this paper, I attempt to study the factors that affect the adoption of e-learning instructional technologies among the faculty of my Computer Information Sciences (CIS) department at the Abu Dhabi Women's College campus of the Higher Colleges of Technology (HCT) as part of the UAE higher education institutions using an autoethnographic research methodology.

The problem of diffusion of e-learning

Higher education institutions have followed the global trends in adopting new technologies and in particular they have spent millions of dollars on acquiring e-learning instructional technologies (Dlamini, 2015). However, the rate of diffusion of e-learning solutions among faculty in higher education institutions in the UAE is still slow (*E-learning Barriers in the United Arab Emirates*, n.d.). With the introduction of Blackboard Learn as the main learning management system in my CIS department, the rate of adoption among the faculty of my department is very slow when compared to the slow usage of the capabilities provided.

Purpose of this study

Considering the extensive investment in e-learning instructional technologies in my CIS department, the purpose of this qualitative research is to investigate and identify the factors that positively impact the diffusion of Blackboard Learn as a new e-learning instructional technology in my CIS department. To achieve this objective, an autoethnographic research methodology is used to research my current personal stance, opinions of two of my colleagues and the current literature. The Higher Colleges of Technology is the largest federal higher education institution in UAE with more than 23,000 full time students in 16 campuses serving all emirates of the UAE ("About HCT," n.d.; "Enrollments," n.d.). The HCT was among the first higher education institution to implement e-learning systems. My CIS department in Abu Dhabi Women's College is the largest IT department in the HCT system with 20 full time faculty.

Research Questions

Traditional information technology success measurement theoretical models as investigated by (D. A. Adams, Nelson, & Todd, 1992) cannot produce accurate investigation of the factors that affect the diffusion of e-learning instructional technologies among the faculty of my CIS department. In addition, other organizational theoretical models as investigated by researchers in organizational theories such as Melville, Kraemer, and Gurbaxani (2004) and Nilakant and Rao (1994) are not adequate to be used to investigate the diffusion factors. In general, many researchers have focused their studies on the information technology success factors. On the other hand, what has not yet been established are the factors that affect the adoption of e-learning instructional technologies among faculty in higher education institutions in the UAE. Therefore, the overarching research question of this study is to investigate the factors that affect the diffusion of a new e-learning instructional technology from the perspective of the CIS faculty and how they measure its success? The particular research questions that will be addressed in this study are:

RQ1. What do the faculty of the CIS department believe are the factors that affect the diffusion of a new e-learning instructional technology?
RQ2. How do the faculty of the CIS department measure the success of the diffusion of a new instructional technology?

LITERATURE REVIEW

Frustration is the emotion that can summarize my personal experience with the adaptation of use of Blackboard Learn in our department. My frustration started last semester when I noticed that some instructors were not using Blackboard Learn as planned. In our regular instructors meetings, no concerns were raised which added another layer to the existing mystery of why some of the information technology instructors were not using blackboard Learn. Frustrated with this situation, I started to research the literature to seek answers on why instructors who are experts in technology decide not to use a new instructional technology and revert to their own delivery methods.

This literature review aims to provide a complete overview of the factors that affect the adoption of e-learning systems in higher education institutions. The literature review is organized as follows: the evolution of e-learning systems is examined first. The factors that affect the adoption of e-learning in higher education institutions are examined after that. This is followed by a review of the diffusion of innovation theory framework. Next is a discussion about the factors that affect the adoption of learning systems among the faculty of higher education institution using the diffusion of innovation theory as a lens. Finally, the literature review concludes by identifying the literature gaps on the factors that positively affect the diffusion of e-learning systems.

I have used a combination of the following key keywords: e-learning, instructional technology, adoption of innovation, and diffusion theory to search for articles in peer-reviewed journals such as Journal of Educational Technology Systems, Canadian Journal of Learning and Technology, Educational Technology and Society. Overall, 37 peer reviewed articles and 5 books were used and were published between 1989 and 2017.

The Evolution of e-learning

Czerniewicz and Brown (2009) defined e-learning as the use of information and communication technology (ICT) in learning and teaching. E-learning includes any intentional use of electronic instruments like computers, iPads, televisions, or delivery of content via internet, social media, and so on for learning (Ozkan & Koseler, 2009; Shee & Wang, 2008). McGill, Klobas, and Renzi (2014) observed two types of e-learning systems in higher education institutions. The first type is at the institutional level and the second type is at the local level. At the institutional level, e-learning systems are instructional technology systems that are used to manage the delivery of course material to enrolled students. Learning management systems (LMS) are an example of e-learning systems at the institutional level. At the local level, e-learning systems are observed at the level of the single course or even at the class level, lesson or the learning activity. McGill et al. (2014) argued that with such a broad scope of e-learning covering both institutional and local levels, the success of e-learning should be considered by merging the two levels.

Learning management systems play a fundamental role in strengthening the e-learning systems in higher education institutions. They provide faculty with a software platform to blend in class face to face teaching with online teaching. There are two main types of LMS that higher education institutions can select from. The first one is the open source code LMS like MOODLE ("Moodle - Open-source learning platform | Moodle.org," n.d.) and ATutor ("ATutor Learning Management System: Information:," n.d.). The second one is the commercial LMS like Blackboard Learn ("Blackboard | Education Technology & Services," n.d.) or TalentLMS ("TalentLMS - Cloud LMS Solutions. Online Learning Management System," n.d.). All LMS provide a set of tools to support faculty in their course curriculum. Examples of the tools provided by LMS are listed in the table below (Findik & Özkan, 2013):

Table (1) *Learning Management Systems*

Example of Learning Management Systems	**Example of Tools**
MOODLE ATutor Blackboard Learn TalentLMS	Discussion Boards
	Forum
	Chat Rooms
	Online Grading
	Online Exams
	File Sharing
	Assignment Management
	Cataloguing of Syllabus
	Schedules
	Announcements
	Course Planning

Note: This table lists four examples of LMS and the tools they provide.

Ross and Gage (2006) stated that the adoption of e-learning systems is witnessing a constant increase in higher education institutions around the world. Norberg, Dziuban, and Moskal (2011) added that e-learning had become the new traditional model for course delivery in higher education institutions. Aparicio, Bacao, and Oliveira (2016) went further by considering e-learning systems among the enablers of the 21st century.

We can conclude that e-learning has played a major role in changing learning and teaching in higher education institutions around the world. There is agreement between scholars that higher education institutions are constantly increasing their investment in e-learning systems. However, scholars agree also on the limitation of the available data that accurately measure the degree of adoption of e-learning instructional technologies in higher education institutions (Graham, Woodfield, & Harrison, 2013; Norberg et al., 2011; Oliver & Trigwell, 2005; Porter & Graham, 2016; Ross & Gage, 2006; Sharpe, Benfield, Roberts, & Francis, 2006).

Factors that affect the adoption of e-learning systems

(McGill et al., 2014) studied 64 empirical papers published in peer reviewed literature related journals that examined the conditions associated with the continuation of the e-learning initiatives in higher education institutions. Out of these 64 e-learning initiatives, 20 had not continued. (McGill et al., 2014) stated that the continued and the non-continued 64 initiatives did not offer any financial advantage to their higher education institutions. The authors concluded that the characteristics of the technology itself and the financial support of the initiative by the institution are the only two factors that have distinguished between the continued initiatives and non-continued ones. All the continued initiatives needed to attract others to become involved in adoption and development to secure their sustainability.

Graham et al. (2013) studied six cases of institutional adoption of e-learning. The cases were selected from institutions that are at different phases of their e-learning adoptions. Three phases were identified: (1) awareness and exploration, (2) adoption and early implementation, and (3) mature implementation and growth. In all three phases, the authors concluded that three factors have significant impact on the adoption of e-learning systems. The first factor was the institutional strategy related to issues of the overall design of the e-learning initiative. The second factor is the structure related to issues on the technology, pedagogy, and administrative framework. The third factor is the support related to issues of maintenance, technical support, pedagogical support and faculty incentives.

Cigdem and Topcu (2015) studied the factors that affect the adoption of e-learning systems in a Turkish vocational college. The authors stated that the prediction of faculty intention to use e-learning systems is an important factor in determining the level of adoption. Cigdem and Topcu (2015) used a behavioural conceptual framework proposed by Findik and Ozkan (2013) to determine the factors that affect faculty's intention to adopt e-learning systems. The proposed framework was based on the technology acceptance model as proposed by Davis (1989) and it included the following factors: perceived ease of use, perceived usefulness, behavioural intention, application self-efficacy, technological complexity, and subjective norm.

Following the steps of scholars who studied the factors that affect the adoption of new instructions technologies, Sara M. Kardasz (2013) used the diffusion of innovations theory (Rogers, 2003) as a lens to guide her study of these factors. The author used the four elements of the diffusion of innovations theory and considered their effect on the adoption of e-portfolio by faculty in higher education institutions. The four elements are: the innovation, the communication channels, time, and social systems.

Diffusion of innovation theory framework

The literature is rich in theories that focus on studying the best approaches for encouraging faculty to use e-learning systems. Considering the questions that my research is seeking to answer, I found that diffusion of innovation theory as elucidated by Rogers (2003) provides theoretical guidance that can be used to direct my autoethnographic research study. Diffusion of innovation theory seeks to describe how, why and at what rate new technologies spread out. Surry and Farquhar (1997) described the innovation theory of diffusion in the field of instructional technology and how it has been used to form diffusion theories specific to the field of instructional technology. The authors presented two major IT related diffusion theories which are the systemic change and the product utilization theory. Surry and Farquhar (1997) stated that the diffusion theory is valuable to the study of the diffusion of instructional technology due to three reasons. The first one is that most instructional technologists do not understand why their product are adopted. The second reason is that instructional technology is inherently an innovation-based discipline, and the third reason is due the nature of the diffusion theory that can lead to the development of a systematic prescriptive model of adoption and diffusion.

Szabo and Sobon (2003) presented a case study about an educational reform that took place in a research university through the introduction of instructional technologies using the diffusion theory as lens to guide the process. The authors stated that the lack of technical knowledge results in fear of use by faculty.

Sara M. Kardasz (2013) used the diffusion of innovation theory as presented by Rogers (2003) to study the diffusion of instructional technology - ePortfolio use among faculty members at Stony Brook University. She presented recommendations on how to best encourage faculty members to use ePortfolios with their students. The author concluded by identifying the gaps and questions that need to be addressed in order to develop further the study of diffusion of innovations theory for instructional technologies.

We can conclude that while many scholars have investigated the factors the affect the adoption of e-learning systems in higher education institutions (Cigdem & Topcu, 2015; Graham et al., 2013; McGill et al., 2014), the factors provided by the diffusion of innovations theory as proposed by Rogers (2003) are more comprehensive and provide a wider lens that can be used to study these factors.

A brief description of the gaps

The reasons stated by Surry and Farquhar (1997) and combined with the case study of Szabo and Sobon (2003) provided some explanation to my personal experience with the adaptation of Blackboard Learn among the faculty of my department. However, the gaps identified by Sara M. Kardasz (2013) call for further studies in order to understand the factors that have direct impact on the diffusion of instructional technologies among faculty in higher educational institutions. I am confident that sharing my personal experiences through this autoethnography study will support bridging some of the gaps identified.

Theoretical Framework

The diffusion of innovation theory as presented by Rogers (2003) provides theoretical guidance that can be used to direct my autoethnographic research study. Roger (2003) stated that four main elements influence the spread of new ideas: the innovation itself, communication channels, time and the social system. Rogers defined his perceived attributes of each element as explained in Figure. 1. I will be using these four elements along with their perceived attributes as a conceptual lens to guide the development of my autoethnographic research.

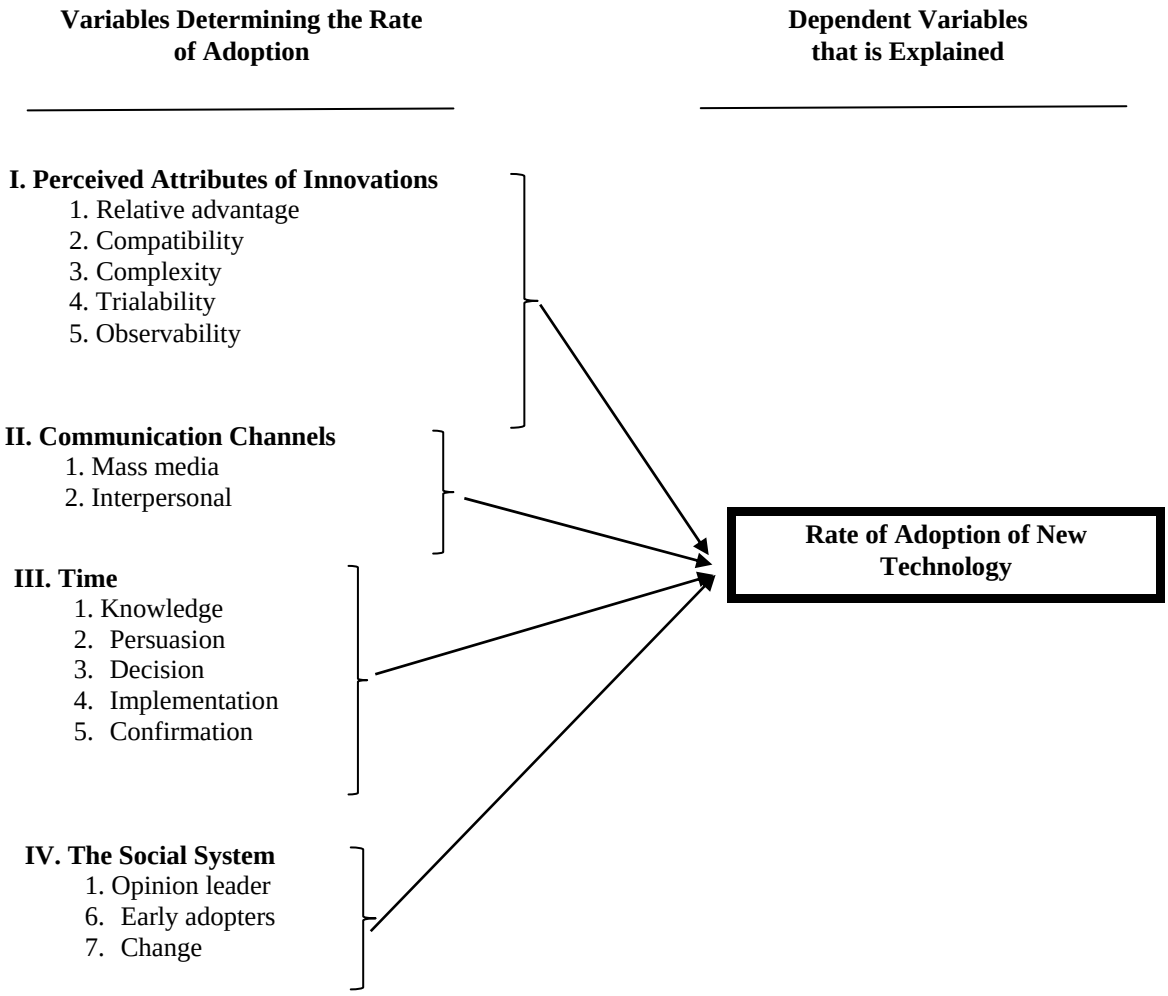

Figure 1. Rogers (2003) diffusion of innovation theoretical model

RESEARCH METHODOLOGY

Autoethnography is a form of qualitative research where self-reflections are used to explore personal experiences which allows authors to connect their autobiographical stories to the wider meanings and understandings (T. E. Adams, Holman Jones, & Ellis, 2015). Autoethnographic research methods might be considered to be unstructured and uncontrolled since they are centred around the personal experiences of authors and hence introduce subjectivity and anecdotal evidence to the research findings. Nonetheless, Many scholars find autoethnographic research methods as legitimate, familiar and a useful way to conduct research since they encourage researchers to include their self-experiences and reflections in their studies (T. E. Adams et al., 2015; Clark & Gruba, 2010; Sikes, 2015).

In this research, I used an autoethnographic research methodology to investigate my personal experiences and to examine fully, deeply and meaningfully the research problem and find the best answers to the raised questions. In addition to exploring my personal experiences, autoethnographic methodology allowed me to connect my autobiographical story to the diffusion of innovation theory and use it as a lens to guide this research.

Data Collection and Analysis

Data was collected from my own personal reflections presented in my personal experiences, and from my own recall of discussions with colleagues who are currently teaching with me. Discussion with my colleagues included interchange of emails and face to face personal discussions. All data collected was text based extracted from my own diary and from e-mail correspondences with my colleagues. A linear hierarchical approach was used to analyze the collected data by building from bottom to the top with multiple interactions between the steps (Patton, 2001; Shank, 2005). In the first step, I organized and prepared the collected data for analysis. I read through all the collected data and reflected on its overall meaning in the second step. In the third step, I started a coding process using the variables presented by Rogers (2003). I used the NVivo ("NVivo," n.d.) software to analyze and evaluate the collected data

Quality and trustworthiness of the study/findings

Data was collected from my personal experiences, and in order to improve the quality and trustworthiness of the collected data, data was also collected from discussions with two of my colleagues who are also using Blackboard Learn this semester. Like any autoethnographic study, the personal quality of the researcher plays a focal role in assuring the quality and trustworthiness of the study, and my 20 years of experience should have some value in assuring the required quality (T. E. Adams et al., 2015; Clark & Gruba, 2010; Sikes, 2015).

Ethical Issues and Limitations

I don't foresee any ethical issues since most of the data was collected from my own personal experiences and from my own recall of discussions with colleagues and I made sure no names or references to human subjects are included. According to Cozby (2008), there are three levels of research risks. The first one is the exempt research, the second one is the minimal risk and the third one is the greater than minimal risk. All risks are based on comparing the risk to harm the participants against the risk the participants face on daily basis during their regular work.

This research is under the exempt research type since the risk to harm the participants, who is me in this case, is not greater than the risk I encountered during my normal working activities.

Findings

I was fortunate to witness the introduction of e-learning instructional technologies in my institution right from the beginning. Online tutorials, virtual classrooms software, wikis, clickers, e-portfolios, Pearson e-college, moodle, sakai, lore, and iTunes U are just few examples of the e-learning instructional technologies that we tested and tried to implement at our institution. Last year, my college decided to use Blackboard Learn as the main online delivery platform for all courses. Our CIS department was among the first department to volunteer to publish all our courses on blackboard learn. Similar to the previous e-learning instructional technologies, I noticed that the acceptance rate among faculty was still low. With the start of the second semester, I wanted to investigate the factors that impact the diffusion of a new e-learning instructional technology among the faculty of my CIS department using the diffusion of innovation variables to guide my ethnographic study. To do that, I volunteered to coordinate two courses with 13 CIS instructors overall in 16 campuses and below are my findings. The first course was about e-business applications development. The second course was about human computer interactions.

Perceived attributes of innovations

- **Resources sharing**

With two CIS courses to coordinate this semester, it was quite an advantage for me and the faculty to have Blackboard Learn. As coordinator of these courses, my role was to organise the development and sharing of the content writing between faculty. I was also responsible organizing online assessments and the development of the final online exam including all items analysis and to make sure that questions follow Bloom's taxonomy.

The learning contents can be accessed at anytime and anywhere. Blackboard Learn makes document sharing very easy and accessible. It can happen in a matter of few clicks. The materials can be stored in a various form. This can be looked at as a great advantage in terms of availability and accessibility of course materials, lecture notes, slides, internet hyperlinks and audio/visual aids. I noticed that the 13 faculty started to share these documents with me and among themselves using the features provided. I distributed the content development among the 13 faculty, and using these sharing capabilities, we were able to complete the development accurately and in less time. I still remember the appreciation email that I received from one of the two colleagues stating how much these sharing resources contributed to saving time and accuracy of content development.

- **Communication**

Furthermore, using such an e-learning system, improved the communication among the faculty and students. Faculty started to use the announcements, discussions, and emails to communicate among themselves and with students. Students got the announcements immediately after logging in to the system. It is an advantage, as it ensures that all students are up-to-date immediately. Another great advantage was the discussion function since it allowed all the students in all campuses to carry out online discussions at any time of the day, with any students and with all faculty.

In terms of communication via email, students' email addresses are stored within the students' profile area. This was another excellent advantage for communication purposes that all faculty were happy to use. It is an excellent option. It gives the faculty a great flexibility to communicate with students. Blackboard Learn allowed me to communicate with all students on individual basis, groups of students, or with the whole cohort in one go. Faculty took advantage of the communication features and I noticed an increase in communication between faculty and their students. I still remember one email from one of the two colleagues appraising the increase in communication with students.

- **Compatibility**

Another feature is the compatibility of Blackboard Learn with other office applications. I experienced that in a variety of ways. The first was its compatibility with Excel uploading and downloading. Using Blackboard Learn, I can manage the course grades online, and then I can download them to Excel. I use the collected data on Excel to analyse and get grade distribution charts. I found the compatibility of Blackboard Learn with both MS Word and PowerPoint a major compatibility advantage of this e-learning system. Both my two colleagues and I were able to simply develop the content in Word or PowerPoint format and in one click upload it to Blackboard Learn for students' use and team sharing.

Blackboard Learn is also compatible with exam authoring systems. Blackboard Learn works very well with Respondus 4.0 ("Respondus 4.0: Exam Authoring Tool," n.d.). Respondus is an exam authoring system and is fully compatible with Blackboard Learn. I used it to prepare all the exams for these courses whether they were paper based or online exams. It is a great tool as Respondus 4.0 offers two ways to create an exam: within the application itself using simple question templates, or by converting an entire exam from MS Word format (images, tables, equations and formatting are retained). I noticed that all faculty in all campuses appreciated and took advantage of these compatibility features.

- **Usability**

I wish I could say the same about the usability of the Blackboard tools. They are complex, and the level of complexity is high. I am an IT instructor and the faculty with me are all experts in IT and still we found the usability of the tools and the tools themselves complex. For example, tools to release the material in a sequential way are not easy to configure or use. Preparing content to be used on different browsers is another complex procedure. I came to the conclusion and the two faculty agreed with me, that all faculty need time to get trained and practice in order to make use of this learning management system. I feel sometimes the training has to be very specific such as assessment, discussion, portfolio, and so on. This can be time consuming and needs some dedication.

Training alone will not be enough, I needed to test and try different features available before publishing. Blackboard provided a lot of features and options to present the content to students, we needed to try some of these options before we selected the right one for them. The problem is that what we choose today for one class, might not work for another, so we need to try other options. Trialability of all these options is essential to the adoption of Blackboard.

I also observed that faculty teaching this course with me used Blackboard Learn for the two CIS courses and their usage in other courses was minimum. This gave a negative impact on the overall observability of this initiative.

Analysis of the perceived attributes of innovations

Reading my above narration on the perceived attributes of innovations, it is clear that Blackboard Learn has positive relative advantages that my two faculty colleagues and myself are satisfied with. The same conclusion can be reached on the compatibility features of Blackboard Learn. On the other hand, it can be concluded from the narration above that the faculty and I perceive Blackboard Learn as a difficult system to understand and use. We also think that level of experimenting with Blackboard Learn is not adequate and hence the degree of

trialability is low. Finally, we believe that the degree of observability is low since faculty are only using Blackboard Learn for these two courses.

The narration above was coded in NVivo and using a word frequency query reveals that the words advantage and compatibility had higher frequency than the words complex, trialability and observability as listed in table 2. This analysis from NVivo supports my findings above that these last three attributes of innovation had lower presence than the relative advantage and compatibility attributes.

Table 2: *Weighted percentages which is the frequency of the word relative to the total words counted and count of the five attributes of Innovation as extracted from NVivo*

Word	Count	Weighted Percentage (%)
Compatibility	6	1.58
Advantage	6	1.58
Complex	4	1.05
Observability	2	0.53
Trialability	1	0.26

A text search using NVivo on the words advantage, compatibility, complexity, observability and trialability *shows* the relationship of these words with the sentences used in the narration, and again provide more tangible evidence of higher presence of the attributes advantage and compatibility versus the other three. Figure 1 shows the word trees of these five words.

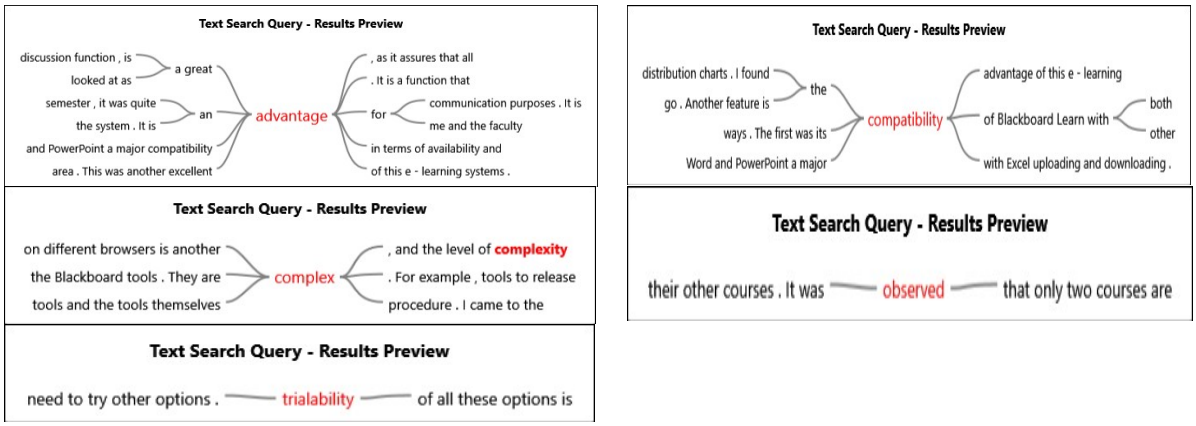

Figure 1. The text search results of the words *advantage, compatibility, complexity, observability and trialability* and their relationship with other sentences.

Communication channels

The first time I learned about Blackboard Learn was when we received an email from our IT support division announcing the acquisition of this system. A couple of weeks later, we received another email from our division announcing the usage strategy of this system and listing all the advantages. As an instructional technology expert, I started spreading the news about the features and capabilities of Blackboard Learn among the faculty of my department and to others. Few training sessions on Blackboard Learn took place during the official professional training weeks. These training sessions were conducted mainly by faculty who are expert in learning management systems. From my perspective, I can say that few emails, and limited interpersonal communications, and few training sessions helped to initiate the adoption process, but were not enough to diffuse the usage of Blackboard Learn at the speed we all hoped for. In summary, we can conclude that three different communication channels were used which were not enough to adequately start the diffusion process at the rate we were all looking for.

Analysis of the communication channels

The narration above was coded in NVivo and using a word frequency query shows that the words *training* and *email* were among the highest repeated words as listed in table 3.

A text search using NVivo on these three words produces a word tree that clearly links training and communication with the adjectives few and limited as per figure 2. This provides further tangible evidence of the limitation of the communication channels used to announce and diffuse Blackboard Learn. It is important to note that NVivo did not link *email* in this word tree.

Table 3 *Weighted percentages and count of the three words used to describe the communication channels as extracted from NVivo*

Word	Count	Weighted Percentage (%)
Training	4	4.49
email	3	3.37
communication (announcements, discussions, and emails)	2	2.25

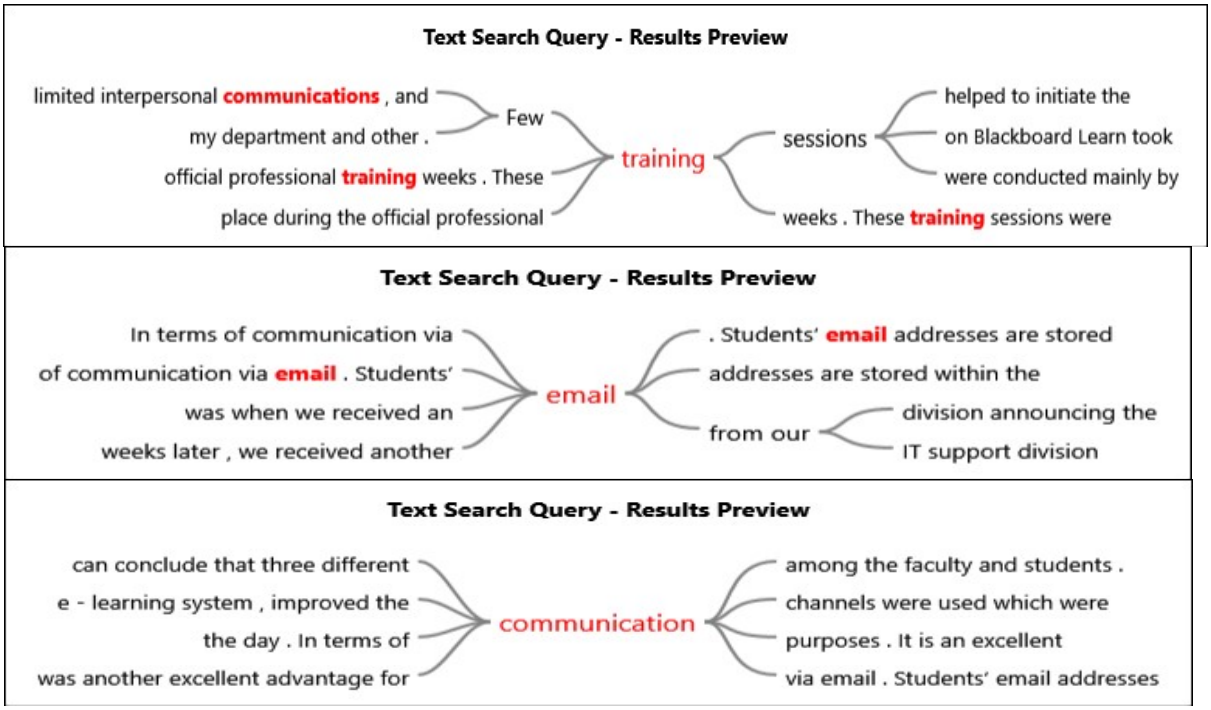

Figure 2. The text search results of the words *training, email, communication* and their relationship with other sentences.

Time

It takes time for faculty to decide whether or not to adopt any new innovation and I can say it took them time to decide on the usage of Blackboard Learn (Rogers, 2003). There is agreement between scholars that the time needed for any e-learning innovation to diffuse is directly related to the following attributes: knowledge, persuasion, decision, implementation, and confirmation (Hardaker, 2014; Lee, Hsieh, & Hsu, 2011; Levin, Stephan, & Winkler, 2012; Rogers, 2003). At the *knowledge* level, I can confirm based on my discussion with my other two colleagues that faculty in my department have the necessary knowledge about e-learning and their capabilities. In the end, we are all IT faculty and it goes without saying that we should have the technology *knowledge* needed to use such systems. I cannot say the same about the *persuasion* and *decision* level among the faculty. As stated before, I couldn't deduct any adoption issues in our face to face meetings. It is clear that the level of *persuasion* and *decision* among our faculty is still not enough to convince them to use Blackboard Learn in their other courses. On the other hand, an *implementation decision* was taken at the college level which resulted in faculty using the e-learning system for these two courses that I am coordinating. The *confirmation* level is still not adequate since I noticed that faculty are still debating the capabilities and tools available in Blackboard Learn and comparing it with other e-learning systems. In summary, and based on my own

perspective, we can conclude that the time factor is still not supporting the diffusion at an acceptable rate since while knowledge is there, the levels of persuasion, decision, implementation and confirmation are still not adequate.

NVivo was not used to code the above narration. However, the five subcategories of the *Time* variable have been highlighted in italics to show their frequency in the narration above.

Social System

The social system as presented by Rogers (2003) is "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (p.23). The first attribute to have a positive social system that will support the adoption of e-learning in higher education institutions is the *opinion leader*. *Opinion leaders* are the *early adopters* and they act like a catalyst in supporting the diffusion of e-learning. Few of our faculty are considered as *opinion leaders*. I am sure that there is a need to increase the number of *opinion leaders* as *early adopters* to increase the rate of diffusion of Blackboard Learn.

Overall, I was one of the *early adopters* as I was involved in this process from the very beginning of the adoption of Blackboard Learn. A lot of changes took place in terms of course and assessment delivery. A lot of learning and training took place to make this happen. It did take a lot of time for the faculty to learn and use the tools provided by Blackboard Learn.

The *change* agent is the second attribute in the creation of positive social system. Rogers (2003) stated that change agents are usually professionals from outside the social system that can help the opinion leaders. In our situation, faculty from other divisions played the role of change agents. Inviting faculty from other divisions to speak and share their experiences with our department faculty played a positive role as change agents in increasing the adoption rate among our faculty.

NVivo was not used to code the above narration. However, the three subcategories of the *Social System* variable have been highlighted in italics to show their frequency in the narration above.

CONCLUSION AND RECOMMENDATIONS

This autoethnographic research study aimed to identify the factors that positively affect the adoption of e-learning systems in higher education institutions in the UAE by analysing my current personal stance, my recalls of the opinions of two of my colleagues and researching the current literature. Two research questions were identified to guide the investigation of this autoethnographic study. This autoethnographic research revealed that the faculty of my CIS department use the four variables of the diffusion of innovation theory (Rogers, 2003) as the main factors that affect the diffusion of new e-learning instructional technology in their department. It confirmed that the faculty use the attributes of perceived innovation as one measurement of the success of the diffusion of new e-learning systems. Particularly, a high rate of innovation features and compatibility are considered as positive factors to increase the rate of adoption for Blackboard Learn. On the other hand, increased complexity and a low degree of trialability and observability are considered by faculty as negative factors that affect the rate of adoption and are used as negative measures on the success of the diffusion.

This autoethnographic study revealed the existence of three communication channels that faculty of my department believe have positive impact on the adoption of new e-learning systems. Mainly they are: emails, training and interpersonal communications. These three channels are also used by the faculty as indicators of the success of the diffusion. This research revealed the need to increase the number of channels used in communication. It also revealed the need to improve the current three channels. As per Rogers (2003) diffusion of innovation theory framework, time is a critical factor in determining the success of new innovations. This research confirmed the importance of time by revealing that faculty consider the four attributes of time as critical factors that affect the diffusion. While the existence of the knowledge attribute was confirmed and its role in measuring the success of the diffusion was also confirmed, this study revealed the need to increase the persuasion, decision, implementation, and confirmation attributes in order to increase the adoptions rate of Blackboard Learn among faculty.

This study confirmed the importance of the social system variable as a main factor in determining the diffusion of e-learning system in higher education institutions. This study established the role of opinion leaders, early adopters and change agents as positive factors in increasing the rate of diffusion of e-learning initiatives. It also revealed that faculty consider the increase in opinion leaders, early adopters and change agents as a measure of success and recommended to increase the number of these leaders and agents in order to increase the adoption of Blackboard Learn.

As per the findings above, this autoethnographic study answered the first research question by identifying four variables as the factors that affect the diffusion of a new e-learning instructional technology in my CIS department. The four factors are: *perceived attribute of innovation, communication channels, time* and the *social system*. Furthermore, this autoethnographic study answered the second question of this research by identifying the attributes of these four variables as the measurement used by my CIS department to measure the success of the diffusion of a new instructional technology. Particularly, two attributes of the *perceived innovation*, *relative advantage* and *compatibility* were confirmed to have positive impact on the success of the diffusion in my department. On the other hand, *complexity*, *trialability*, *observability*, *mass media*, *interpersonal communication*, *knowledge*, *persuasion*, *decision*, *implementation*, *confirmation*, *opinion leader*, *early adaptor* and *change* were confirmed to have negative impact of the success of the diffusion of a new e-learning instructional technology in my CIS Department.

In conclusion, this autoethnographic research study explored and investigated the factors that affect the diffusion of a new e-learning instructional technology from the perspective of the CIS faculty and identified the attributes they used to measure its success. Further research is needed to extend the findings of this study to other departments in my college.

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