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Editorial

# Instructional Design 2: Based on Research

Donald G. Perrin

Last month we determined that instructional design is based on instructional technology – a systematic way of designing, carrying out, and evaluating the total process of learning and teaching. The Kemp instructional design model encompasses assessment, objectives. Content and instructional strategies, systemic design, development, production, presentation and evaluation based on research in human learning and communication. It employs a combination of human and non-human resources to bring about more effective instruction. The Kemp model is a cyclic process for course development and improvement based on initial assessment of need, goal setting, design, presentation, evaluation and feedback.
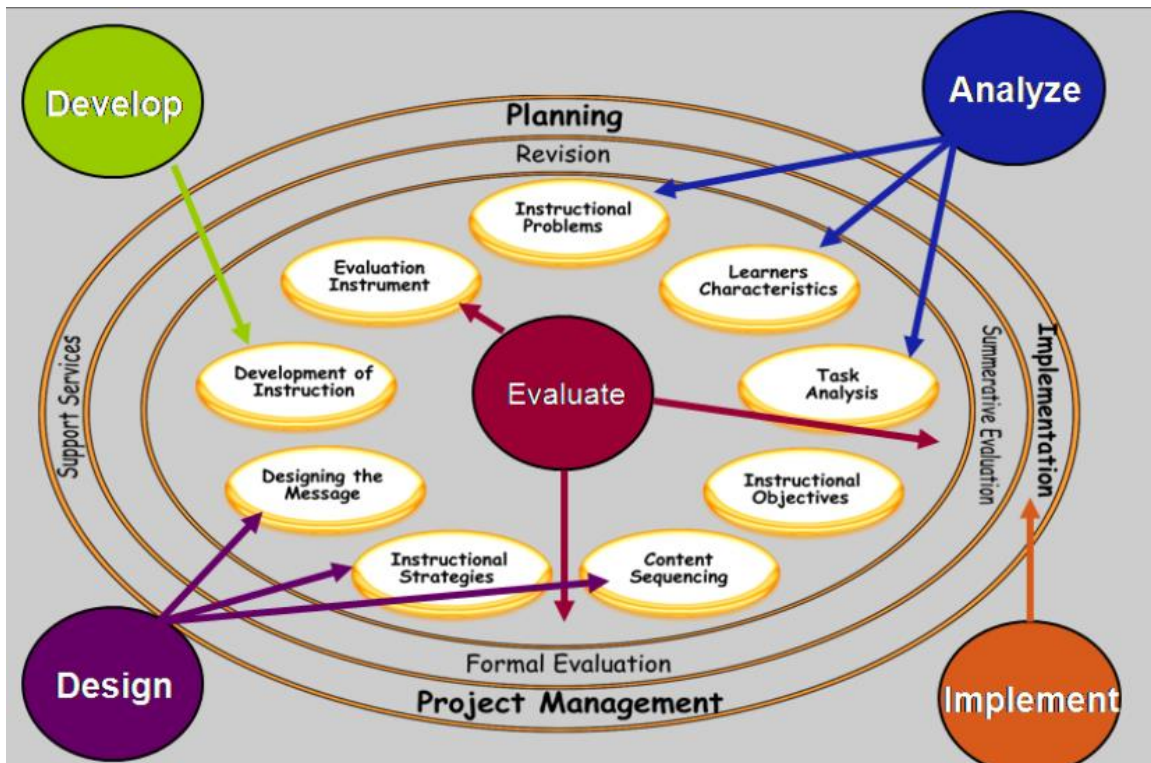
Wikipedia defines instructional design as the practice of "creating instructional experiences which make the acquisition of knowledge and skill more efficient, effective, and appealing". It gives an extensive history beginning with military training in World War II and addresses the role of many researchers, disciplines and theories in instructional design theory and implementation.
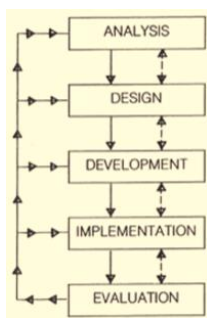
In the late 1970's, the ADDIE model emerged as part of Instructional Systems Design (ISD) for U.S. military training and was promoted by the American Society for Training Development

Molenda notes: "I am satisfied at this point to conclude that the ADDIE Model is merely a colloquial term used to describe a systematic approach to instructional development, virtually synonymous with instructional systems development (ISD). . . .What everyone agrees on is that ADDIE is an acronym referring to the major processes that comprise the generic ISD process: Analysis, Design, Development, Implementation, and Evaluation.

Other models have emerged based on learner characteristics and alternative methods of delivering instructional materials. These include Gagne's "Conditions of Learning" and the Keller "ARCs Model of Motivational Design. Keller determined that the learner could learn more effectively when given clear objectives, assurance of success, and valued the learning experience as something worth doing. The model addresses four main areas – attention, relevance, confidence, and satisfaction.

Some research is focused on learner attributes. Harvey Silver "learning styles" are related to the Myers-Briggs personality inventory tests. Note how active learning styles lead to higher levels of learning.
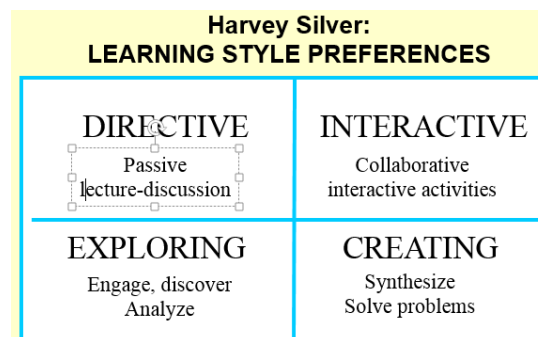
In 2005, George Siemens and Stephen Downes introduced Connectivism, "a learning theory for the digital age," based on their analysis of the limitations of behaviorism, cognitivism and constructivism to explain the effect technology has had on how we live, how we communicate, and how we learn. The new theory combines relevant elements of many learning theories, social structures, and technology to create a powerful theoretical construct for learning in the digital age.

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ICT Based Education at the University of Jordan

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Jordan

Abstract

This study investigates e-Learning in the Faculty of Educational Sciences (FES) at the University of Jordan (UJ). It assesses the perceptions of students regarding ICT based education. Questionnaires and personal interviews were used to solicit information from a sample of students pertaining to their computer abilities, understanding of ICT capabilities and their preferred method of learning, i.e. ICT based education versus traditional education. The findings of the study revealed that the students were well versed in computers, well aware of ICT capabilities and merits and that most of them did not previously participate in e-Learning. The main objection of the majority of students to ICT based education was their perception that it lacked the kind of interaction between students and instructors that traditional methods provide. The study concludes with specific recommendations that may apply to other faculties in Jordan and in other countries with similar conditions.

Keywords: ICT, e-learning, perceptions, higher education, ICT based education, Jordan, the University of Jordan, capabilities, online learning.

Introduction

This paper describes a study undertaken to assess the perceptions of students in the Faculty of Educational Sciences (FES) at the University of Jordan concerning the use of Information and Communication Technology (ICT) in the learning process. The study was prompted by 1) the realization that ICT has been integrated into the curricula at various school levels including higher education worldwide. 2) The factors which favor the use of ICT, such as large class size, rural areas that are remote from higher education institutions and difficult economic conditions exist in Jordan as in other developing countries. 3) The fact that the continuous stream of ICT products, such as Iphone, Ipad and the World Wide Web, makes it imperative for researchers in Jordan to assess the status of ICT use in the country so that the officials concerned can make the necessary decisions. 4) The understanding that the use of ICT in higher education in other countries has been generally successful and cost effective. 5) The belief that ICT constitutes an important element in the next study plan which the faculty members of the FES were asked to formulate. It should be noted that some of the reasons behind the students' perceptions of ICT probably exist in other faculties at the University of Jordan and other universities in Jordan and the region where conditions are similar. This would enhance the importance of this study.

Literature Review

Definition of Terms

Through the past decades, the world of education has been impacted by the rapid developments in information and communication technologies (ICT). This has revolutionized teaching and learning, particularly distance education (Tayebinik & Puteh, 2012). The term distance learning is used interchangeably with terms like e-learning, online learning, online collaborative learning, virtual learning, web-based learning and technology mediated learning (Ahmad & Ali, 2011). It embraces a variety of electronic delivery media, for example web-based multi-media, interactive television, virtual classrooms, video conferencing and so forth.

Characteristics of E-Learning

E-learning is characterized by (1) separation in time and/or space between the teacher and students, among the students themselves, and between the students and educational resources, (2) interaction between the teacher and the students, among the students, and between the students and educational resources, (3) a process of teaching and learning not limited to the immediate time or place (Oh, 2003 as cited in Yaghoubi, 2008). Distance education can save travel time for both students and instructors, and cut cost down because one instructor can handle very many students (Hannay & Newvine, 2006). It permits students to work at their own pace regardless of race, sex, disability or appearance (Richardson & Swan, 2003; Swan et al, 2000 as cited in Yaghoubi, 2008).

The Importance of ICT

ICT is becoming a necessity for economic and human development. It is estimated that by 2015 most jobs in the EU countries, regardless of the kind of industry, will require at least basic IT skills (Tas, 2011). ICT is utterly important for schools and higher education institutions. If students are prepared to use ICT in schools, the transition from schools to higher education will be feasible (Lim & Hang, 2003). Higher education, in particular, constitutes a critical factor in the processes of social, cultural and economic development (Bergen Communique, 2005; Kitagawa, 2004; European Commission, 2004; as cited in Bosco & Gomez, 2011). ICT permits restructuring of education by the introduction of online or distance learning whereby the classroom becomes merely one more instance of support for learning (Rue & Martinez, 2005 as cited in Bosco & Gomez, 2011). ICT allows new forms of engagement; it can be used to engage those who may have been marginalized, disadvantaged, or excluded from traditional education programmes (Candy, 2004 as cited in Carbone et al., 2010). The integration of ICT permits exchanges among people in terms of communication, knowledge, information and ideas that were not apparent before the adoption of technology and the knowledge society (Ott & Pozzi, 2011).

ICT provides students with the opportunity to become self-directed learners by accessing and retrieving information via the World Wide Web and discovering their own approaches to learning based on their own interests and needs. ICT also impacts cultural heritage education which previously relied on traditional teaching methods where the teacher was the sole provider of learning and textbooks were the only sources of knowledge. Almost all developed countries have created free electronic archives and made relevant attempts at digitizing their cultural heritage (UNESCO, 2005 as cited in Ott, 2011).

ICT in some developed countries

According to the US Department of Education's National Center for Education Statistics, 90% of public two-year and 89% of public four-year institutions offered distance education courses in 2000-2001. Of those, 88% indicated they had plans to increase the use of the internet as a primary mode of instructional delivery (Waites & Lewis, 2003as cited in Al-Omari & Salameh, 2012). In Japan, distance education programmes have been regulated differently from campus-based programmes of higher education. In 2008, 229,734 students were seeking degrees at a distance in 41 universities that provided distance learning undergraduate programmes, accounting for 9.1% of total higher education enrollees (Aoki, 2010, pp.868). Out of the 41 universities, 37 offered both on campus education and distance education programmes, while 4 were exclusively distance learning institutions. Although the majority of distance education institutions in Japan utilized print based materials for instructional delivery, one unique university used radio and television broadcasting as the major mode for that purpose. It was named the University of Air, and later in November 2007 was renamed the Open University of Japan (Aoki, 2010).

ICT in some developing countries

In 1994, the six most famous universities in China, including Tsinghua University and Peking University set up the first education network using the China Education and Research Network (CERNET). It connected five major cities (Beijing, Shanghai, Guangzhou, Nanjing, Xian) and linked them to the internet (Guodong & Zhomgjiao, 2010). Chinese colleges and universities adopted the e-campus method to introduce ICT in higher education. E-campus refers to an institution based on a campus network, and the integration of digital resources, building up and e-educational administration portal, e-learning, distance education and multi-media broadband network, campus management information system, etc. (Guodong & Zhomgjiao, 2010).

E-learning in Chinese higher education adopted three approaches: conventional, blended and distance models. The first approach is associated with the physical teaching environment such as the classroom where teachers optimize instruction via conventional e-learning methods. Examples include, but are not limited to, television, sound recorder, email, bulletin board, etc. The second approach is a combination of the traditional (face to face) teaching and virtual learning using the Course Management System (CMS). After classroom instruction, the teacher assesses the students' outputs via the network instruction platform which is implemented entirely by CMS on the internet, at any time and place (Jiang & Zhomgjiao, 2010). The introduction and implementation of DE in African countries face many obstacles and challenges in practice. They include inadequate infrastructure, insufficient number of professionals trained in that field, intermittent power cuts and poor internet connectivity. Those most affected are students residing in rural areas whom are outside the reach of national telecommunications network and access Sedcom Fibre optics cable (Mtebe, Dachi & Rapheal, 2011). In the Arab countries, the speed of introducing internet access devices has been increasing rapidly. In the Arabian Gulf States, ICT and internet penetration levels are comparable to the west. However, for the Arab States as a whole the percentage of internet users who use Arabic Language based internet amounts to 3.7% of internet users in the world (source: internet world statistics Nov. 30, 2007 in Emdad, 2009).

In Jordan, ICT integration fell in the midrange of ICT development indices (UNDP, 2003 as cited in Al-Mobaideen, 2009). An education strategy was initiated in 2000 aiming at using ICT widely to achieve the objective of the e-government project (MoICT Report, 2004 as cited in Al Mobaideen, 2009) which called for the transformation of Government Services using ICT. In 2001, His Majesty King Abdallah II proposed a visionary initiative to reconstruct the quality of human resource performance in most Government's sectors, especially with regard to ICT in education (Al- Mobaideen, 2009). The Status of ICT utilization in higher education institutions for technology- enhanced learning purposes was investigated in 2007. A survey covering various fields of study in 22 Jordanian universities was conducted to assess the expertise of professors in the use of ICT software tools. The results indicated that their expertise was excellent in Word Processing, Power Point, E-mailing, Internet Browsing; and good to excellent in Spread Sheet; and fair to good in Webpage Designing. The University of Jordan adopted the Blackboard Learning System which is a web-based server software platform. It is used to augment the face to face traditional approach. Likewise, Blackboard had been integrated into the information system of the Hashemite University in Jordan since 2003.

Obstacles Hindering the Use of ICT in the Arab Countries

A number of factors limit the growth of ICT in the Arab countries. Some of those factors are applicable to developing countries in general.

1. **Language**: lack of Arabic based internet, insufficient knowledge of the English language by some people and resentment to the use of English Language by others.

2. **Technology**: insufficient internet connections which is determined by the state of the country's telecommunication infrastructures including the number of telephone lines per

capita and the international connection bandwidth (HRW, 2008 as cited in Emdad, 2009). Also, nearly all equipment is imported; there is no local ICT production. Likewise, there is weakness in local software development capabilities and increasing reliance on foreign technology in programming, language standards definition and software development.

3. **Cost**: Internet and telephone services are expensive; in fact more expensive in the Arab countries than in the United States (HRW, 2008 as cited in Emdad, 2009). High speed internet users in the Arab world pay on average six times more, for their services, than users in Europe (Gara, 2009 as cited in Emdad, 2009). Thus, one of the challenges facing service providers is how to provide broad band internet connectivity and make it affordable to the people.

4. **Government policies**: absent or ineffective national policies to invest in ICT are a constraint. Moreover, there is no common strategic Arab plan for ICT. The approaches of individual Arab countries are often competing instead of cooperating.

5. **Culture**: conservative people do not favor using the internet, in education or otherwise. Older people tend to stick to their own traditional ways.

The above mentioned obstacles apply to Jordan. In 2009, a study by Al-Mobaideen tried to identify the factors that impeded or facilitated the implementation of ICT in the country's higher education system. Consequently it explored the role of ICT in four public and private universities. It was found that the universities had established webpages on the internet which provided brief information about the university such as its objectives, faculties, degrees offered, tuitions and costs of study. (Younis, 2002 as cited in Al Mobaideen, 2009). Multimedia resources such as CD-Rom were generally used at both departmental and faculty levels (Al-Zoubi et al., 2007). However, obstacles and challenges to the implementation of ICT in Jordanian universities persisted due to the absence of critical success factors which the study identified as: (1) policies and strategies, (2) infrastructure and networks, (3) funding and sustainability and (4) culture. Favorable policies and strategies are the responsibility of the education sector at the national level. The universities should develop an adequate ICT infrastructure and provide computers and network access tools for both faculty and students. The universities should promote distance learning, invest in e-learning tools and modern facilities and provide online information from off-campus sources which can be readily used by all individuals. The funding and sustainability of ICT programs fall within the responsibility of the Government which could solicit funds from international organizations such as the World Bank, USAID and UNESCO (Al-Mobaideen, 2009). The culture factor influences the attitudes of individuals at the university. The impact of culture on technology was found to be significant with respect to understanding and accepting ICT diffusion. It could negatively influence people who like to stick to traditional methods (Al-Mobaideen, 2009).

Measures that Can Increase the Use of ICT in the Arab Countries

1. Making the Arabic language a basic means of accessing information (Accassina, 2006 as cited in Emdad, 2009); creation of Arabic search engines.

2. Exploring advances in wireless technologies, especially for rural areas. Wireless technologies are easier to deploy and help eliminate some geographical barriers and costs associated with wired telecommunication systems. Wireless internet via mobile technology is possible in the Arab countries (Lu, Liu, Yu & Yao, 2005 as cited in Emdad, 2009).

3. Designating one institution with a comprehensive responsibility for e-learning in the country.

4. Formulating a common Arab ICT strategy relying on Arab funding for creating transnational teams devoted to that objective. The strategy should aim at developing indigenous ICT industry using local (not imported) skills.

5. Upgrading skills of instructors relating to e-learning technologies as well as online teaching strategies. A study on the status of ICT in higher education institutions in Jordan (referred to before) revealed that almost two thirds of the professors did not receive any training on ICT before or during their teaching careers.

6. Universities should monitor students attitudes, expectations and readiness regarding the role of e-learning.

The factors that determine advances or setbacks in the evolution of ICT in education were investigated in a study on South Korea (a developed country) and Chile, a developing country (Sanchez, et al., 2011). The much superior performance of South Korea was linked to the following factors:

1. Sustained development of ICT industry, especially that relating to hardware, which creates an environment prone to innovation.

2. Explicit emphasis that the vision of the educational system must be connected to a long term strategy for national development. Consequently, continuous review and renewal of the curriculum takes place, and more spending is done on ICT education.

3. The South Korean society has a strong focus on technology. This is the cultural factor.

Students' perceptions of ICT

A study was conducted in two major cities in Egypt to assess the students' reactions and perceptions relating to adopting e-learning in the higher education system. The findings revealed that the majority of the sampled higher education students preferred the traditional on-campus mode of learning. This result might be due to a number of factors such as resistance to change, cultural aspects, fear of uncertainty, lack of synchronous feedback to questions and assignments, minimum interaction between student and instructor, technological infrastructure problems (internet speed and bandwidth) and expectations concerning e-learning programmes (Abd El Aziz, El Gamal, 2011). Although those students might have heard about e-learning, they were unaware of the benefits that it might bring to them and to the institutions. On the other hand, students who preferred e-learning perceived it as a solution to some of the problems, such as large class size, and big universities, and as an effective instructional delivery that could resolve differences in learning styles (Abd El Aziz, El Gamal, 2011).

In an online course, the immediate accessibility of information, assistance and feedback by the instructor influence the students' satisfaction with that course. Therefore, instructors should remain in contact with the students through e-mail and online forum discussions (Poon et al., 2004 as cited in Ali, 2011). Likewise, for students, getting feedback from the instructors concerning their needs and preferences is crucial for the successful design and implementation of the e-learning environment (Sahin, 2007 as cited in Ali, 2011). The key factors that determine students' satisfaction in an e-learning course are in descending order: student-instructor interaction (guidance, encouragement, feedback), instructors' performance (effectiveness, stimulation, presentation of material) and course evaluation (relevancy, usefulness, fair testing and evaluation procedure).

The advantages of ICT learning vs. traditional (face to face) learning were pointed out in previous paragraphs. However, it is often mentioned that traditional learning offers stronger interaction between student and instructor and among students. Moreover, certain fields favor traditional

learning such as technology courses (Richardson & Swan, 2003 as cited in Yaghoubi, 2008). Consequently, the blended approach, which utilizes online and face to face (traditional) learning, has been advocated as the most effective way for virtual learning and as possessing advantages over both types of learning. Blended learning tends to foster the sense of community belonging and remove the frustration created sometimes by mere online environment. The face to face element is important because it highlights the effect of body language, tone of voice, facial expression and eye contact on communication. Blended (or hybrid) learning should appeal to young students living on campus and immersed in university life to whom e-learning or distance learning is not appealing. Recent studies by (Kim & Bonk, 2006), (Gomez et al., 2007), (Eynon, 2008), (Young & Ku, 2008), (Steele, 2008), (Garrison & Vanghan, 2008) and (Moskal & Dziuban, 2011), all cited in Fillion, G., & Ekionea (2012), showed the growth of blended learning.

Objective of the study and research questions

The impact of ICT on study and learning practices has generated research seeking to identify both the extent of ICT usage and the effects this is having on students' experience at university more broadly. Thus, the objective of this study is twofold: to *evaluate* the use of ICT in the Faculty of Educational Sciences (FES) at the University of Jordan and to *investigate* students' perceptions of ICT. Accordingly the research questions are:

1. What are the students' evaluations of the computer labs at the FES?

2. What are the students' ICT abilities and, experiences, i.e. their ability of using ICT applications?

3. What are the students' experiences in e-learning methods?

4. What are the students' perceptions of the merits of using ICT in education versus the traditional education methods?

5. What are the students' perceptions regarding the importance of opportunities offered by using ICT?

Methodology

The methodology adopted consisted of two tasks:

1. Soliciting information from a sample of students, by means of a questionnaire, to answer the research questions. This was then processed by the statistical computer package (SPSS) to obtain descriptive analysis.

2. Conducting interviews with selected respondents who express negative perception of ICT.

3. Conducting t test to find out the effect of specific variable on students' perception of ICT.

Population and sample

An accessible population can be defined as "all individuals who realistically could be included in the sample" (Gall & Borg, 2003, pp.168). In this study, the accessible population consists of all students in the FES at the University of Jordan. It includes students enrolled in the bachelor, master and doctoral programs in all faculty departments: Curriculum and Instruction, Educational Psychology, Educational Administration and Foundations, Counseling and Special Education, and Library and Information. The population at the time of the survey in the spring semester of 2011/2012 was 2843 with a ratio of 1:5, males to females. A purposeful sample was used in this study. It included 269 students who participated in completing the questionnaire.

Questionnaire design and data collection

One structured questionnaire, taken from the SOCRATES program[1], was used to gather the needed information from the sample. The questionnaire consists of six parts. The first part, solicits personal data about the students such as gender, age, nationality, field of study, and degree pursued. It also contains close ended questions which can be answered by either 'yes' or 'no' and which solicit additional information about the student's level of engagement with the computer, its accessories, and programmes. The second part answers Research question one. It investigates the students' evaluation of computer labs at the FES. It consists of both open ended and close ended questions. The close ended questions employed two different likert scales of 1-5. The first ranges from always to never, the second from strongly agree to strongly disagree. The domains under investigation include: Internet connectivity speed, technical support and management (software upgrades, technical support for students, maintenance of computer facilities, availability of computer accessories; physical conditions (temperature, air quality, adequate lab areas, especially for students with special needs). Part three of the questionnaire answers Research question two, which investigates the students' ICT abilities, and experiences. It is divided into four domains: word processor, email programmes, PowerPoint presentations, and using the internet for bibliographic database. The students are asked to choose from three possible answers: I can do it by myself, I need some help, and I never did it before. Part four of the questionnaire answers Research question three pertaining to the students' experiences in e-learning methods; It consists of 5 domains: Interactive website, Online discussion forums, Video-conferencing, Blackboard , WebCT, and E-mail. The students are asked to answer yes or no. Part five answers Research question four, which investigates the students' perceptions of the merits of using ICT in education versus the traditional methods. It consists of 14 statements and a 1-5 likert scale ranging from strongly agree to strongly disagree. Finally, part six of the questionnaire answers Research question five, which investigates the students' perceptions regarding the importance of opportunities offered by using ICT. It consists of 16 statements and a 1-5 scale ranging from very important to I don't know. The reliability for the tool (questionnaire) used in this study is shown in Table 1

Table 1
Reliability of questionnaire

Part in Questionnaire	Number of Items	Cronbach Alpha
3	4	.614
4	5	.497
5	14	.498
6	16	916

Profile of students

The information collected in part one of the questionnaire was used to construct the profile of students in the sample as shown in Tables 2a and 2b. Almost all students (99%) knew how to use the computer, and (91%) owned computers.

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[1] An Educational Initiative of the European Commission, 31 countries took part

Table 2a
Profile of students

Nationality	Number of Students	% of Students in sample
Jordanian	253	94.1
Palestinian, Saudi Arabian, Yemen, Turkish	13	4.8
No response	3	1.1
Age		
18	32	11.9
19	69	25.6
20-29	157	58.4
30-39	7	2.7
40	2	0.7
No response	2	0.7
Gender		
Female	228	84.8
Male	41	15.2
Degree Programme Pursued		
Bachelor	248	92.2
Master	15	5.6
Doctoral	5	1.9
No response	1	0.3

Table 2b
Profile of students

	Yes		No		No Response	
	No. of Students	%	No. of Students	%	No. of Students	%
Can you use the computer	266	98.9	3	1.1	0	0
Do you have a computer	244	90.7	25	9.3	0	0
Do you have a laptop	162	60.2	106	39.4	1	0.4
Are you connected to the internet at home	207	77.0	60	22.3	2	0.7
Do you have your own email address	219	81.4	50	18.6	0	0
Do you have a Facebook account	192	71.4	76	28.3	1	0.3
Do you have a webpage	45	16.7	223	82.9	1	0.4
Do you have a printer at home	111	41.3	158	58.7	0	0
Do you have a scanner at home	47	17.5	222	82.5	0	0
Do you have a digital camera at home	139	51.7	130	48.3	0	0
I learned to use the computer on my own	169	62.8	100	37.2	0	0
I learned to use computer in secondary school	98	36.4	171	63.6	0	0
I learned to use the computer by participating in training sessions	10	3.7	259	96.3	0	0

Findings and discussion

Answer to Research question one: What are the students' evaluations of the computer labs at the Faculty of Educational Sciences (FES)?

The answer to this question is derived from Part two of the questionnaire and is shown in Tables 3a, 3b, and 3c. The majority of the students, around 80%, stated that the computers and their accessories in the computer labs were working well. However, only half of them thought the programmes were new and one third thought the speed of the internet was fast. Also, about one third of the students thought the lab areas were adequate and only 20% thought they were adequate for students with special needs.

Table 3a
Students' evaluation of the computer labs at the FES

	Yes		No		No Response	
	No. of students	%	No. of students	%	No. of Students	%
The speed of the internet is fast	175	65.1	90	33.4	4	1.5
Computers in the labs work well	213	79.2	30	11.2	26	9.6
Programmes are new	139	51.7	46	17.1	84	31.2
Accessory devices like printers & scanners are available	226	84.0	36	13.4	7	2.6
A lab specialist is available to assist students	230	85.5	30	11.2	9	3.3
Air conditioners in labs work well	176	65.4	83	30.9	10	3.7
There are headsets in the labs	26	9.7	235	87.4	8	2.9
Printers used for research purposes	239	88.9	20	7.4	10	3.7

Table 3b
Students' evaluation of the computer labs at the FES

	Always		Most of the time		Sometimes		Seldom		Never		No Response	
	No. of St.	%	No of St.	%	No. of St.	%	No. of St.	%	No. of St.	%	No. of St.	%
Computer accessories like printers and scanners work well	63	23.4	120	44.6	58	21.6	7	2.6	4	1.5	17	6.3
Ink in the printers	85	31.6	121	45.0	39	14.5	10	3.7	5	1.9	9	3.3
Paper in the printers	107	39.8	99	36.8	41	15.2	7	2.6	3	1.1	12	4.5

Table 3C
Students' evaluation of the computer labs at the FES

	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		No Response	
	No. of St.	%	No. of St	%	No. of St	%	No. of St.	%	No. of St.	%	No. of St.	%
The lab areas are adequate	18	6.7	74	27.5	124	46.0	33	12.3	15	5.6	5	1.9
The lab areas are adequate for special needs students	12	4.5	38	14.1	72	26.8	72	26.8	68	25.2	7	2.5

Answer to Research question 2: what are the students' ICT abilities and experiences? i.e. their ability of performing ICT applications. The students were asked to state their abilities in using computer programmes to perform certain tasks. Their responses are shown in Table 4. They indicate that although more students were able to use the specified computer programmes by themselves, yet those who said they needed some help or that they had never used the programmes before were in the range from 26% to 42% which is significant.

Table 4
Students' ICT abilities

Computer Programme	I can do it by myself		I need some help		I never did it before		No Response	
	No. of St	%	No. of St	%	No. of St	%	No. of St	%
Using word processor to prepare a C.V or type a research report etc.	196	72.9	53	19.7	18	6.7	2	0.7
Using Email to send attachments	153	56.9	76	28.3	38	14.1	2	0.7
Using PowerPoint for presentations	188	69.9	58	21.6	17	6.3	6	2.2
Using the Internet to find bibliographic database, etc.	168	62.5	57	21.2	39	14.5	5	1.8

Answer to Research question 3: what are the students' experiences in e-learning methods? The students were asked to report if they had ever participated in e-learning activities. Their responses are shown in Table 5 and indicate that the majority of students did not participate in those methods, especially in video conferencing and online discussion forums. This also implies that the instructors are not introducing those methods as much as they should in order to promote e-learning.

Table 5
Participation of students in e-learning methods

E-learning method	Yes		No		No answer	
	No. of St.	%	No. of St.	%	No. of St.	%
Interactive Website	111	41.3	154	57.2	4	1.5
Online Discussion Forums	57	21.2	206	76.6	6	2.2
Video Conferencing	18	6.7	247	91.8	4	1.5
Blackboard, WebCT	78	29.0	181	67.3	0	3.7
Emailing instructors	109	40.5	155	57.6	5	1.9

Answer to Research question 4: what are the students' perceptions of the merits of using ICT in education versus the traditional method? The students were presented with a number of statements and asked to comment on them, ranging from "I strongly agree to I strongly disagree". Their responses are shown in Table 6.

Table 6
Students' perceptions of ICT based education versus traditional methods

Statement	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		No response	
	No. of St.	%	No. of St.	%	No. of St.	%	No. of St.	%	No. of St.	%	No. of St.	%
In general, learning via ICT consumes more time than traditional method	50	18.6	50	18.6	40	14.9	79	29.4	42	15.6	8	2.9
I prefer reading ICT based texts	60	22.3	92	34.2	50	18.6	45	16.7	12	4.5	10	3.7
I believe that ICT can improve my education	102	37.9	106	39.4	34	12.6	14	5.2	4	1.5	9	3.4
It is difficult to find good quality information on the internet	25	9.3	49	18.2	54	20.1	97	36.1	33	12.3	11	4.1
I wish to study via the computer even if it may be difficult	50	18.6	70	26.0	64	23.8	58	21.6	12	4.5	15	5.6
I believe that video and audio texts can improve my education	98	36.4	109	40.5	37	13.8	11	4.1	8	3.0	6	2.2
I prefer learning via the traditional method, i.e. from books and not computers	40	14.9	55	20.4	64	23.8	67	24.9	31	11.5	12	4.5
ICT allows exchange of skills in an effective manner	98	36.4	126	46.8	30	11.2	6	2.2	3	1.1	6	2.2
If learning via the computer is difficult, one can go back to the traditional method, i.e. books	53	19.7	99	36.8	70	26.0	36	13.4	5	1.9	6	2.2
Learning via ICT requires high computer skills	78	29.0	110	40.9	32	11.9	37	13.8	4	1.5	8	3.0
I like to work using the computer with a small group of students	47	17.5	107	39.8	48	17.8	42	15.6	14	5.2	11	4.1
Learning via the computer lacks interaction between the student and instructor	82	30.5	93	34.6	47	17.5	34	12.6	9	3.3	4	1.5
I believe interaction between student and instructor has positive effect surpassing the use of the computer	127	47.2	85	31.6	32	11.9	13	4.8	8	3.0	4	1.5
Learning via the internet alone is acceptable to me	47	17.5	101	37.5	50	18.6	45	16.7	15	5.6	11	4.1

The majority of students had positive perceptions regarding certain aspects of ICT based education. They pointed out the following merits:

- Availability of good quality information on the internet and their preference to read ICT-based texts.

- The belief that ICT including audio and video texts improve their education, and that it allows the exchange of skills effectively.

On the other hand, the majority of students stated that computer-based education lacks interaction between students and instructor. This interaction, according to about 80% of them, surpasses the merits of ICT based education

Answer to research question 5: what are the students' perceptions regarding the importance of opportunities offered by using ICT? The students' responses to a set of statements is shown in Table 7. The statements mentioned the impact of ICT on students regarding their learning, self-development and social aspects. The students were asked to comment on the statements by choosing one of the following: very important, important, neutral, not important, not important at all. The response of the students to every statement was overwhelmingly positive. 81% to 90% of the students mentioned that ICT was very important or important whereas only 14.5% was the highest percentage of students who stated that it was not important or not important at all. This result indicates that the students in the sample were well aware of ICT capabilities and perceived them positively.

Table 7
Students perceptions of importance of opportunities offered by using ICT

Statement	Very important		Important		Not Important		Not Important at all		Don't Know		No response	
	# St.	%	# St.	%	# St.	%	# St.	%	# St.	%	# St.	%
Enabling students to get acquainted with higher education institutions in their countries and abroad	147	54.6	92	34.2	16	5.9	2	0.7	8	3.0	4	1.5
Enabling students to participate in lectures and training conducted by institutions of higher education in other countries via the internet	117	43.5	105	39.0	27	10.0	4	1.5	12	4.5	4	1.5
Enabling students to interact with instructors in Jordan and other countries to receive academic advice	119	44.2	110	40.9	18	6.7	4	1.5	10	3.7	8	3.0
Enabling students to cooperate with other students in Jordan and other countries	114	42.4	104	38.7	31	11.5	6	2.2	8	3.0	6	2.2
Enabling students living abroad to interact with their families and friends	194	72.1	47	17.5	9	3.3	3	1.1	9	3.3	7	2.6
Enabling students living in remote areas to get high education via a less difficult method, the internet	153	56.9	72	26.8	17	6.3	6	2.2	13	4.8	8	3.0
Enabling less fortunate students to get high education via a less difficult method, the internet	137	50.9	95	35.3	16	5.9	5	1.9	10	3.7	6	2.2
Enabling students from developing countries to get high education easier via the internet	120	44.6	95	35.3	25	9.3	5	1.9	11	4.1	13	4.8
Enabling special needs students to get high education easier via the internet	167	62.1	62	23.0	16	5.9	8	3.0	9	3.3	7	2.6
Developing skills relating to problem solving, group work,	130	48.3	93	34.6	22	8.2	8	3.0	10	3.7	6	2.2

self- education and presentations

Developing education that depends mainly on student initiative	122	45.4	106	39.4	19	7.1	4	1.5	10	3.7	8	3.0
Enabling graduates to get continuous professional development	142	52.8	94	34.9	12	4.5	6	2.2	8	3.0	7	2.6
Enabling students to participate in many university activities	121	45.0	110	40.9	17	6.3	8	3.0	7	2.6	6	2.2
Enabling students to get feedback relating to their progress in educational process	139	51.7	93	34.6	15	5.6	6	2.2	11	4.1	5	1.9
Enlarging scope of resources and info available to students by using the internet	133	49.4	99	36.8	19	7.1	6	2.2	5	1.9	7	2.6
Developing group education methods instead of individual methods	120	44.6	100	37.2	32	11.9	7	2.6	5	1.9	5	1.9
Enabling students to participate in lectures and training conducted by institutions of high education in other countries via the internet	117 43.5	105 39.0	27 10.0	4 1.5	12 4.5	4 1.5					
Enabling students to interact with instructors in Jordan and other countries to receive academic advice	119 44.2	110 40.9	18 6.7	4 1.5	10 3.7	8 3.0					
Enabling students to cooperate with other students in Jordan and other countries	114 42.4	104 38.7	31 11.5	6 2.2	8 3.0	6 2.2					
Enabling students living abroad to interact with their families and friends	194 72.1	47 17.5	9 3.3	3 1.1	9 3.3	7 2.6					
Enabling students living in remote areas to get high education via a less difficult method, the internet	153 56.9	72 26.8	17 6.3	6 2.2	13 4.8	8 3.0					
Enabling less fortunate students to get high education via a less difficult method, the internet	137 50.9	95 35.3	16 5.9	5 1.9	10 3.7	6 2.2					
Enabling students from developing countries to get high education easier via the internet	120 44.6	95 35.3	25 9.3	5 1.9	11 4.1	13 4.8					
Enabling special needs students to get high education easier via internet	167 62.1	62 23.0	16 5.9	8 3.0	9 3.3	7 2.6					
Developing skills relating to problem solving, group work, self- education and presentations	130 48.3	93 34.6	22 8.2	8 3.0	10 3.7	6 2.2					
Developing education that depends mainly on student initiative	122 45.4	106 39.4	19 7.1	4 1.5	10 3.7	8 3.0					
Enabling graduates to get continuous professional development	142 52.8	94 34.9	12 4.5	6 2.2	8 3.0	7 2.6					
Enabling students to participate in many university activities	121 45.0	110 40.9	17 6.3	8 3.0	7 2.6	6 2.2					
Enabling students to get feedback relating to their progress in the educational process	139 51.7	93 34.6	15 5.6	6 2.2	11 4.1	5 1.9					
Enlarging the scope of resources and information available to students by using the internet	133 49.4	99 36.8	19 7.1	6 2.2	5 1.9	7 2.6					
Developing group education methods instead of individual methods	120 44.6	100 37.2	32 11.9	7 2.6	5 1.9	5 1.9					

A t test (one way ANOVA) was performed to identify the impact of gender, age and degree programme on students' perceptions of ICT based education. The results shown in Table 8

indicate that only degree programme had an impact. Table 9 shows that PhD programme students perceived ICT based education more positively than other students

Table 8
t-test: Effect of Gender, Age and Degree on Students' Perception of ICT

Variable	df	Sig
Gender	265	.751
Age	264	.062
Degree	265	.015

Table 9
LSD Test: Effect of Degree Programmes on Students' perceptions

Degree Programme	N	Mean	Std Deviation
1: Bachelor	246	10.0976	1.89915
2: Masters	15	11.0667	1.62422
3: Doctoral	5	12.000	0.00000
Total	266	10.1880	1.89398

Interviews with selected students

After examining the filled questionnaires, I interviewed 8 students who expressed the most negative perceptions concerning using ICT in education versus the traditional method (Part five of the questionnaire). They invariably pointed out that the traditional method provided much better interaction with the instructor, including:

- continuous communication between student and instructor
- instructor's gestures, facial expressions and body language assist students in understanding what the instructor means.
- exchange of thoughts and ideas with instructor are easier.
- response of the instructor is prompt.

Sometimes there is no internet connection. electricity is out or the instructor is busy.

The result of the interviews confirms the results obtained through the descriptive analysis, namely that the main obstacle against using ICT in education is the lack of interaction between student and instructor.

Conclusions and recommendations

The students seem to be well versed with computers. (91%) of them own computers and (99%) can use computers. About 80% of the students believed that computers and their accessories in the computer labs at the FES were working well. However, only half of them thought the available programmes were new, and one third thought the speed of the internet was fast enough. Also, one third of the students thought the lab areas were adequate and only one fifth thought they were adequate for special needs students.

More students mentioned that they could use the following programmes without assistance from anyone: word processor, to type a research project, email to send attachments, PowerPoint for presentation, and the internet to find bibliographic database. However, those who mentioned that

they needed some assistance or that they had never used the programmes before ranged from 26% to 42%, which is a significant number of students. Moreover, the majority of students had not participated in the following e-learning methods: Interactive website, online discussion forums, video conferencing, Blackboard, WebCT and emailing instructors. This implies that the students had not been exposed to those ICT programmes and methods.

The majority of students (from 81% to 90%) mentioned that ICT offered important opportunities to students. Those opportunities included, but are not limited to, enabling them to get acquainted with other institutions, students and instructors in Jordan and other countries, enabling less fortunate students and those living in remote rural areas to get high education. This means that the students were well aware of ICT capabilities and perceived them positively. Also the majority of students pointed out the merits of ICT based education versus traditional education methods. Those merits included availability of good information on the internet, ability of ICT including audio and video texts to improve their education and allow the exchange of skills effectively, etc.

On the other hand, about 4 out of 5 students stated that computer-based education lacked interaction between the students and the instructor. This interaction which exists in traditional education surpassed the merits of ICT based education, according to about 80% of the students.

There was no indication that culture played any negative role in the students' perceptions of ICT based education. This can be explained by the fact that Jordanians are well educated, by regional standards. Moreover, there was no significant relationship between gender, or age, and students' perceptions. The only significant relationship was with the degree programme, where PhD programme students had more positive perceptions than other students.

Keeping in mind that the students are well versed with computers and aware of the merits of ICT based education, it is recommended that the university takes the initiative in promoting, introducing and supporting ICT based education. The action plan could include:

1. Upgrading existing computer labs, computer programmes, and internet speed.
2. Enhancing the capabilities of faculty members in the areas of ICT based education, e.g. through workshops by specialists in the field.
3. Formulating a long term plan to gradually introduce ICT based education. The plan ought to benefit from the experiences of countries like South Korea, and it must guarantee easy, immediate and adequate interaction between students and instructors. Some form of blended education (ICT/traditional) education could be adopted for that purpose.
4. Promoting the idea of ICT based education with the Government Ministries and agencies concerned.

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A distributed architecture to support distance education in developing countries

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Abstract

Research has shown that outcomes via distance education (DE) delivery methods are equivalent to students learning in a traditional classroom (Russell, 2001). In the developing nations, the huge shortage of quality teaching staff has been the main factor for the slow growth of primary education. DE can help to address this problem only if there is an effective and feasible training model that can be implemented using a content delivery architecture that is not network capacity intensive. This paper presents a low cost synchronous Internet distance education tool, an *n*-tier hierarchical training model, and a selected architecture for DE content delivery and exchange to developing countries with limited network resources. Many design parameters were simulated to determine the optimized design for the selected architecture. Some of the simulated results are presented in this paper.

Keywords: distance education, online teaching and learning, training model, peer-to-peer, overlay network

Introduction

Distance education (DE) is becoming popular in developing countries. Why is this true? There have always been those who question whether DE is an effective delivery method. Do students at a remote location learn as much as students in a traditional classroom (Smith, 2001)? Research has shown that outcomes via DE delivery methods are equivalent to students learning in a traditional classroom (Russell, 2001). In the developing nations, the huge shortage of quality teaching staff has been the main factor for the slow growth of primary education. DE can help to address this problem only if there is an effective and feasible training model that can be implemented using a content delivery architecture that is not network capacity intensive.

This paper has been structured to first briefly describe asynchronous and synchronous DE teaching models, and provide comparisons of three open source and one commercial synchronous distance education tools (SDET), and two asynchronous (one open source and one commercial) SDETs. The comparisons are presented here to show why Moodle Integrated Synchronous Teaching and Conferencing (MIST/C) SDET has been determined to be the cost-effective and suitable solution to use with the selected architecture for training instructors in developing countries. Next section presents the n-tier hierarchical training model that describes how this model can be used to teach a large population of underserved students without a computer and Internet by local teachers in remote areas. Intermediate layers are introduced to show how experienced instructors of major cities can use the selected architecture and SDET to train local instructors for them to teach students in the live classrooms. The proposed architecture is presented in the following section describing its layers and technical features. Different parameters and metric values were fine-tuned and simulated for analysis to determine the best combination for the target architecture, and some of the results are presented following the

section describing the architecture. The paper concludes with recommendations for future research work.

The United States has a significantly higher collection of its population connected to the Internet than the world overall (see Table 1). We will take Bangladesh here as representative of nations undeserved in primary education. The Bangladeshi government, as other international education agencies, is striving to impart primary education to the underserved. This is consistent with the second of the United Nations' Millennium Development Goals (MDG) (2010). These are underserved students between the ages of 10 and 20 who live in remote areas such as villages and small townships where primary education is very poor, largely because the student to teacher ratio is 50:1 and there is a severe lack of competent teaching staff. If this goal is achieved, the literacy rate of the country would improve, gradually alleviating poverty, and be a key driver for economic growth (Islam & Snow, 2009; 2011).

Table 1 is a snapshot of the distribution of Internet users.

Table 1
Percentage of Internet Users (2012)

Location	Population	Internet Users	% of Population
World	6,930,055,154	2,095,006,005	30.2
United States	310,232,863	239,232,863	77.3
Bangladesh	158,065,841	617,300	0.4

Paprock (2006) says past research demonstrates basic education is very important for economic growth and poverty alleviation in developing countries. Education is the catalyst for better health and quality of life, productivity, higher well-being of women and improved government. He also cites the Independent Commission for Population and Quality of Life (ICPQL): "...education is one of the keys to social development, and virtually every aspect of the quality of life" (p. 90).

DE teaching methods may be used to address this problem. For DE to be successful, the participants must have access to a shared network. Plus, the network connectivity has to offer adequate data bit rate and have high availability standards. For synchronous DE, the bit rate has to be at least 100 kb/s, which is quite high since currently popular distance learning tools require, at a minimum, this much data capacity for transmitting audio and graphics without video.

There are three important barriers to DE as pointed out by Paprock (2006): 1) the lack of resources needed for meaningful development and sustenance of technology based learning; 2) lack of infrastructures (which includes information and communication hardware systems) to support modern technologies in the least developed and/or low technology countries, and, 3) lack of recurrent funding necessary to acquire or develop appropriate software and courseware on a continuous basis, and maintain service and replace the equipment.

Wireless communication has come a long way in developing countries. These countries leapfrogged the wired infrastructure of developed countries, taking advantage of this newer technology to improve their data communications infrastructure and meet the growing needs of their vast population. For example, in Bangladesh there are about 70 million users of cellular phones (Bangladesh Business News, 2012) and 617,300 Internet users (2012). Unlike developed nations, wireless Internet service is provided via Enhanced Data Rates for GSM Evolution (EDGE) cellular networks that are able to offer up to 100 kb/s data bit rate. The Internet is the network of choice for the DE model since students at remote locations would access education

material stored at distance locations over the Internet using their distance learning client application software on their local computer or mobile devices via their cellular network service provider (Islam et al., 2011).

We can overcome all three barriers listed above if a distance learning software that is not cost prohibitive can be used to exchange education materials, teach students and train local instructors remotely leveraging an n-tier hierarchical training model via an efficient network delivery architecture over the Internet.

It is worth noting that access to primary education has improved from the time MDG was established because primary school enrollment rose worldwide from 82% in 1990 to 89% in 2008 (The Economist, 2010). Despite this rise, an enormous challenge in primary education remains. There are about 67 million children not in school, of which 32 million are in sub-Saharan Africa (MDG, 2010; Islam et al., 2011). Shortage of one million instructors, in sub-Saharan Africa alone is a huge obstacle in enrolling a percentage of the 32 million students (ONE, 2012). Figure 1 illustrates majority of these underserved children are from developing countries.
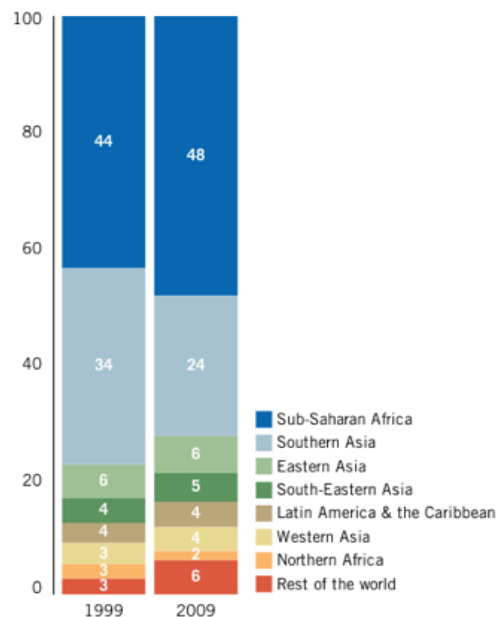

Figure 1: Distribution of out-of-school children by region (percentage), 1999 and 2009
(Snow & Islam, 2012)

Asynchronous and synchronous DE

There are two distinctly different types of DE delivery methods: asynchronous and synchronous. Synchronous DE creates an environment where the students are remotely attending a live, in-person class in a classroom setting without having to actually go to a classroom. Asynchronous DE lets students learn during times that are convenient for them because it is not a necessity for them to listen to lectures during a scheduled time slot. Students are able to learn with high degree of flexibility as long as they meet the course expectations and deadlines (Smith, 2001). Hrastinski's research results of (2008) show there are benefits and limitations of asynchronous and synchronous DE delivery methods, and they complement each other. With asynchronous DE delivery, there is an increase in cognitive participation to deal with complex issues because the remote student has ample time to analyze and understand the message that does not require immediate response. On the other hand, with synchronous DE, a greater level of personal participation increases psychological arousal because the remote student is motivated to read the

messages and participate with the instructor and other remote students with less complex subject matters, since immediate response is expected. These DE delivery methods are included in this work because local instructors and students in Bangladesh, or any country, may take advantage of both asynchronous and synchronous DE delivery to learn from scarce quality teaching staff.

Distance learning tools

It is important to facilitate the delivery of DE material. DE web-based software application tools used by students and faculty are one of the key components of DE. Any effective solution to this problem must make the learning process easy, yet effective. There are DE learning management systems (LMSs) and SDETs on the market that are difficult to learn and use, and turn out to be an obstacle for faculty and students (Unal & Unal, 2011). Comparison of three open source and one commercial SDET is presented here. Survey of one commercial and one open source LMS is also included in this section. The evaluations of this section helped determine Moodle and MIST/C are effective and easy-to-use distance education tools yet cost-effective.

Synchronous DE: NEW

Network EducationWare (NEW) is an open source SDET developed by computer scientists at George Mason University that is able to support quality DE content delivery. NEW is not network capacity intensive in delivering high quality presentation, without video, over 56 kb/s connections. It does not require expensive or special hardware platform and complex software, and is easy-to-install, use and administer. Further, the application software is entirely open source that allows users to use the source code for education purposes, and freely distribute and use the code in educational and governmental settings. It is able to deliver audiographic content composed of lecture presentation slides, annotations made on the slides, and presenter's voice to the end clients with at most a few seconds delay. NEW is easy-to-use because it is not necessary to learn several controls. Key controls to master are the recorder, whiteboard and floor control. It is inexpensive to set up and operate because the capital outlay is minimal, and may be used by non-English speaking users since it uses Unicode to support several languages for its display components and controls (Snow, Pullen & McAndrews, 2005).

MIST/C

Pullen and Clark (2011) have gone beyond NEW to combine asynchronous and synchronous modes to achieve more effective delivery of DE materials to students. They do so by taking advantage of software integration capabilities of Moodle to combine with their existing SDET, NEW for the design and implementation of a new synchronous online teaching system called Moodle Integrated Synchronous Teaching/Conferencing (MIST/C). Similar to NEW, it is not network capacity intensive because it is able to operate over a 56 kb/s Internet connection without video and can support video over a better network connection. Furthermore it is well integrated with the premier open-source LMS, Moodle.

MIST/C runs not only on Windows OS platform but also on Linux and Apple Macintosh OS X platforms. Several features contribute to MIST/C reliability: auto reconnect feature automatically reconnects to the server following a network connection failure without disrupting face-to-face live class or the local recording session. Server-side recording and download has been made possible where class sessions are automatically recorded on the server in addition to the client in the event client-side recording misses a segment of the class session, and the instructor may download that missing segment from the server to post in Moodle for students. A second mirrored whiteboard window is available for students to see full-size slides on a classroom projector, free of the control components seen on the master client primary whiteboard window. This feature, not available with other synchronous teaching systems, is a significant advantage in classroom presentation.

MIST/C's whiteboard displays static presentation slides and dynamic annotations. Slides may be in PDF (single or multiple page), JPEG, PNG, or PostScript formats. It can import the display of any application running on the client machine for display and annotation on the whiteboard. MIST/C's floor control includes a voting interface that can be used by the instructor to post a question and students are able to enter their vote in real time. Breakout rooms or groups may now be formed by the instructor using the Breakout Group Manager feature (students of a group may communicate only with members of that group). MIST/C has been extensively used to teach 16 graduate level Computer Science courses and feedback of students and faculty has been positive (Pullen, Clark & McAndrews, 2011).

Blackboard (Bb) and Moodle

Unal et al. (2011) conducted a study on usability of Blackboard (version 7.0) and Moodle (version 1.9) LMSs. 135 students participated during fall 2008 and spring 2009 semesters. Their study showed Moodle, an open source asynchronous LMS, was favored by participants over the commercial LMS, Blackboard. Only the discussion board module of Blackboard fared slightly better than the corresponding Moodle module. This survey clearly shows Moodle to be as effective as Blackboard, and so can be used as a low-cost alternative for online courses. Moodle also offers better technology usability that improves pedagogical usability, and has low total cost of ownership since it is an open source LMS. Table 2 outlines the comparison results of Moodle and Blackboard.

Table 2
Comparison of Blackboard and Moodle (Unal et al., 2011)

	Blackboard	**Moodle**
Format & Layout	Not favored	Favored
Announcements	Not favored	Favored
Course Documents	Not favored	Favored
Assignment Manager	Not favored	Favored
Discussion	Favored	Favored
Collaboration	Not favored	Favored
Communications	Not favored	Favored
Gradebook	Not favored	Favored

Elluminate vs. Dimdim

Turning our attention now specifically to tools that support the synchronous delivery method, we compare Elluminate (now known as BlackBoard Collaborate) and Dimdim.

Lavolette, Venable, Gose and Huang (2010) review Elluminate version 9.0 and Dimdim version 4.5, and their results are presented here. The researchers collect participant data based on their experience with the interface and features of both systems.

Table 3 lists the features of Elluminate and Dimdim. This survey had 12 Elluminate participants and 5 Dimdim participants attend a one hour workshop using Google applications, after which they were provided with a set of questions for feedback. It is evident from results of Lavolette et al. (2010) that both systems have positive and negative traits and it is entirely up to the user to make the final selection. It is clear, however, that the participants lean more toward Dimdim since it is free because it is an open source SDET. But since Elluminate has some additional features over Dimdim and because it is a popular commercial product that has been in the market since

2001, and is being used by many educational institutions, participants feel comfortable using it. Dimdim was launched in 2007 and has limited coverage.

Table 3
Features of Elluminate 9.0 and Dimdim 4.5 (Lavolette et al., 2010)

Features	Elluminate	Dimdim
Communications Tools		
Participants	Unlimited	20 or less
Voice chat	6 or less	4 or less
Text chat	Yes	Yes
Video	6 or less	1
Content Tools		
Guided web browsing	Yes	Yes
Interactive whiteboard	Yes	Yes
Slide presentation	Yes	Yes
Polling and quizzing	Yes	No
Multimedia presentation	Yes	No
Application sharing	Yes	No
Desktop sharing	Yes	Yes
Simple feedback	Yes	Yes
Logistics Tools		
Breakout rooms	Yes	No
Recording and playback	Yes	Yes
Password secured	Yes	Yes
Cross platform	Yes	Yes
Plugins required	Java	Flash

BigBlueButton (BBB)

BigBlueButton (BBB) is an open source synchronous conferencing tool for DE. The project started in 2007 at Carleton University in Ontario, Canada and has evolved to offer core features like chat, video, audio and desktop sharing. The BBB client runs within the Adobe Flash Player and is written in Action Script. This is scripting language developed by Adobe. The three main server components are the real-time server, application server, and voice conferencing server. These components are mostly written in Java. The server keeps all users in sync, manages and records individual sessions. The real-time server of is based on red5, an open source implementation of Adobe's Flash Media Server. The application server is a Java-based application running within Apache Tomcat, and it handles the API calls and requests of the client. The voice conferencing server is built on FreeSWITCH, an open source telephony platform. Incoming audio packets from the BBB client are routed to FreeSWITCH through red5phone. This is an open source voice over IP (VoIP) phone. BBB does not bundle any built-in web

applications. Instead, it provides HTTP based API that can be integrated with 3rd party application like Moodle (Roesler, Cecagno, Daronco & Dixon, 2012).

The need for Flash Player is a huge disadvantage because it is unable to work in limited capacity networks, and this is apparent since the minimum upstream data bit rate requirement at the user side is 500 kb/s and 1 Mb/s for download. (Although, it offers most of the features of its open source competitor MIST/C, it does not fare well with MIST/C largely due to its network capacity intensive characteristics. MIST/C has the primary advantage of operating over 56 kb/s network capacity and other advantages such as the breakout room and mirrored whiteboard that are not available with BBB ("BBB Frequently Asked Questions," 2013).

The choice

MIST/C and Elluminate have identical features and fare well in the user community. MIST/C seems to be the most cost-effective, easy-to-use and simple distance learning tool available today because it is open source, has a second mirrored whiteboard that is not available with any other system, and it has been favorably tested with graduate level Computer Science Department courses at George Mason University. The comparisons of this section validate its rich features and capabilities which were critical in selecting this SDET for use by individuals with the n-tier hierarchical model described next and in (Snow & Islam, 2012), and the target architecture, discussed later in the paper, for delivery of DE content to remote users with limited capacity networks. Since MIST/C is suitable for low capacity networks, its client application in leaf nodes of the network tree, that will access the Internet via low data bit rate EDGE cellular networks, would be able to operate without problems.

n-tier hierarchical training model

The n-tier model is proposed next, to make tractable the teaching of a large student population by introducing intermediate layers where expert instructors teach local instructors who, in turn, teach students in the target group

The n-tier hierarchical model described here may be applied in any developing nation but the example presented in this section focuses on Bangladesh, a developing country that does not have the physical infrastructure to offer high speed wireless Internet service. ISPs offer Internet service (locally described as "broadband") with data bit rates up to 500 to 600 kb/s using cable physical infrastructures, but this service is available only to households in large metropolitan areas. There are only six major cities in six Divisions or Districts in the country. There are 481 Upazilas, of which 121 are in Dhaka Division, 99 in Chittagong Division, 121 in Rajshahi Division, 59 in Khulna Division, 38 in Sylhet Division, and 40 in Barisal Division. On average, population of each Upazila is approximately 300,000 (Ahmed, Ahmed & Faizullah, 2010). There are hundreds of small villages in each Upazila. Districts are larger areas similar to the concept of a state in the United States. Upazilas can be viewed as a county within a state.

Data rate of the EDGE network is not adequate to support media-rich content such as video and animated PowerPoint slides, but is fine for voice. IT-tool developers in the developed countries are busy enhancing features of the LMSs and SDETs to make them user-friendly in a rich network environment. They are not keen on releasing versions of their tools that would operate in low data rate networks of the developing world. This is because their primary audience is in developed countries where high capacity networks are generally available. Going forward, we need to teach with what we have in hand at present, because time is of the essence. To do so, a layered hierarchy described below and illustrated in Figure 2 is proposed to facilitate online instruction environments with low capacity network service providers.
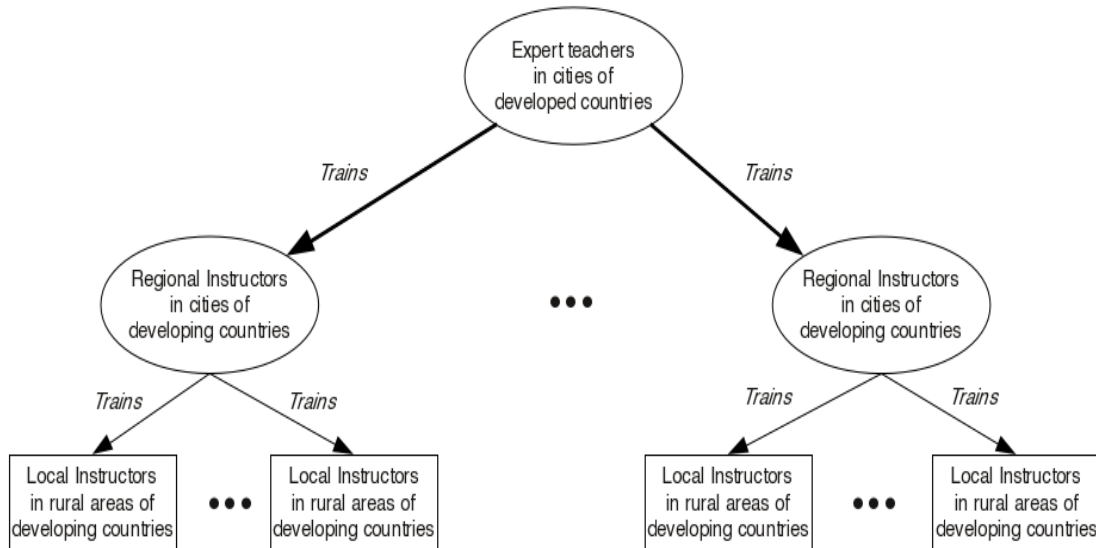
Figure 2: n-tier hierarchical training model

Smartphones and laptops are cost-prohibitive for the poor; a majority of students lacking basic education cannot afford to own these devices. It would be difficult to reach these students from distant locations via the Internet. The other option is to have them trained in classrooms at their location by local instructors. The problem is, there is a huge demand for quality teachers in developing countries because good teachers are hard to find there. On a positive note, quality teachers can be teaching from any part of the world (Habib, 2011).

The goal must be to train the *regional* instructors who are located at large metropolitan cities of the six Divisions or Districts by the bright, experienced and motivated *expert* instructors located at cities in developed nations. Once they are trained, the regional instructors would then train the local *assistant* instructors residing in Upazilas. Our target audience is about 500 local *assistant* instructors: one per Upazila who will be trained by the *regional* instructors via synchronous DE using limited capacity networks. We chose 500 as a practical limit but in reality we will work with no more than 100 local assistant instructors. Figure 2 illustrates the training process via the *n*-tier hierarchical training model. This model would enable students with no access to smartphones, computers and/or Internet service to learn from local assistant instructors in a classroom setting.

Target architecture

We will describe the logical design of the content delivery target architecture in this section. In the next section, we will present results of the simulated tests used to determine the best solution for the design of the selected architecture. MIST/C and the *n*-tier hierarchical model will be used with the selected architecture to deliver and exchange DE content over limited capacity networks.

Content delivery is a process. It involves several components of different layers to work together for *efficient* content delivery. Legacy delivery methods are resource and network capacity intensive. They use the client-server model with traditional IP packet forwarding mechanism that is slow, and not fault tolerant and scalable. This work introduces distributed nodes operating at an overlay network to overcome these limitations.

To have a scalable solution in place, five design goals are important: 1) Peer-to-peer (P2P) distributed nodes communicating in a rich overlay network, 2) robust search mechanism in place, 3) possess efficient connection mechanism, 4) have high degree of fault tolerance and 5) be resilient under churn.

These goals can be met with the following five measures: 1) mechanism to determine number of peers in the network factoring in their arrival and departure rate, upload and download capacity, and resource and capacity information, 2) ensure performance does not deteriorate as size of the network grows, 3) break large files into smaller fragments for distribution, 4) group peers with similar preferences, and 5) have fairness.

Efficient overlay formation may be possible leveraging peer proximity information of the underlying network. This is quite complex because nodes join and leave the network frequently (a condition known as "churn"). It is therefore ideal if node capacity measurements and similar file preferences are used for overlay formation. Using this approach, nodes need to have local information instead of a global view to enable them to locate and evaluate peers already in the network to build a better overlay. The BitTorrent (BT) (Cohen, 2003) protocol uses swarms to group peers with similar file preferences, and uses choking and unchoking mechanisms for efficient communications between peers in a swarm.

P2P Overlay Content Delivery (POCD) architecture is presented here that is a content search and delivery framework, which overcomes limitations of existing architectures to present a better platform to enable fast content search, delivery and exchange by the nodes in limited capacity networks. The core feature of this four-layer architecture is distributed storage and efficient routing by the distributed user nodes.

Four layers make up the content delivery architecture. They are access layer, presentation layer, build and search layer, and data layer. The architecture is illustrated in Figure 3. The following sections describe each of the four layers.

Access Layer

The *access layer,* the underlying physical infrastructure of the public switched telecommunications network, is used by Internet service providers and cellular service providers to access the Internet.

Presentation Layer

The *presentation layer* has the node or peer, the user and search agent. The GUI enables the user to generate search queries for content and to interact with the SDET and other P2P applications.
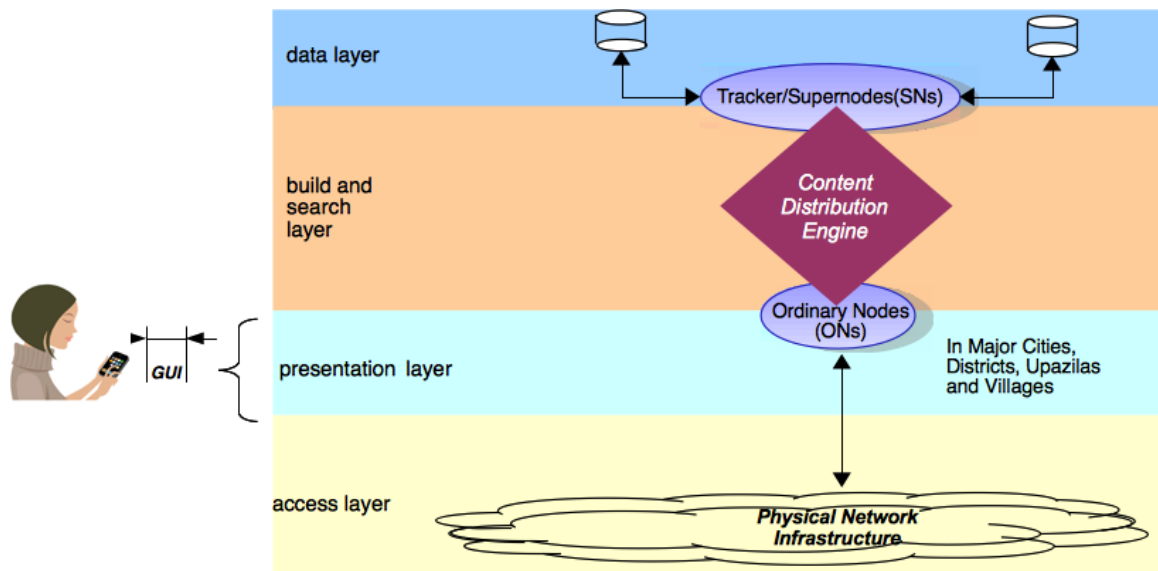

Figure 3: P2P Overlay Content Delivery (POCD) architecture

Build and search layer

The *build* and *search layer* has the *content distribution engine* that consists of the *index engine*, and the *build* and *search agents*. This is the core layer of this architecture and a detail description with an example is presented in this section. It also includes the BT protocol for overlay formation and content search. There are *ordinary nodes (ONs)* and *tracker servers (TSs)*. TSs are more powerful machines and maintain a database with identifiers of all files its children ONs are sharing. When the ON launches the BT custom client application, it establishes connection with the standard *web server (WS)*, and downloads a torrent file that has information about the file, its length, name, tracker server's URL, etc. The torrent file seamlessly connects the ON's client application to the TS that helps the ON locate the swarm or group of peers that is sharing the file it is searching. Upon receipt of the location of other peers with the pieces of the entire file that the ON is looking for, it directly establishes connections with those peers. ONs periodically update the tracker with information on the file pieces they have and their resource utilization. This information is updated in the index of the tracker.

Since the large file is broken into small fragments of 32 KB and 128 KB, it makes the distribution process fast and efficient. It also scales the network better because file sharing can be achieved quickly as the number of peers grows since more peers are able to share their pieces with each other, and have the entire file faster. The choking and unchoking mechanisms are unique and facilitate efficient and effective distribution of content. It is also possible to control the number of neighbors an ON can have and the swarm size. Many experiments were done to determine the best critical combination of parameters and metrics for a solution of the target architecture, and the results are presented in the next section. The swarm basically has the number of ONs that are sharing pieces of the same file. This information may be kept in the cache of each ON in the network. This is useful information because it enables the requesting ON to quickly unchoke ONs with the best downloading capacities in the swarm.

The user node initiates a query using the search agent. The distribution engine receives the query and refers to the index engine for a match. The index engine has an index of metadata and pointers to nodes storing that content. This is updated in short intervals by the build agent via discovery service of the search agent. If there is no match to the target query, the search agent probes other nodes for a match and upon discovery updates the build agent. The build agent feeds this discovery to the index engine and the process continues.

Data Layer

The data layer simply consists of several data sources with presentation files, user data, index and routing tables, HTML and multimedia files, and images. These may be stored in database servers, ONs, TSs and WSs.

Simulated results and the selected architecture

We simulated several environments with a range of parameters and metric values to determine the best combination of parameters and metrics to achieve optimized solution for the design of the selected architecture. Summary of the tests and respective results are presented in this section. Due to space limitation, we did not include the graphs of the following tables.

File and fragment size evaluation

The following parameters and values were simulated to determine the best combination for achieving optimized performance:

> network size: 100
>
> peerset size: 50
>
> maximum growth: 20

swarm size: 80

file size: 50 MB

link speed: 50 kb/s

duplicate request: 1

fragment size: 32 KB, 64 KB and 128 KB

seeder percentage: 1

peer percentage: 1, 5 and 10

Table 4 has the values for sharing a 50 MB file in 32 KB, 64 KB and 128 KB fragments by the participating nodes using 50 kb/s data rate links.

Table 4
Simulated results of 1, 5 and 10% peers with 50 kb/s links for 50 MB file

Link Capacity: 50 kb/s	% Downloading	% Downloading	% Downloading
Piece Size (Block Size)	1%	5%	10%
32 KB	200000	210000	240000
64 KB	220000	160000	200000
128 KB	130000	160000	170000

Seeder: 1%

Based on the results of Table 4, it is evident that 128 KB fragment size fares better than 32 KB and 64 KB fragments.

Performance optimization by peer percentage size

To further optimize the system, simulated similar environment with different network, peerset, and percentage of peer (leecher) sizes. It was determined via the simulations of the previous tests, 10% leechers perform well when they use 128 KB fragments to download a 50 MB over 50 kb/s data rate links. Since 10% leechers of a network size of 100 is quite a small number (10), it was important to determine the results with more leechers. That is, 80% or 90% of leechers in a network of 100 peers.

This was made possible by simulating the same environment of *file and fragment size evaluation* section with 50 kb/s link capacities with 50 MB files. 100 MB files were also simulated, but rejected from this analysis because its performance was not practical. Table 5 has the values for sharing a 50 MB file by the participating nodes in 32 KB, 64 KB and 128 KB fragments using 50 kb/s data rate links.

Table 5
Simulated results of 80 and 90% peers with 50 kb/s links for 50 MB file

Link Capacity: 50 kb/s	% Downloading	% Downloading
Piece Size (Block Size)	80%	90%
32 KB	810000	1410000
64 KB	440000	1540000
128 KB	360000	760000

Seeder: 1%

Here, we see for both 80% and 90% leechers in a network of 100 nodes, 128 KB fragments perform better than 32 KB and 64 KB fragments. It takes 760 seconds to download the 50 MB file by 90 leechers and 360 seconds by 80 leechers with 50 kb/s data rate links. Is it possible to optimize this any further? The parameters were fine-tuned further and simulated to determine the best metrics.

Evaluation of larger network and peerset sizes with small percentage of peers

To do so, the next approach was to increase the size of the network so percentage of peers could be reduced, yet maintaining close to similar number of leechers.

The following parameters were simulated with different metrics of file and fragment sizes, and peer percentages to determine the combination of values that optimized performance further. The parameters and metric values are:

> network size: 500
> peerset size: 100
> maximum growth: 20
> swarm size: 80
> file size: 50 MB
> link speed: 100 kb/s
> duplicate request: 1
> fragment size: 32 KB, 64 KB and 128 KB
> seeder percentage: 1
> peer percentage: 15, and 20

With 15% peers in a network of 500 peers, we have 75 leechers, and with 20% peers we have 100 leechers, which is close to the 80 and 90 leechers of the experiments done in *peer percentage size* evaluation section.

Table 6 has the values for sharing a 50 MB file in 32 KB, 64 KB and 128 KB fragments by the participating nodes using 100 kb/s data rate links.

Table 6
Simulated results of 15 and 20% peers with 100 kb/s links for 50 MB file

Link Capacity: 100 kb/s	% Downloading	% Downloading
Piece Size (Block Size)	15%	20%
32 KB	240000	170000
64 KB	120000	180000
128 KB	110000	160000

Seeder: 1%

From the results of this section, we see 128 KB fragments perform better than the others while downloading a 50 MB file using 100 kb/s data rate links. That is, 110 seconds with 15% peers trying for the file and 160 seconds while 20% leechers are trying.

Table 7 has the optimum performance attained via combination of different parameters, and a summary graph of the best-of-the-best results is presented in Figure 4.

Table 7
Optimum performance

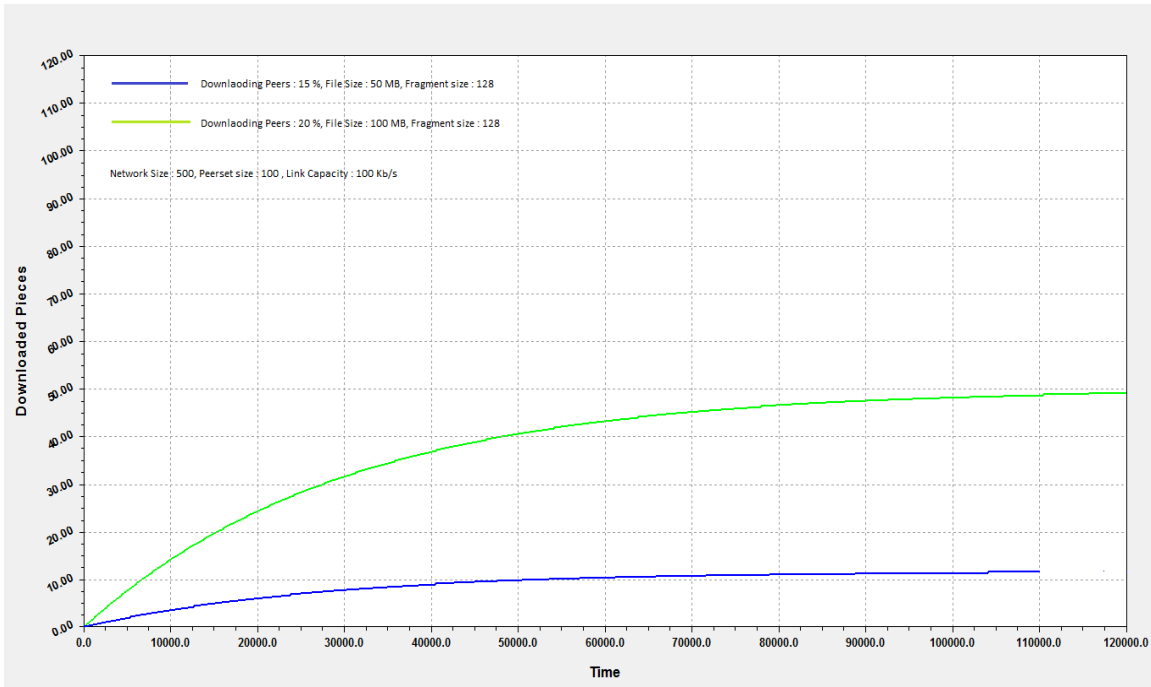| Network	Peerset	% of Peers	File (MB)	Link (kb/s)	Fragment (KB)	Time (ms)
500	100	15	50	100	128	110000
500	100	20	100	100	128	120000

- - -

Figure 4: Best-of-the-best results

Conclusion

Over 200 combinations of parameters and metrics were simulated to determine the critical combinations and metric values for the architecture described here. The following parameters and metrics with the BT protocol have been determined to optimize the performance of the system, and selected for this architecture:

> network size: 500
> peerset size: 100
> maximum growth: 20
> swarm size: 200
> file size: 50 MB and 100 MB
> link speed: 100 kb/s
> duplicate request: 1
> fragment size: 128 KB
> seeder percentage: 1
> peer percentage: 15 and 20

The selected architecture may be used for any type of content delivery and exchange, but the focus has been on DE content because the goal of this work is to implement this solution and enable students living in rural areas of both developed and developing countries to get the proper education they deserve. Since quality teachers are scarce in those areas, DE content delivery and exchange can work as an alternative for those students to learn from quality teachers residing in cities far away. But as described earlier, under-served students in the rural areas cannot afford to own a computer and have Internet service. The *n*-tier hierarchical training model presented in this paper can be used to train the junior local instructors of rural areas so they can gradually improve their teaching skills while continuing to teach the local students in live classrooms, and gradually become quality teachers.

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The use of weblogs in citizenship education: a theoretical analysis of integration of weblogs and English citizenship curriculum

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Abstract

New technologies have changed the way people perceive the world as well as access to knowledge. The ubiquitous influence of the Internet has also impacted traditional teaching in schools. According to existing studies, the weblog, or blog, is one of the most commonly applied new technologies in teaching due to its ability to allow a combination of text, photographs, videos and discussion forums on an interactive platform. Its influence is particularly keenly felt in language teaching, distance learning and natural science education. However, its use in the humanities, including history, geography and citizenship education is relatively unexplored.

The author discerns a strong connection between weblogs and citizenship education and argues that they share the mutual objectives of transmitting knowledge, enhancing deliberative interaction, cultivating participation and contribution as well as generating a sense of community. While citizenship education is widely included in school timetables across countries to stave off social apathy and reverse the trend of ever-declining participation in public affairs, the nature of blogging can be an effective tool to encourage information sharing and opinion exchange between pupils as well as teachers. This may further stimulate participation and confidence in school, community and the larger society and transform the acquired civic knowledge in class into real life experience.

This article investigates this issue by means of theoretical analysis and, in order to facilitate understanding, the author uses the English citizenship curriculum as an example to contextualise the theoretical arguments and demonstrate the integrative potential of the subject and this technological device. Not only are the advantages proposed in the research, but also possible disadvantages are illustrated in order to bring additional attention to the detrimental effects that the new technology may inflict.

Keywords: ICT, weblogs, citizenship education, English curriculum, constructivist theory, political literacy

Introduction:

New technologies have resoundingly influenced our daily lives and the trend of information and communications technology (ICT) use and culture changes with time. From the outset, the Internet was characterised by its convenience; transcending space and time, lower cost, and anonymity, but evolving to the present, the initial depersonalised and public attribute is being moderated by the emerging trend towards personalisation, self-awareness and self-expression (Guadagno, Okdie & Eno, 2007, p.1995). Web-logs (blogs) are one of the optimal examples and have been utilised in a variety of fields, including news broadcasting, business, travel and education. According to Pascu's study (2008, p.ix), the 'blogosphere' has been growing at a phenomenal pace with more than 100,000 new blogs being created every day and approximately one third of Internet users gleaning information from these platforms while often contributing feedback in return and thereby becoming active cyber participants. Besides, from some related research on blogging (Henning, 2003; Herring *et al*., 2004), it is reported that the 13-20 age-

group accounts for 40-50% of blog authors. Young people growing up with these digital innovations, including weblogs, are labelled the 'net generation' or 'digital natives' and this new form of self-expression gives a significant online social identity to young adolescents (Wodzicki *et al*., 2012). Even though social networking applications, such as Facebook and Twitter, may have overtaken the population of young bloggers and Wikipedia contributors, from the point of view of educational value, weblogs, with their better pedagogical applicability continue to be given more attention by school teachers, and are regarded as a profound breakthrough when linked with traditional teaching methods. Since blogs can successfully attract teenagers' attention, the adequate integration of education and blogging might motivate pupils for learning.

A number of studies have explored how blogs are effectively used in language teaching, natural science and distance learning (Liu, Lin & Wang, 2003; Duda & Garrett, 2008; Soares, 2008; Xie et al., 2008; Top, 2012), but very little related literature deals with social science subjects, including history, geography and citizenship education (CE). Specifically, the connection between CE and blogs with regard to communal concepts, such as promoting a sense of community, fostering deliberative interaction, and enhancing social participation are rarely explored in educational research and has drawn insufficient attention from both researchers and practitioners. The nature of CE is to cultivate pupils' critical thinking and rational debating competence, and blogs, as a form of personal journal which allow interactive feedback, provide youngsters with space for this type of reflection and discussion. Besides, the enormous resources (news, academic articles, photos, video- and audio- clips) could be uploaded to blogs as supplementary materials for further study and contextualise what they have learned during class with ICT aids in the virtual world. Moreover, many literatures (Klein, 1999, p.216; Ferdinand, 2000, p.6; Stefanone & Jang, 2008; Soares, 2008; Top, 2012; Wasson & Vold, 2012) have indicated that ICT can promote a participatory culture, peer collaboration, a sense of democracy and community involvement, which matches the essence of CE. Therefore, this article seeks to demonstrate the theoretical interconnection between blogging and CE and how to merge blogging properly into education to facilitate teaching and learning. After a brief introduction of blogging, constructionist theory will be adopted to analyse this discourse tool and the following section will delineate the possibility of integration of blogs and citizenship in theory and practice as well as the potential detrimental effects that blogs may incur. To demonstrate how this technological creation can function in education, the author uses the English CE as an example to illustrate the compatibility in theory and its applicability in practice. This research, centring on the three core strands of the English citizenship curriculum (1) political literacy (2) community involvement (3) social and moral responsibility (Advisory Group on Citizenship Education, 1998), analyses the linkages between CE and blogging to provide contextualised insights for future studies to consider the probability of combining this ICT tool with humanity courses in other countries' schools.

Understanding blogs

Blogs, also known as web-logs, started as an American pastime. The first tools for blog creation were invented in 1999 and substantially increased in mid-2005 (Ojala, 2005, p.271). The original concept of blogs stems from online personal journal or diary and the entries/articles are presented in reverse chronological order. Bella (2005) describes blogs 'a Web-log is an easily created and updateable Web-site that allows people to publish to the Internet instantly'. Besides, blogs are interactive because the visitors have the opportunity to post comments. With the refinement of technology, the functions of blogs are not limited to article posting and gradually combine other Internet resource becoming an information platform. It offers the possibility of uploading hyperlinks, photos, slide shows, PowerPoint presentations, and audio and video resources. Besides, in the 'blogosphere', blogs link together and formulate an interconnected web, which embodies a sense of online community (Herring *et al*., 2004; Top, 2012; Kang *et al*., 2011).

Blogs, education and Constructivist theory

The trend towards integrating technology in education is burgeoning and it is clear that the interdisciplinary complementation facilitates the efficiency and effectiveness of teaching and learning leading to increased motivation among children, compared to the traditional 'lecture and drill' approach (Higgins, 2003, p.5; Smeets, 2005; Smith, Hardman & Higgins, 2006). The applicability of blogs to education consists in its functions of information sharing, interactive feedback and collaborative learning. When a student posts an article on a blog, other students can not only receive the message, but also provide reflective feedback to it. With the responsive interactivity, blogs construct a space for group discussion, knowledge accumulation and inspiration of creativity, which is consistent with constructivist theory.

Constructivism defines learning as a process of active knowledge construction rather than passive understanding acquisition, advocating that knowledge is constructed by the participants instead of being transmitted by a particular knowledge authority (Duffy & Cunningham, 1996; Jonassen, 1999; Wasson & Vold, 2012). Meanwhile, the learning process requires active participation, unlike the traditional educational viewpoints paying more attention to the role of the teacher as Harasim (1996) said '*the focus from knowledge transmission to knowledge building*' and individual contributions can enrich the knowledge reservoir. In blogs, besides the leading of the discussion by the author, there is no specific authority/instructor having knowledge leverage and every participant is entitled to have their say. The responsive feedback can accumulate knowledge and inspire new thoughts as an expanding database congregating overall viewpoints and the threads are published on the Internet for further different opinion solicitation and information gathering, which is the essence of constructivism.

Besides, constructivist theory emphasises that individuals make meanings via the interactions with each other and the surrounding environment to create a new personal view of the world (Jonesson *et al*, 1995, p.10). As Piaget (1985) said, after the process of 'accommodation' and 'assimilation', pupils internalise new acquisition into a prior cognitive system and reach a new equilibrium. As a result, the learning environment with highly interactively instructional practice and adequate challenge for learners' deeper thinking is what constructivist approaches pursue and the forum of blog platform could be utilised as a means to challenge ingrained knowledge and reflect on previous experience.

Clearly, the blog users are from different backgrounds, harbouring distinct knowledge and therefore, the reflective feedback posted through logical vein could be regarded as 'scaffolding' for knowledge extension. It can be argued that blogs' device of response posting to some degree corresponds to Vygotsky's zone of proximal development (ZPD), which refers that teachers or competent peers give lessons and enough challenge, from easy to difficult but not overly frustrating, to the learner and guide them to upgrade from the present stage to an upper level (Vygostky *et al.*, 1978). This not only identifies the potential of applying blogging for deeper and critical thinking cultivation, but also the concept of collaborative learning among bloggers embedding in this new form of technology.

Concepts of blogging and English Citizenship education

In 2002, CE was officially introduced into the English national curriculum and implemented as a statutory subject in secondary schools. The initial initiative of this subject introduced by the Labour government rests on the low turn-out of the 18-24 age-groups in elections, and the government's concern that young adolescents' disengagement from society and politics might lead to democracy's destruction and social apathy (Advisory Group on Citizenship Education, 1998).

In contrast to other subjects, CE not only delivers knowledge, but also cultivates pupils' interest and skill applicable to a social context. 'Active citizens' is what CE intends to 'produce' (Arthur & Davison, 2000, p.15), but under the limitations of age, space, finance and legal civil capacity, pupils can merely acquire the knowledge from textbooks, unable to participate and exercise their civil rights in person. However, according to communication scholar Marshall McLuhan's concept '*media is the extensions of our limbs*' (1964), via Internet, pupils have the chance to explore the other undiscovered side of the world and practise what they have learned from citizenship education, such as online voting and online environmental issues campaigning. The following section will adopt the Crick Report's three strands of CE (1) political literacy (2) community involvement (3) social and moral responsibility with some additional revision and then respectively analyse the connection between CE and blogging (Advisory Group on Citizenship Education, 1998). Besides, the term 'blog platform' as used below refers to traditional online personal journals combining forums, bulletin board, video-, audio- clips and hyperlinks. It should be noted that apart from pointing out the compatibility of this ICT resource and each core strand in the English curriculum, the research is also intended to demonstrate the drawbacks and possible detrimental effects underlying the application of such technologies to education.

Blogs and political literacy

CE in England was unofficially launched in some schools in the 1970s because of the fear of neo-fascist influences among the youth and prevailing individualism detrimental to the preservation of democracy (Heater, 2001, p.109). The government's focus is mainly on political literacy, stressing the advantages of liberal democracy and the dangers of totalitarianism (Kisby, 2006, p.86). In this respect, 'democracy consolidation' is the most significant issue. Interestingly, as Coleman (2007, p.191) mentioned, the youth are among those who are least able to perceive democracy as relevant to them but they are also the most likely to be competent in ICT. As a result, it can be argued that if 'E-democracy', which means that democracy can be developed by the means of information and communication technologies (Gross, 2002), can be successfully promoted, these mostly politically unmotivated youngsters might attend to democratic issues and improve their political literacy through the Internet.

Regarding 'E-democracy', a number of studies have suggested that new technologies are beneficial to democratic development and social equality which are consistent with the nature of CE (Klein, 1999, p.216; Ferdinand, 2000, p.6; Oral, 2008, p.438). Alexander (1999) argued that online networking extends the participation into real life and advances the level of public discourse on public and community issues. Take 'MP Blogs' as an example, this is a blog platform for MPs to write articles to convey their campaigns and newly ratified legislation to their constituencies. Simultaneously, readers are able to leave their comments or seek MP services, which facilitates communication and makes MPs more approachable than before.

When discussing democracy in CE, 'direct democracy', 'representative democracy' and 'deliberative democracy', these three concepts are major elements of democracy. Because of the increase of population and the expansion of the nation-state, 'direct democracy' is gradually replaced by 'representative democracy', especially at a regional or higher level. However, blogging as a platform, combining narrative posting, feedback and an online public forum system provides many-to-many communication. Transcending time and space, blogging reproduces 'direct democracy' again and every participant's thoughts can be well articulated by themselves, avoiding representatives' abuse of rights or dereliction of duty.

Besides, concerning 'deliberative democracy', from its definition, in contrast to the traditional democratic process which relies on voting as the ultimate solution, deliberative theorists argue that the most rational choices can be made through the broad deliberation of citizens. Therefore, the 'deliberative model' perceives that communication is the conditional and necessary process of decision making in order to achieve a better consensus rather than simply casting ballots to

legitimise the majority's opinion (Elster, 1998). Looking at the 'deliberative democracy' in education, the Qualifications and Curriculum Authority (QCA) Citizenship curriculum for Key Stage1 & 2 in Unit 1 says, ' *Taking part – developing skills of communication and participation'*, *'interaction with others, negotiating plans and activities, and taking turns to speak'.* To cultivate competency in idea exchange and effective communicative skills is one of the major aims of CE. On blog platforms, every post invites further questions and rational-critical discussion attempts to reach a collective outcome instead of making a decision merely on the basis of a majority rule. As John Mill in mid-19th century identified, an absence of continued and in-depth debate may lead to 'the tyranny of majority' (Gray, 2008). As a result, according to Ferdinand (2000), it is likely that if new technology can congregate citizens in some 'virtual' forum, then the more genuine and pre-eminent form of deliberative democracy can be restored and developed. Blogs, this 'marketplace of ideas' illuminates the essence of 'deliberative democracy' and the educative effects of this political theory could be transmitted via this discourse tool.

However, when the positive effect of the Internet is optimistically acclaimed, the concern about the promotion of rational-critical discourse by blog platforms should be noticed. Although blog users obtain access to the Internet and can have their say on it, different types of blogs appeal to specific audiences respectively. For example, left-wing websites attract more Labour Party supporters. Undoubtedly, blog users tend to revisit the blogs they identify with or whose authors they agree with. Hill and Hughes (1998) and Davis (1999) explicate that although the Internet encourages diverse opinions, ideologically homogeneous 'communities of interest' form in the end. In other words, differing opinions gradually are marginalised to the point of invisibility because the majority tends to ignore or attack opposing viewpoints and therefore, some minority opinion holders choose to leave and join other blogs where their viewpoints are in the majority. More severely, Fishkin (1991) points out that like-minded discussion hinders people from understanding the reasons behind the opponents' belief and might subsequently elicit more negative viewpoints of the other side. The mutual exclusion between the opposite types of blogs may be an impediment to responsive dialogue and the differentiated or differing remarks can rarely be made among the like-minded blog users, which is detrimental to civil debate and democratic development (Dahlberg, 2001). Consequently, it can be argued that when it comes to the tolerance of dissent and difference on the Internet, the Internet's overwhelming characteristic of trans-space and convenient accessibility constantly masks the underlying limitation and therefore, online communities may lead to another form of unnoticed segregation rather than information exchange, much less knowledge construction and integration.

Blogs and community involvement

Marshall (1997) identifies three elements of citizenship – civil, political and social. The civil element includes '*rights necessary for individual freedom – liberty of the person, freedom of speech… the right to own property and conclude valid contracts, and the right to justice*'. 'The freedom of speech and expression' is particularly important given that it protects different claims, celebrates diversity and in turn encourages discussion and civil participation. The Internet is open not only to a specific social class or presently existing privileged group but also to everyone having the access to a computer and Internet connection (Oral, 2008). Besides, because the Internet is characterised by depersonalisation and de-individuation, the imbalanced power and discrimination between genders, social class and ethnicities in cyberspace are easily eradicated (Postmes, Spears & Lea, 2002). As a result, considering it more deeply, blogging features the concept of equality and multiculturalism.

The voting rate, as an important criterion in political participation, is one form of self-expression on social issues or elections, and is particularly emphasised in *Citizenship Education Curriculum for Key Stage 3* to teach pupils how to vote and the implications of a low turnout. In some blog platforms, electronic elections and electronic voting are constantly conducted on a variety of

issues ranging from daily life events to social policies, and pupils construe how the act of voting might change policy making and that every single ballot should be valued. Bouras *et al*. (2003) indicate that electronic elections and online voting are another contribution of the Internet to democracy. Therefore, electronic voting offers pupils the chance to practise their political rights and might have a positive effect on their future voting behaviour.

In the curriculum, CE not only wants to create 'informed citizens' but also intends to cultivate responsible 'active citizens'. This concept derives from 'civil republicanism', which advocates that liberal individualism merely self-centredly focuses on personal rights and the pursuit of the good life instead of a focus on socially responsible action and communal resistance to threatening forces or oppressive authority (Shafir, 1998). Therefore, civil republicans place great stress on setting aside personal factors for the public interest and endorse the value of social involvement (Arthur & Davison, 2000). Meanwhile, the significance of community is stressed in citizenship curriculum. When applying the theory of civil republicanism to online behaviour, an identical sense of community can be found.

Like the blog platform, 'blogosphere' means that the interconnected web-logs form a new virtual community where those having similar identity can join and find other kindred spirits from the hyperlinked blog platform (Hsu & Lin, 2008). According to social identity theory, Tajfel and Turner (1985) identified that people tend to categorise themselves into a certain social classifications. Due to a sense of belonging, people are satisfied with the fundamental need to feel certain about their world and their own position within it. This satisfaction offers them a meaningful existence and reduces anxiety about social uncertainty (Hogg & Grieve, 1999, p.81). Therefore, it can be suggested that blog users are willing to blog because of their online community identification. Hampton and Wellman (2000) pointed out that the Internet strengthens social ties and the maintenance of relationships and Kent (2008, p.35) indicated that blogs can foster identification and engagement. As a result, the nature of the effect of the blog platform on virtual community participation corresponds to the concept of 'community and social cohesion' in the citizenship curriculum.

Blogs and social and moral responsibility

'Global citizenship'- this term signifies the importance and necessity of interactivity beyond borders and reminds us that a nation requires civilians with this awareness to adapt to the variable world. The CE curriculum especially stresses the aim –'to teach pupils to consider the interconnections between the UK and the rest of Europe and the wider world' (QCA, 1998). It is obvious that if pupils can perceive themselves as global citizens, they can also learn to understand the local-global connection.

A number of blogs are concerned with global campaigns including charitable work, human rights and environmental protection. In this decade, activists have incorporated the Internet into their repertoire but the Internet has also changed activism. 'Cyberactivism' is a successful example of new technology into social campaigns. Online activists recruit and attract potential participants on blog platforms and the collective identity and consciousness are raised and solidified via constant discussion on common goals and interactive post-feedback format. Through wide-spread of technology and dissemination of information, cyberactivists promulgate a certain agenda either to challenge social injustices or achieve communal goals. For example, 'Amnesty International UK Blogs' and 'Greenpeace Weblogs' are two blogs centering on global human rights and environment protection issues.

Habermas (1989) explicates his concept of 'public sphere', defining *private people gathered together as a public and articulating the needs of society with the states… a realm of our social life in which something approaching public opinion can be formed'*. It is obvious that the online discourse extends the public sphere but from Habermas' viewpoint, an active public sphere does

not definitely result in more rational-critical communication. Due to the development of global business and cultural commercialisation, the public sphere is squeezed out and controlled by capital interests when the masses turn into simply consumers instead of rational citizens (Habermas, 1989). The Internet now is hugely dominated by corporate interests and full of online commerce. Some blog owners sell space to advertisers and therefore, their audience suffers the colonisation of online commercial life (Dahlberg, 2001, p.617). As a result, when blog owners succumb to the temptation of commercialising their site, their audience maybe simply become the target market for business, which undermines the possibility of social improvement through cyberactivism and shrinks the public sphere.

Along these lines, the Internet is a discourse tool mixed with advantages and disadvantages and more attention should be paid to applying blogs to CE. Firstly, Bimber (2001) researched the connection between political information and social participation and there is weak evidence to support that increased information leads to more participation. That is to say that the abundant information purveyed by blog platform does not necessarily reduce the political apathy among the youth. Streck (1997) also suggests that online participation does not definitely transfer to democratic participation in the real world.

Secondly, for the quality of dialogue on the Internet, Wilhelm (1998) specifically identifies that most postings were not interactive exchanges and the effect of discussion was minimal. Investigating the percentage of 'rational discussions and effective communications' in websites and news groups, Hill and Hughes (1998) found that only small minority of the researched blogs actually deliver this purpose and most of them barely improve rational dialogue. Likewise, Bentivegna (2002) is pessimistic about the online forum and points out that the 'jumble of voices' sometimes are incomprehensible, impeding serious discussion and are unable to create a deliberative democracy. Many are convinced that the Internet has unlimited capabilities but this viewpoint may be naïve and the ability of the Internet to benefit the development of civil society should not be overestimated. The achievement of social participation might be minimal and only 'thin democracy' is created (Barber, 1984). In consequence, it could be said that although the concept of blogging and CE theories are consistent, the actual effects of the combination of CE and blogging on the practical side still deserve further examination and practitioners should deploy this technological aid with critical reservations as will be suggested below. However, this first half of the research has demonstrated the potential for reciprocity between blogging and the English citizenship curriculum. The second half of the research will look into the practical aspects of the combination and how weblogs can enhance the effectiveness and efficiency of citizenship teaching in real classroom settings.

Application of blogging into citizenship education: teaching and learning

Some evidence has supported the possibility of integrating blogs into certain subjects (e.g. foreign languages, physics and distance learning) (Liu, Lin & Wang, 2003; Duda & Garrett, 2008; Soares, 2008; Xie, Ke & Sharma, 2008, Top, 2012). Although there are still no published results about such incorporation into CE specifically, the feasible methods about such integration and its possible outcome presented in this theoretical study might be an inspiration for further research. 'Structured controversy' and 'values clarification' are the two most well-known teaching methods of CE. The former attempts to broaden pupils' competence of critical thinking by selecting a controversial issue for in-depth discussion to investigate the underlying intentions in the opposite discourses (Johnson, D.W & Johnson, R.T., 1998). This method tries to demonstrate the diverse viewpoints about controversial issues and requires pupils to value and respect perspectives. Different to the former, the latter method tries to construct personal value judgment when pupils are faced with making a decision between alternatives. This method first proposed by Louis Rath. Use of this method requires teachers to create an honest, comfortable and enthusiastic learning

environment and everyone feel free to have their say about moral issues (Green, 1975, p.156). The following will demonstrate how feasible the blogging can fit into CE and complement the shortcoming in traditional pedagogy.

Some school teachers keep a blog platform, employed as both a citizenship information library and a class blog. PowerPoint presentations, related articles, assignment templates, slide shows, audio and video clips are either posted or hyperlinked. By doing so, a diversification of resources can meet different kinds of pupils' needs because some students like to read plain text but some prefer visual aids, and the multi-media fosters the authenticity of learning environments (Smeets, 2005). For example, simulations and videos visualise how voting procedures are implemented in the Parliament. Meanwhile, pupils run their own blogs and take turns to write articles in association with civil issues on their own blogs and other pupils are encouraged to post feedback and exchange of opinions, which is especially beneficial to the cultivation of social observation and awareness. The above provides the reader with a preliminary understanding of the use of the blogging in school. The following will dissect the practical teaching of CE into three subthemes: (a) controversial issue teaching; (b) reflective learning process and (c) class/school/community cohesion, to explore how blogging may elevate the traditional pedagogy to a more revolutionary level.

Blogs and controversial issue teaching

According to the Department for Education and Employment's (DfEE) documentation, the expected outcome of CE denotes the importance of teaching controversial issues:

> *Thinking skills, through helping pupils to engage in social issues that require the use of reasoning, understanding and action through enquiry and evaluation.*

> *Moral development, through helping pupils develop a critical appreciation of issues of right and wrong , justice, fairness, rights and obligations in society.* (DfEE, 1999, p. 7-8)

Therefore, the inclusion of controversial issues in the teaching, such as GM crops grown in the UK, legalising of voluntary euthanasia, and the abolition of the death penalty, could help to prepare pupils for critical thinking and reasoning. However, Cross and Price (1996) pointed out that when teaching controversial topics, teachers express serious concern about the expression of their own perspectives which might lead to indoctrination and subjective judgments. Whereas, with the aid of blog platforms, multiple resources could be adopted as supportive evidence and diverse opinions can be displayed without the limit of the timetable in schools. More importantly, every pupil's perspective can be heard on blogs and the responsive debates not only balance teachers' viewpoints but also help them to discover the interplay of different interests underlying every point of view (Oulton, Day, Dillon & Grave, 2004). From Xie et al.'s research (2008), classmates reported that other bloggers' articles and comments provided different opinions, and they could more likely gain 'a holistic, in-depth view of the content'. It can be argued that exposing pupils to multiple perspectives is a necessary part of teaching and blog platforms compensate for some of the deficits in traditional classroom teaching.

Although the subsidiary role of blogs is to be able to extend the discussion and engagement in the classroom, the 'anarchy of information' on the blog might be a major concern. Gossip, slander, and superficial banter sometimes hinder the learning environment. Given this, on the basis of constructivist theory (Piaget, 1985), although teachers are not the all-knowing controllers of activities in blogging, teachers still need to be 'facilitators' to coordinate the discussion adequately, redress the digressing focus, create 'scaffolds' and inspire further thinking.

Blogs and the reflective learning process

Besides, pupils' personal or group writing practices on blogs can entrench what they have learned from the class and some pupils may change their learning attitude from a 'knowledge recipient' to

an 'independent learner' in order to gather more supportive information to complete their posts. Pupils can feel empowered and responsible for what they write as their articles will go public and receive other readers' complimentary or critical feedback (Kang *et al*., 2011, Wasson & Vold, 2012). Besides, on a psychological level, related research indicates that some individuals perform better on their blogs than they do in the classroom because they develop a higher public self-awareness to maintain their public appearance and image with the underlying intention of keeping a good online reputation in public when posting (Guadagno, Okdie & Eno, 2007).

Meanwhile, from the psychological perspective, 'reflective learning processes' emerge when students are writing articles on the blogs. Reflection is a process of integrating new knowledge into the cognitive structure and associating it to previous experience and understanding (Xie, Ke, Sharma, 2008). While writing on the personal journal, pupils connect the new knowledge with preceding experience and reframe new perspectives after a critical overview. During the meaning-construction process, students pause and have the chance to review and re-consider their ideas. Kang *et al*. (2011) and Xie *et al*. (2008) indicate that journaling and peers' comments are perceived as an effective approach to promoting students' reflective thinking skills and this process uplifts them to the higher-order learning stage. Stickel & Trimmer (1994) state that blogging is useful for students to externalise their reasoning and reflections on prior experience.

However, there are doubts about the effectiveness of the reflective writing and the peer feedback for reflection for younger-aged and less competent students. For primary and early secondary school pupils, cognitive skills may not be developed enough to link personal thought, new knowledge and social issues. Besides, a lack of life experience might hinder their ability to internalise new knowledge and construct independent perspectives. Therefore, writing reflective articles on the blogs could be a struggle for younger or less competent students. Sandberg and Barnard (1997) state that learners cannot achieve deeper learning until they have a comprehensive understanding of content knowledge. Although the interactive comment on their blogs should be one of the important components of reflection, Latham (1997) was sceptical about the quality of feedback offered by the peers and Sandars (2006) also said that the lack of quality assurance or peer review of what is posted is the major concern of the educative value of blogs. Therefore, the formation of 'collaborative learning' by blogging is questionable. Although Vygotsky (1978) pointed out that apart from teachers and instructors, the potential of 'zone of proximal development' is also constructed by more 'capable peers', his vision is hard to achieve because of the deficient constructive online feedback from younger pupils. As a result, without enough cognitive development and collaborative interactivity among peers, the learning outcome of constructivism may fail to be delivered and the effectiveness of blogs might be questioned.

Blogs and class/school/community cohesion

Besides the tutor blog as the learning resource library and pupils' personal blogs, the 'class blog' can act as an 'extra-curricular extension of the classroom' (Stanely, 2005), fostering a feeling of community and participatory culture between classmates (Top, 2012; Soares, 2008, p.520). Assignments, class affairs, group projects, electronic voting and public opinion polls can be discussed and conducted on the blog. Class blogs can be utilised as discussion boards and encourage pupils to make their voices heard, especially for more introverted and quiet individuals. According to *Article 12 of the United Nations Convention on the Rights of the Child* (ratified and implemented by the UK government):

> *'creating a safe and inclusive space in which children, can communicate their views; ensuring that children are afforded a voice, by being assisted in both forming and expressing their views; and assuring children that there is an audience for their views.'*

Clearly, contemporary education values pupils' viewpoints toward learning environment. The nature of blogging provides a chance to change the traditional 'teacher-centred' learning

environment and break the imbalanced relationship between the 'authority and the subordinates'. McEvoy and Lundy (2007) and Kang *et al*. (2011) indicate that blogging could be used as a student-consultation tool to solicit pupils' opinions about schools. Students are empowered to attend to class and school affairs actively and the 'student voice' is well-consulted. In this way, democracy does not only exist in CE theory but also prevails in the school atmosphere. Meanwhile, recently, student councils and community attendance are assumed as the precursors of future political participation and the space for practising civil rights. Torney-Purta et al. (2001) and Kerr et al. (2002) indicate that children who are engaged in democratic practices in schools are more likely to become active citizens in future lives. The concept of 'class blogs' can be applied to 'school council' and 'community' as a discourse tool for public affairs discussion. Blogging therefore provides another alternative to extend pupils' participation in school democracy construction and community policy formation.

However, it cannot be denied that some limitations exist in the application of blogging to CE. The primary deficit is that a number of pupils still cannot have their say through blogging as a teacher-student communication platform because of the lack of access to IT equipment. The socio-economic status reflects the inequality of educational resource access and deprives some pupils of the opportunity to extend their learning with the assistance of ICT. Besides, the 'exclusion' might engender a feeling of learning helplessness and pupils' motivation may gradually deteriorate if the teacher overestimates the connection between blogging and 'participation'. As a result, the integration of blogging should take pupils' financial situation and their access to the Internet and computers into consideration. Otherwise, ironically, CE, which attempts to promote social equality and mobility, will, on the other hand, end up fostering a new form of inequality and hierarchy.

Conclusion

In the 21st century, the World Wide Web has proved to be the most sophisticated communications network and the potential of the Internet as a tool can be used in a number of ways. The positive results from combining blog platforms and subject-specific domains (e.g. language learning and natural science) are shown in several pieces of research (Liu, Lin & Wang, 2003; Duda & Garrett, 2008; Soares, 2008; Xie, Ke & Sharma, 2008; Top, 2012). Although related study on CE is still lacking, a multitude of researchers have spelled out the interplay between the Internet, blogs, democracy, participation and citizenship. The author therefore accentuate the close relationship between this technological device and CE from the theoretical perspective in order to advocate the applicability of ICT in practical citizenship teaching. With this evidence, it is clear that web-logs can be integrated into CE and can enhance the effect of practical teaching in terms of pupils' civic knowledge acquisition and the cultivation of deliberative skills and social participation despite constraints which are in need of practitioners' vigilance.

At the theoretical level, it can be argued that the underlying meaning of deliberative democracy, rational-critical dialogue, civil republicanism, active participation and global awareness can be found both in the nature of citizenship and in blogging. This demonstrates the extraordinary compatibility of blogging and CE. Besides, the great potential for integration might inspire educational institutions to launch the 'E-democracy scheme' to promote citizenship courses in schools or to promote continuing education or even immigrant education projects. However, online commercialisation, unnoticed segregation among communities and the anarchy of information should be paid more attention since these might hinder the educative effect of blogging.

In practical teaching, blogs based on constructivist theory, encourage collaborative learning and the sense of virtual community belonging, and responsibility motivates pupils to post constructive and critical feedback as the 'scaffolding' for learning. Besides, the online journal format of the

blog platform instigates 'reflective learning process' for bloggers to revisit what they have learned, combine new and old understanding and experience the process of reframing and internalisation, which has proved beneficial to deeper learning (Xie et al., 2008). As for future study on practical teaching, the pedagogy which integrates blogging, 'structured controversy' and 'value clarification' might illuminate a new approach to advance the effect of CE teaching.

Unsurprisingly, mixed feelings about technology remain. Habermas (1989) stated that due to commercialisation and advertising, previously rational citizens become consumers and the public sphere transforms from a rational-critical discussion into a platform for commerce. However, Habermas' pessimistic concern to some degree disparages the public's competence of judgment and pursuit of improvement and public interests. Meanwhile, the virtual world is the prism of real-life society and it reflects part of the realities. CE stresses the cultivation of critical thinking and living skills, and cyberspace could be one touchstone for pupils to contextualise themselves in the external world.

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Cheng-Yu Hung is a PhD candidate of the Faculty of Education at the University of Cambridge, UK. He has over five years of experience in teaching Citizenship Education in Taiwan. Being interested in the politics of education, his research focuses on the contemporary theories of liberalism, communitarianism, national identity and Confucianism as applied to the curriculum construction and the development of Citizenship Education in Taiwan and the UK

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Editor's Note:

Taiwan undergraduate students' e-learning with application for mobile devices

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Taiwan

Abstract

E-learning provides teachers and students one-on-one learning access to PCs, Internet connectivity, and integration to the education environment. E-learning is not confined to geographical barriers, but has flexible learning materials and information, and students can participate in self-directed learning without space limitation.

Application (APP) specific content could apply for geography, math, world languages, literacy development of reading and writing, e-readers and audiobooks, word processing and handwriting, note-taking, reference materials, and so on.

This research uses a quantitative study to discuss student and non-student teacher e-learning with APP on background demographic characteristics with (gender, school, educational status, school department, app learning, and technology contact), learning styles and how e-learning factors affect undergraduate students' attitude toward APP.

The accessible population included 290 participants, resulting in a response rate of 91%. Research Hypothesis 1 was not supported for student learning styles, e-learning, and attitude toward APP with student teachers. Research Hypothesis 2 showed no statistical significance for student learning styles, e-learning, and attitude toward APP with non-student teachers. Research Hypothesis 3 was not supported for the R Square value in student learning styles, e-learning, and attitude toward APP with student teachers than with non-student teachers'. Research Hypothesis 4 showed no statistical significance for learning styles, e-learning, and student attitude. Research Hypothesis 5 was supported for significance value in background demographic characteristics, learning styles, e-learning, and attitude.

The research design of the study was limited to a non-experimental and quantitative study. Future study might adopt a qualitative research design by interviewing participants and eliciting participant opinions on e-learning with APP on iPad, iPhone, and iPad, and should add more diverse occupations of language learners to compare their motivation and attitude to enhance research quality.

Keywords: E-learning, APP, student teacher, learning styles, attitude

Introduction

Internet network technologies have facilitated a learning revolution. Unlike the traditional educational system, students may spend years learning a project (Peters & Britez, 2009). The number of people connected to the network in the twenty-first century has increased, and technology has changed students' learning environment dramatically. E-learning has changed the educational materials designed, developed, and delivered to students (Duan, Habib, Hosseini, Voo, & Robert, 2006; Intel Corporation, 2009).

E-learning provides teachers and students with one-on-one learning opportunities to access PCs, Internet connectivity, and integration to the education environment, such as at school, in different locations, or even at home. E-learning is not confined by geographical barriers, but possesses

flexible learning materials and information, and students can participate in self-directed learning without time and space limitations (Wu, Hwang, 2010; Intel Corporation, 2009).

Application refers to the abbreviation of APP. The term has been used in the community for a long time and recently becomes popular mobile application in smart phones and tablets. Especially, due to the advent of apple's iTune App store in 2008 (PC magazine, 2012). Since APP was launched in July 2008, more than 200,000 items in the APP store have been downloaded more than 4 billion times (U.S. Fed News Service, 2010; Jemina, 2010). Mobile touch screen devices such as the iPhone and iPad with APP are an attractive e-learning platform for learning. Learning activities can create gaming, inspire and customize magazine formats, and increase learning convenience (McKiernan, 2011; Jemina, 2010).

The current college students have the trend to learn App from mobile devices. However, several Taiwan colleges provide the learning courses with APP for mobile devices. Therefore, the current study discusses student and non-student teacher e-learning with APP on background demographic characteristics with (gender, school, educational status, school department, student living expenses or wage, studying places, app learning, technology contact) learning styles, and how e-learning factors affect undergraduate students' attitude toward APP.

Literature review

Learning styles

Keefe (1979) defined learning styles as the "composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment" (p.2). Kolb (1971) developed Learning Styles Inventory (LSI) theory to assess the different patterns of individual learning styles. He identified four basic learning styles: diverging - emphasizes the innovative and imaginative approach, assimilating-using different observations to integrate the whole, converging - emphasizes the practical implication of ideas and solving problems, and accommodating - trial and error usage (Kolb, 1984, 1999a). Kolb's (1984) model is organized by four main stage cycles that are defined clearly: concrete experiences (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE) (Kolb, 1984).
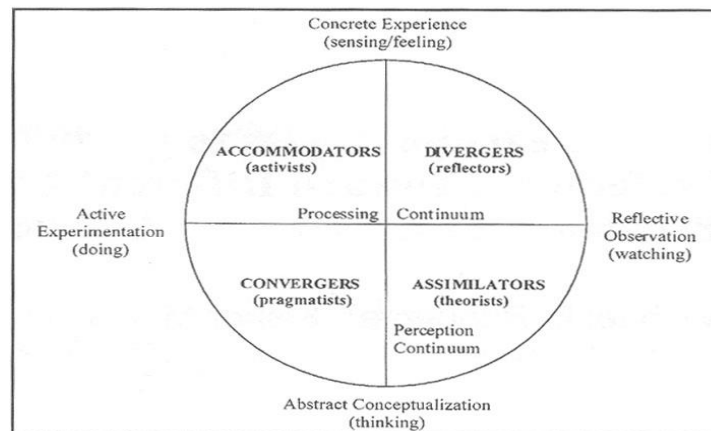
Fig. 1: Kolb's Learning Styles inventory (adapted from Kolb, 1984)

Honey and Mumford (1982, 1983) adapted Kolb's model in *The Manual of Learning Styles* and *Using Your Learning Styles*. McCarthy (1987) developed the 4Mat system based on Kolb's learning types on teaching in a cyclical process. Sun, Joy, and Griffiths (2007) combined a new method to learning styles theory and adaptive e-learning system to improve education systems.

E-learning

E-learning defines "use of technology to support and enhance learning practice" (Mayes, & Freitas, 2007, p.5) and "use of various technological tools that are either Web-based, Web-distributed, or Web-capable for the purposes of education" (Nichol, 2003, p.2). E-learning incorporates communication, self-motivation, technology, and efficiency (Comerchero, 2006). The e-learning framework of Fowler and Mayes (1999) is organized by three main stages: conceptualization refers to users' initial contact with other people; construction refers to the process of building and combining concepts to users' performance tasks; application means the testing and tuning of conceptualizations to applied contexts. The conceptual e-learning framework includes transformative learning by integrating dilemmas, threshold concepts, concept mapping, social learning, variability, inquiry, and conflict (Land & Meyer, 2010; Glancy & Isenberg, 2011).

In the *P3 Model*, people involved in e-learning can be referred to the whole comprehensive picture: e-learning team, development, and materials.

PEOPLE	→	PROCESS	→	PRODUCT
E-Learning Team	→	Development and	→	E-Learning Materials

Fig. 1: E-Learning P3 Model (adapted from Khan, 2004)

APP

APP specific content could apply to geography, math, world languages, literacy development of reading and writing, e-readers and audiobooks, word processing and handwriting, note taking, reference materials, and so on (Newton & Dell, 2011). The iPod touch, iPad, and iPhone could be an educational tool such as an e-reader for students with disabilities, handheld script, visual learning of logistic structures, language coach for studying abroad, and for interface design and usability of digital textbooks (McKiernan, 2011). The APP becomes worthless if students cannot use it. Therefore, Apple could build some features for the iOS (operating system for mobile devices), such as voiceover for users who are blind; zoom and large font for users with low vision; white on black display; closed captioning and mono audio, and voice control (Newton & Dell, 2011). More than 300,000 are filled in the iTunes APP stores, and 100,000 to download to the Android market. Some APPs require payment, for example, angry birds, doodle jump, and skee ball, and some APPs are free, such as Facebook, words with friends free, and Skype (Bascaramurty, 2010).

Attitude

Gandner (1985) defined attitude as an evaluative reaction to attitude toward the object and the basis of individual belief or opinion. Doob (1947) and Ajzen (1988) referred to attitude as a learned, implicit anticipatory response and extensively explored and explained human behavior. Fishbein and Ajzen's (1975) attitude theories provided a foundation to understand attitude and predict behavior. Fishbein and Ajzen's (1975) views on attitude can be categorized into three theories: a) information and integration theory - accumulating and organizing information; b) expectancy value theory - believe in something; c) theory of reasoned action - the effect of behavior on people's attitude and the effect of belief on people's actions. Fishbein (1972) developed the attitude model as follows:

$$Ao = \sum_{i=}^{n} b_i e_i$$

where,

Ao = Attitude toward the object (brand)
b_i = belief on the brand's possession of the attribute
e_i = evaluation of the attribute as good or bad
n = a limited number (n) of attributes a person considers

Rosenberg and Hovland (1960) proposed three component views of the attitude model: a) the affective component consists of positive or negative emotions, b) the cognitive component consists of individual thoughts or beliefs toward attitude objects, and c) the behavioral component comprises individual actions or intentions.
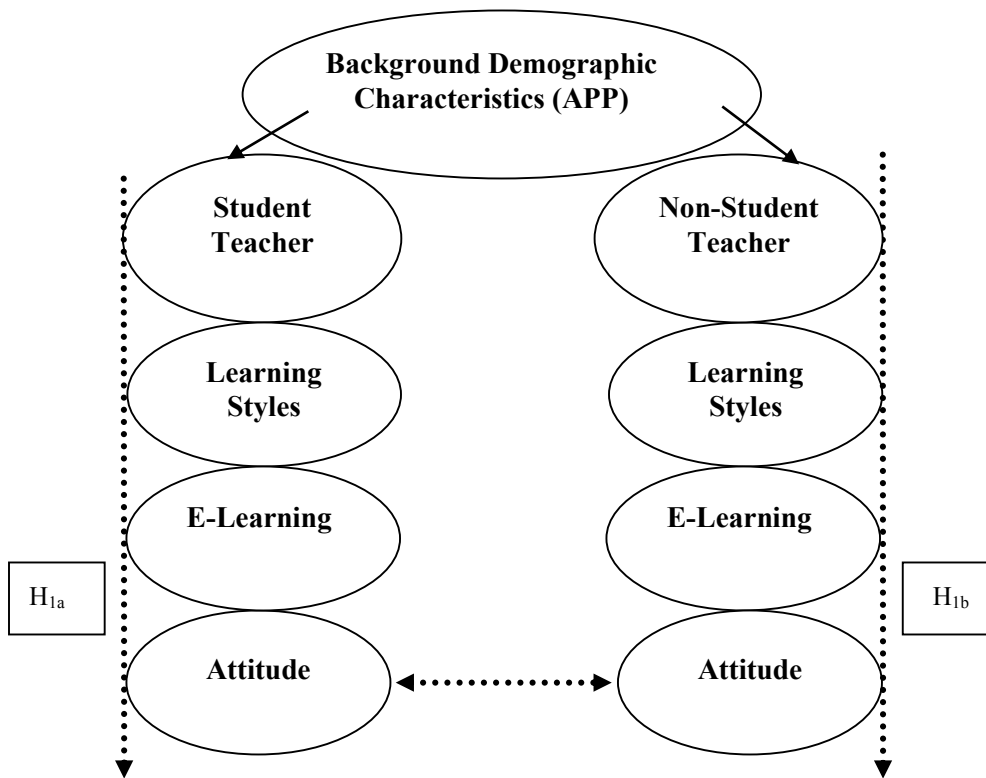
Hypotheses development and methodology

Fig. 3: Hypothesized model of student and non-student teacher, background characteristics, learning styles, e-learning, and attitude

Research question and hypotheses

Are there any differences in undergraduate student background demographic characteristics, learning styles, e-learning, and attitude toward APP between the student teacher and the non-student teacher?

H1: Taiwan undergraduate student teachers are significant explanatory variables of student learning styles, e-learning, and attitude toward APP with student teachers.

H2: Taiwan undergraduate student teachers are significant explanatory variables of student learning styles, e-learning, and attitude toward APP with non-student teachers.

H3: Taiwan undergraduate student teachers have a greater explanation of the relationship of student learning styles, e-learning, and attitude toward APP than non-student teachers (Compare adjusted R-Squares in H_{1a} versus H_{1b}).

H4: Learning styles (auditory, visual, tactile) and e-learning (audio-visuals, computer program, internet) are significant explanatory variables of perceived attitude (integrativeness, motivation, instrumental, orientation) for Taiwan undergraduate students.

H5: Background demographics characteristics, learning styles, and e-learning are significant explanatory variables of attitude for Taiwan undergraduate students.

Research design

A non-experimental, quantitative, SPSS 17.0, research design explored the relationship of background demographic characteristics, learning styles, e-learning, and attitude.

Population and sampling plan

Target population: According to the Taiwan Ministry of Education Department of Statistics (2011), over 100,000 students have taken the national university entrance exam, which is roughly 66.6%. Since the 1990s, many junior colleges and trade schools have been promoted to universities. Target populations were 177 college students in Taiwan. The convenience sample included students enrolled in the National Taichung University of Education, Ling Tung University, and Toko University in Taiwan.

Sampling plan: The entire accessible population included 390 people, who were invited to participate in the study. However, the final data-producing sample was self-selected, depending on those who agreed to participate in the study.

Instrumentation

The instrument used in this study includes four parts: For the surveys, (1) *Background Demographic Characteristics* were developed by the researchers, (2) learning styles were measured by items from the *Learning Styles Inventory (LSI)* developed by Kolb David (1984), (3) e-learning was measured by *Informational and Communication Technologies (ICTs)*, developed by Dennis Stevenson (1997), and (4) attitude toward APP was measured by the *Attitude Motivation Test Battery (AMTB)* by Gardner (1985).

Background demographic characteristics

These were developed by the researchers, including eight questions that measured gender, type of school, educational status, school department, student living expenses, study location, APP usage, and types of contact people.

Learning styles

These were measured by items from the *Learning Styles Inventory (LSI),* consisting of 24 items. The LSI included three auditory, visual, and tactile subscales. The researchers adapted and modified nine items from the original questionnaires.

E-Learning

The Informational and Communication Technologies (ICTs) include 24 items. The ICTs consists of three audio-visual, computer program, and Internet subscales. The researchers adapted and modified nine items from the original questionnaires.

Attitude Motivation Test Battery (AMTB)

This comprises 130 items. The AMTB includes 11 subtests of five categories with integrativeness, attitude toward learning situations, motivation, instrumental orientation, and language anxiety. The researchers adapted and modified nine items from the original questionnaires.

Results

Table 1
Independent sample t test for all variables
with student teacher and non-student teacher.

		Levene's test for equality of variances		t test for equality of means	
		F	Sig.	t	Sig. (two-tailed)
Gender	Equal variances assumed	10.552	.001	2.036	.043
	Equal variances not assumed			2.009	.046
School	Equal variances assumed	7.920	.005	-1.423	.156
	Equal variances not assumed			-1.432	.154
Educational_Status	Equal variances assumed	.054	.816	.020	.984
	Equal variances not assumed			.020	.984
School_Department	Equal variances assumed	2.698	.102	-.261	.794
	Equal variances not assumed			-.213	.832
Student_Living_Expenses	Equal variances assumed	2.074	.151	.371	.711
	Equal variances not assumed			.387	.699
Learning_Style_Average	Equal variances assumed	.000	.986	1.238	.217
	Equal variances not assumed			1.223	.223
E-Learning_Average	Equal variances assumed	.440	.507	.817	.415
	Equal variances not assumed			.809	.419
Attitude_Average	Equal variances assumed	.796	.373	3.478	.001
	Equal variances not assumed			3.364	.001

Research Question: Independent t tests

Levene's test for Equality of Variances in Table 1 indicates that the variances of students who learned with a student teacher and a non-student teacher according to gender ($p = .001$) and type of school (public and private) ($p = .005$) differed significantly between the student teacher and the non-student teacher. Other variables did not differ significantly between the student teacher and the non-student teacher.

Hypothesis 1, 2: Multiple regression analyses and Hypothesis 3: R-Square

The value of significance ($p = .105$) in Table 2 indicates no statistical significance. Therefore, Research Hypothesis 1 was not supported.

Table 2

***ANOVA for multiple regression analyses of student learning styles,
e-learning, and attitude toward APP with student teacher***

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.460	2	1.230	2.331	.105[a]
	Residual	34.304	65	.528		
	Total	36.765	67			

a. Predictors: (Constant), E-Learning Average, Learning Styles Average

b. Dependent Variable: Attitude Average

The value of significance (p = .000) in Table 3 indicates statistical significance. Therefore, Research Hypothesis 2 was supported.

Table 3

***ANOVA for multiple regression analyses of student learning styles, e-learning,
and attitude toward APP with non- student teacher***

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.642	2	5.821	11.676	.000[a]
	Residual	102.702	206	.499		
	Total	114.344	208			

a. Predictors: (Constant), E-Learning Average, Learning Styles Average

b. Dependent Variable: Attitude Average

Table 4 shows that the *R* Square value of the model accounted for 6.7% of the variation in student learning styles, e-learning, and attitude toward APP with the student teacher and 10.2% with the non-student teacher. Research Hypothesis 3 was not supported.

Table 4

***Multiple Regression R Square Analyses of Student Learning Styles, E-Learning,
and Attitude with Student Teacher and Non-Student Teacher***

	Model	*R*	*R* Square	Adjusted *R* Square	Std. Error of the Estimate
Student Teacher	1	.259(a)	.067	.038	.726
Non-Student Teacher	2	.319(a)	.102	.093	.706

Two-way ANOVA analysis

There was no significant (p = .205) main effect for learning styles, e-learning, and student attitude. Research Hypothesis 4 was not supported.

Table 5
Two-way ANOVA for learning styles, e-learning toward student attitude.

F	df1	df2	Sig.
1.334	11	267	.205

Multiple regression analysis

The value of significance ($p = .000$) in Table 6 indicates statistical significance. Therefore, Research Hypothesis 5 was supported.

Table 6
Multiple regression analyses of student background demographics characteristics, learning styles, e-learning, and attitude

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.154	2	7.577	15.175	.000[a]
	Residual	137.813	276	.499		
	Total	152.968	278			

a. Predictors: (Constant), E-Learning Average, Learning Styles Average

b. Dependent Variable: Attitude Average

Reliability analysis

Table 7 indicates that Cronbach's Alphas for internal consistency on attitudinal characteristics a=0.745 were an acceptable value of reliability. All of them were more than 0.70; therefore, internal consistency was satisfactory.

Table 7
Reliability statistics for learning styles, e-learning, and attitude

Cronbach's Alpha	N of Items
.745	25

Factor analysis for construct validity

Table 8 shows the results of KMO and Bartlett's test of sphericity. The value of KMO for learning styles was 0.668; e-learning was 0.595; and attitude was 0.827.

Table 8
KMO and Bartlett's test results on learning styles, e-learning and attitude.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.668
		.595
		.827
Bartlett's Test of Sphericity	Approx. Chi-Square	277.905
		161.053
		518.915
	df	36
		36
		21
	Sig.	.000
		.000
		.000

Table 9 shows that three factor values were larger than one after varimax rotation was extracted, which accounted for approximately 54% of the total variance.

Table 9
Extraction Sums of Squared Loading on Learning Styles

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	2.266	25.181	25.181
2	1.532	17.023	42.204
3	1.026	11.400	53.604

Table 10 shows that the three factor values were larger than one after varimax rotation was extracted, which accounted for approximately 49% of the total variance.

Table 10
Extraction Sums of Squared Loading on E-Learning

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	1.887	20.967	20.967
2	1.297	14.409	35.376
3	1.193	13.253	48.630

Table 11 shows that the three factor values were larger than one after varimax rotation was extracted, which accounted for approximately 45% of the total variance.

Table 11
Extraction Sums of Squared Loading on Attitude

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	3.167	45.241	45.241

Conclusion

The accessible population was 290 participants, resulting in a response rate of 91%. The participants are college students in three colleges in Taiwan. The results for research questions show that student teacher and non-student teacher for gender (p = .001) and type of school (public and private) (p = .005) differed significantly between student teacher and non-student teacher. Other variables did not differ significantly.

The value of significance (p = .105) in Hypothesis 1 was not supported for student learning styles, e-learning, and attitude toward APP with the student teacher. Research Hypothesis 2 (p = .000) was not supported, indicating no statistical significance for student learning styles, e-learning, and attitude toward APP with the non-student teacher. Research Hypothesis 3 was not supported and the R Square value of the model accounted for 6.7% of the variation in student learning styles, e-learning, and attitude toward APP with the student teacher and 10.2% with the non-student teacher. Research Hypothesis 4 was not supported because of no significant (p = .205) main effect for learning styles and e-learning toward student attitude. Research Hypothesis 5 was supported for the value of significance (p = .000) in background demographics characteristics, learning styles, e-learning, and attitude.

Practical Implications

These results show that Taiwanese college students did not prefer using e-learning with APP for student and non-student teachers. Although APP e-learning is prevalent in Taiwan, students still need to become used to learning e-learning with APP, especially for the student teacher. Most student teachers in Taiwan that learn English still use traditional learning styles.

However, Taiwan is an island of rapid technological growth. E-learning can help many students spontaneously learn English without traveling abroad to study. E-learning with APP can manage time-consuming problems and flexible areas instead of staying in the classrooms at a specific time.

The findings of the study are important to the Taiwanese government, educational institutes, students and employees, and other researchers in Taiwan that may benefit from the results of this study and attempt to change their perspectives of e-learning with APP. For the Taiwan government, the Taiwan Educational Department should support more funding to all Taiwanese colleges to purchase technology equipment and improve their attitude toward e-learning with APP. Students can also learn English with technology to improve their learning motivation, and employees can learn e-learning with APP in flexible time and places. Researchers can apply and conduct research in similar research areas.

Limitations and future study

The research design of this study is limited to a non-experimental and quantitative study. All participants were from three colleges in two cities. This research only focuses on undergraduate students in Taiwan, which may not represent Taiwanese students.

Future study might adopt a qualitative research design by interviewing participants and eliciting their opinions about e-learning with APP on iPad and iPhone, and using only iPhone or iPad. Future research should enlarge the accessible population to strengthen generalizability of the study and should add diverse occupations of more language learners to compare their motivation and attitude to enhance research quality.

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