Cite as: Qasem, A. A. A.,&Viswanathappa, G. (2016). Teacher perceptions towards ICT integration: Professional development through blended learning.*Journal of Information Technology Education: Research, 15,*561-575. Retrieved from http://www.informingscience.org/Publications/3562

Teacher Perceptions towards ICT Integration: Professional Development through Blended Learning

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Abstract

Integrating Information and Communication Technology (ICT) into teaching and learning is a growing area that has attracted many educators' attention in recent years. Teachers need to be involved in collaborative projects and development of intervention change strategies, which include teaching partnerships with ICT as a tool. Teacher perceptions are a major predictor of the use of new technologies in instructional settings. Early studies have indicated that blended learning can be as successful as either online or face-to-face instruction, particularly in teacher preparation programs. Blended learning can lead to improved training, increased access and flexibility, and better cost-effectiveness. The objective of this paper is to analyse in-service science teacher perceptions towards integrating ICT in instructional design by training them using the blended learning approach. The present study is quasi-experimental in nature wherein a pre-test/post-test design was employed. The study was conducted on a sample of 60 science teachers of secondary schools in Yemen. A questionnaire was used to determine the in-service teacher perceptions towards integrating ICT in instructional design, which included 25 items. To analyse and interpret the data, t-test and ANCOVA statistical techniques were used. The findings show that there was a significant difference in teacher perceptions towards integrating ICT, especially in the group who were trained through the blended learning approach. The recommendations are, given that teachers are ready to use ICT, that Yemeni authorities in charge of education integrate ICT into programmes for in-service teachers.

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Keywords: blended learning, e-course design, ICT integration, in-service teachers, teachers' perception

Introduction

The rapid growth in Information and Communication Technologies (ICT) has brought remarkable changes in recent years. ICT is becoming increasingly important in daily lives and in educational systems. As the teacher plays an essential role in the management of learning, teachers should equip

Editor: Donna Jean Satterlee
Submitted: July 14, 2016; Revised: August 22, September 6, September 9, 2016;
Accepted: September 10, 2016

themselves with ICT competencies to design new learning environments using the most modern technologies in the field of education.

Sugar, Crawley, and Fine (2004) indicate that technology adoption decisions are influenced by teacher perceptions and attitudes towards technology adoption, which are formed from specific underlying personal beliefs about the consequences of adoption. They found teachers must undergo practical preparation in a real environment with real subjects. Furthermore, blended learning has become widespread in education because of its flexibility for instructors to integrate educational technology into teaching (Khlaisang & Likhitdamrongkiat, 2015). Therefore, training teachers using blended learning may strengthen the adoption of ICT in their own teaching and instructional design. In teacher training courses teacher candidates can participate and exchange ideas in the learning environment whether face to face or online. Therefore, teacher trainers can improve teacher performance through the use of ICT and help develop a positive perception toward ICT integration.

Literature Review

Technology integration at schools and the factors affecting such integration has drawn the attention of many researchers and has been of high interest to them. The studies in this area have focused on exploring related issues and finding effective ways to improve teacher performance.

Teacher Perceptions on Integration of ICTs

Teacher perceptions of ICT is important as it forms a tendency that helps them to be favourable or unfavourable towards the usage of the most modern technology in the field of education. Previous research focused on explaining technology adoption and acceptance; how technology's attributes affect an individual's perception of technology. This in turn affects the usage of specific technology and technological readiness (Porter & Donthu, 2006) to embrace and use new technologies to accomplish goals in home, life, and at work (Parasuraman, 2000).

Previous studies have stated the importance of teacher perceptions as a critical factor among teacher ICT readiness to integrate ICT into classroom teaching. The study of Onyia and Onyia (2011) sought to discover whether a significant correlation exists between perception of self-efficacy and technology adoption among teachers. The findings point out a positive correlation between teacher self-efficacy and the integration of technology. There is a need to address teacher concerns and fears as they integrate technology into their classroom instruction. The results of Al Bataineh (2014) showed that teachers believe ICT competency is needed for implementing technology in social studies classrooms.

Professional Development Trends for Teachers

Teachers must develop not only essential computer skills but also proficiency in using a variety of technology tools to solve problems, make informed decisions, and generate new knowledge related to their professional performance (Teacher Technology Competency Committee, 1998). Establishing quality in e-learning is a very important issue for any academic program or course (Afifi & Alamri 2014). So there is a need to encourage e-course production at various levels of education (Marc, 2001). Eremias and Subash (2013) stated that an e-course is content in electronic form. It is a combination of text, audio, video, image, an animation with visual effects that can facilitate the learning process and the learning outcome. Further, a course delivered over network-based electronic devices allows users to share visions and influence each other's knowledge, attitudes and behaviour.

Content experts agree that online courses should follow the general design principles for web-based course instruction. There are several approaches to explain the design and development

processes for content development (Eremias & Subash, 2013). The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model is a basic model for designing and developing educational content (Seels & Richey, 1994).

The study of Afifi and Alamri (2014) aimed to identify effective principles in the design of courses for internet-based learning in light of current learning theories. Febro, Buan and Sedurifa (2008) developed a course on ICT integration in science teaching for secondary schools, they aimed to determine the appropriate content and delivery for such courses. In their study, teacher participants worked in stages on their teaching portfolios to formulate learning objectives and evidence of attainment, by organizing the learning environment and preparing assessment tools. The findings of Febro, Buan and Sedurifa (2008) showed that the expected content for an ICT integration training program on science teaching could be covered; and the secondary school science teachers in the study perceived that professional development programs on ICT integration and other online professional development trainings programs are beneficial. Their suggestions were to improve functionality and technology use, and increase the number of tutorial sessions, exercises, and hands-on practices.

The technology-enhanced learning environments (e.g., Web 2.0 technologies, social communications, and distant learning management) offer many methods and tools, such as facilitating flexibility in the learning environment, which can help reshape teacher preparation programs to better assist teachers to be more effective in the classroom. Yet developers of online professional learning communities face significant challenges in organizing and maintaining a virtual community in which participants develop a sense of belonging, trust, and support, which are prerequisites to learning in a community (Charalambos, Michalinos & Chamberlain, 2004). One strategy to address the challenge of community building in online environments is to utilize a blended approach to professional development. The interest in research on blended learning in the context of teacher education has increased and developed greatly (Ho, Nakamoria, Ho & Ho, 2013), as evidenced by the growing literature on blended learning, and its value being identified and recognized. While there are a wide variety of definitions of blended learning, the most common is that it recognizes some combination of virtual and physical environments (Bonk & Graham, 2005).There are three categories of blended learning systems based on the primary objective of the blend (Graham, Allen & Ure, 2003):

1. Enabling blends by providing the same learning experience but through different modes where learners choose a mode that meets their cost and time constraints.
2. Enhancing the blend by adopting learning management systems to provide supplementary resources for courses that are mainly conducted face-to-face.
3. Transforming blends by utilising technology-mediated approaches in teaching as a main instruction method combined with traditional learning.

There are significant arguments in the literature regarding adopting a blended learning approach, and a large volume of literature describing the use of it, but at the same time there are relatively limited empirical studies on a blended learning approach in teacher education programs (Abidoye, 2015; Ho et al., 2013; Keengwe & Kang, 2013). The study of Nazarenko (2014) was an attempt to assess the effect of blended learning by surveying students who had completed a blended course to find out their level of satisfaction. The findings indicated that the students had a positive attitude towards learning in a blended environment. According to Weaver's research (2005) some of the main motivators for learner participation are the ability to learn from others by gaining opinions, advice or responses from others, and giving or receiving help from moderators.

Geçer and Dağ (2012) aimed to concentrate on determining the perceptions of students towards computer courses which are taught and implemented in a blended learning environment. According to the results, implementing the course with electronic activities had positive effects on stu-

dents from a learning and evaluation perspective, and the students stated that the blended learning environment supported their active participation in the course activities and further indicated that following the content of the course, homework and projects online were interesting and useful. This agrees with the findings of El-Deghaidy and Nouby (2008) that learners who attended blended learning courses reported positive attitudes towards e-learning over face to face learning, and have higher grades in examinations.

Eryilmaz (2015) has shown that educational practices designed within blended environments are beneficial to the learners in terms of contentment, learning, attention, and motivation. The use of the blended learning approach in teacher preparation programs improves teacher performance in ICT integration and develops positive perceptions towards e-courses.The study of Plešec, Gasparič and Pečar (2016) was conducted on a sample of pre-service primary school teachers. The purpose of that study was to determine the intensity, level, and content of student posts online. The study found that the online discussion helped the participating students to plan their lessons and had a positive impact on student perception about adapting their lesson plans.

Based on the above, to improve the use of ICT in the educational environment it is important to understand teacher perspectives toward improving teacher ICT skills, and, in many cases, change their perceptions about ICT.

Methodology

The Purpose and Questions of the Study

The previous studies pointed out the need to invest in training programs for teachers as the first step towards getting them to use e-learning. This requires investigation of the factors that might affect technology integration. One of the major factors related to teachers and their willingness to adopt technology is teacher perceptions of ICT integration.

The literature review about the effectiveness of blended learning when used in the educational process indicates how blended learning can improve the learning outcomes. But such evidence was from countries other than Yemen and from different learning environments. There is no doubt that educational environments and systems vary from country to country. Although the vast majority of the studies involved an undergraduate course (or courses) at universities and colleges, efforts in blended learning for professional development of the in-service teachers has not been considered. This study addresses the following research questions:

- What are in-service teacher perceptions regarding integrating ICT in e-course design?
- What is the effect of the blended learning approach on in-service teacher perceptions towards ICT integration?

Research Design

The present study is quasi-experimental in nature wherein a pre-test/post-test design was employed with an experimental group and a control group. The experimental group was trained using the blended learning approach towards integrating ICT in e-course design, whereas a traditional learning (face-to-face) method was used to train the control group.

Participants

The population for this research is in-service science teachers in Ibb city, Yemen, who are knowledgeable about computers and internet basics. A sample was selected by a stratified random sampling method based on the teachers' performance (75% and above) as indicated in their in-service training profile during their last training on computer and internet basics. The sample consisted of

60 in-service teachers divided evenly and randomly between the control group and the experimental group.

The Tool Used

A perception scale was used to measure teacher perceptions of ICT integration on e-course design. The perception scale consisted of 25 items, and the response for each item was assessed using a Likert Scale with a 5-point scale ranging from 1=strongly disagree to 5=strongly agree. The content validity was established by a questionnaire which contained questions concerning teacher perceptions on motivation, facilities, and current skill in ICT in terms of e-course design. (see Appendix). The content validity was established by experts in the field, and had a reliability coefficient (Cronbach Alpha value) of 0.89.

The Nature of the Teaching Material

The experimental group, as well as the control group, were given the same curriculum featuring three units: (1) challenges and opportunities of educational technology in Yemeni schools, (2) instructional technology design, and (3) e-learning authoring tools. The curriculum was determined based on instructional technology design from Gad (2008) and Ismail (2009) using the Arabic-language version.

Experimental Intervention

This study adopted the Flex Model of Blended Learning. Horn and Staker (2011) stated that a program with a flex model features an online platform that delivers most of the curricula, that learning is primarily self-guided (as students independently learn and practice new concepts in a digital environment) and that teachers provide on-site support on a flexible and adaptive as-needed basis. This model appears to be the most used in in-service teacher preparation programs.

In our blended course, content and instruction are delivered primarily by the internet with the trainer providing assistance as needed. The participants moved through the lessons and materials at their own pace according to the program's schedule. Face-to-face sessions provided support to complement the online learning through activities such as small-group instruction, group projects, and individual tutoring with the goal of optimizing their skills and knowledge based on their needs.

The training program extended over 8 weeks, 4 days per week for 32 periods of two-hour sessions each, as shown in Table 1.

Table 1. Blended Instruction Model

Time allocation for training program processes	
Process	**session**
Face to face Project (discussion, feedback, and workshop). Computer assisted instruction.	12
Online learning Asynchronous (e-mail, discussion, forum, Facebook). Synchronous (chat, video, audio conference live).	20
Total	32

The face to face sessions includes 12 sessions with computer assisted instruction using a CD-ROM and a PowerPoint presentation, whereas the online learning includes 20 sessions which were provided as synchronous and asynchronous learning discussions. The synchronous learning discussions were organised with the aim of enabling teachers to offer each other peer support and exchange ideas using online chat and video-conferencing. In the asynchronous learning discussions the participants and the online trainer communicated through email, forum postings on online discussion boards, online tutorials, online self-assessments, and electronic texts. Online learning was facilitated via a website online learning platform (https://sites.google.com/site/alearningy/). Before intervention the participants were informed about objectives of the program and session processes. They were extended an invitation to join the website through email. They used a variety of ICT tools, for example the Internet, digital cameras, video cameras and video players, computers, printers, scanners, presentation software, educational software, asynchronous and synchronous discussions. An example of a typical week's four sessions is shown in Table 2 and Figures 1, 2 and 3.

Table 2. An example for the training schedule of four sessions weekly

Type of intervention	ICT Components	Strategies	Activities
F2F (Computer lab)	File documents (e.g., doc, pdf, ppt).	**Session 12** (lecture) Demonstration The subject of Multimedia (e.g., graphics, animation, movies, sound, camera digital, scanner).	Writing the report about presentations software.
Online (Website)	Documents (doc, pdf), files (image, video) hypertext, audio conference live, chat, phone.	**Session 13** (synchronous) The subject of presentations software (PowerPoint, CourseLab).	Creating a new module using PowerPoint or CourseLab.
Online (Website + Forum)	Documents (doc, pdf), files (image, video).	**Session 14** (self-study) The subject of developing module.	Adding complex objects, external elements, and hyperlink.
Online (Facebook)	Documents (doc, pdf, pot), files (image, video) hypertext, chat.	**Session 15** (synchronous) The subject of the assessment of teachers' projects.	Uploading and sharing the final projects.

The control group had a total of 32 sessions in a classroom and also in the computer laboratory. They had assignments which were delivered by and discussed with the trainer.

Figure 1. The navigation to one session (text, video, hyperlink)

Figure 2.Online discussions with group.

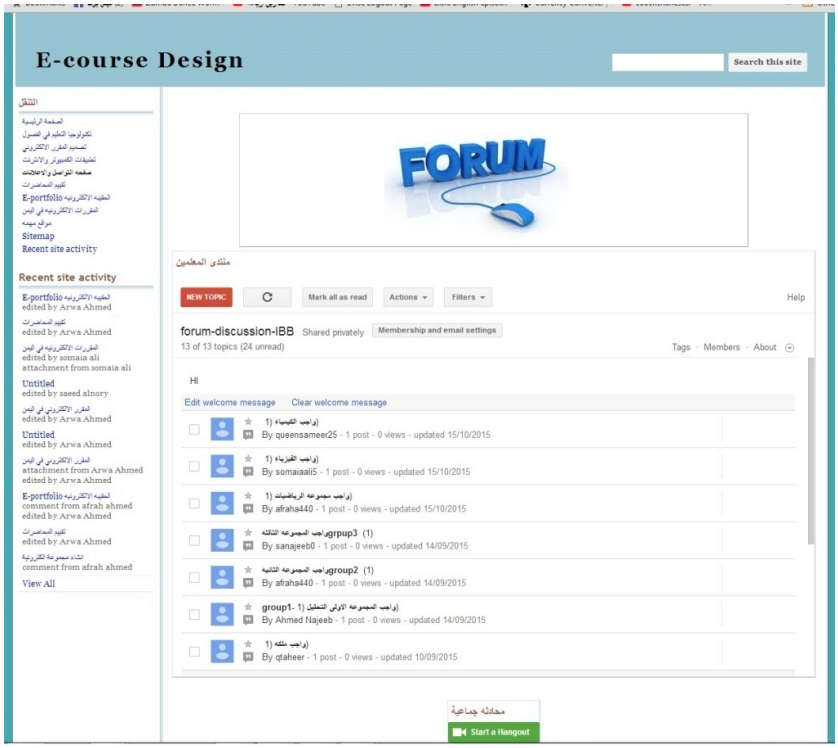

Figure 3.Forum for communication and assessment of the participants' works.

Results

Equality of Variances

Table 3 summarizes the findings of the experimental and control groups in perception scores before intervention.

Table 3. Mean scores between experimental and control group in pre-test before intervention on perception scale toward using ICT in e-course design

Group	N	Mean	Std. Deviation	t	df	Sig (P-value)
Experimental	30	59.3000	4.57994	1.630	58	.108
Control	30	57.3667	4.60497			

An examination of t-test results in Table 3 reveals that there is not a significant difference between the two groups in their perception scores ($t_{(2,58)}$= 1.630, p>0.05). It indicates that the groups were equivalent in their perception or, to put it differently, that the experiment and control groups were similar in their perception.

Effectiveness of Blended Learning on Perception Scale

There were significant differences between the experimental group and the control group after intervention. ANCOVA was conducted to examine the potential differences in teacher perceptions towards ICT integration between the two groups, using post-test scores of perception to-

wards ICT integration as a dependent variable and the pre-test scores of perception towards ICT integration as a covariate variable. The results are given in Tables 4, 5, and 6.

Table 4. The adjusted mean post-test perception scores of experimental group and control group

Group	N	Adjusted Mean Scores of perception scale	
		Mean	Adjusted Mean
Experimental	30	86.27	85.983[a]
Control	30	73.60	73.884[a]

a. Covariates appearing in the model are evaluated at the following values: pre perception = 58.33.

The adjusted mean scores on perception for the experimental group, according to the table (mean=85.983) was found to be greater than that of the control group (mean=73.884). Through analysis of covariance the results were tabulated in Table 5.

Table 5. Analysis of covariance associated with perception scale on ICT use after intervention of groups with perception on ICT use before intervention as covariate

Source	Sum of Squares	df	Mean Square	F	Sig.	Eta Squared
perception scale on ICT use before intervention	105.358	1	105.358	5.117	.028	.082
Group	2099.654	1	2099.654	101.968	.000	.641
Error	1173.709	57	20.591			
Total	387046.000	60				

a. R Squared = .682 (Adjusted R Squared = .670)

From the ANCOVA table, it is evident that the obtained $F_{(1, 57)} = 5.117$ on the adjusted means of perception scale on ICT use before intervention of the treatment groups is significant at the 0.05 level. This signifies that the covariate perception before intervention predicts the dependent variable perception after intervention. An obtained $F_{(1, 57)} = 101.968$ on the adjusted means of perception after intervention of the treatment groups is significant at the 0.05 level. Hence there is a significant difference between the experimental group and the control group in the adjusted mean in post-test perception scores when their pre-test score of perception is taken as covariate. From the main effect of treatment it is concluded that there is a significant effect on perception after intervention after controlling for the effect of perception before intervention. From Table 6 it is noticed that there is a difference among the groups in perception by taking the adjusted mean.

Table 6 shows that the mean differences in the post-test for the groups of the teacher perceptions on ICT integration before intervention as a covariate was positively signifying better effect on the experimental/blended learning group than the control/traditional learning group, and with a p value < .05 it is statistically significant. The result found that there is significant difference in the effect of blended learning on teacher perceptions over the traditional method. This indicates that the blended learning strategy is more effective compared to the traditional method for the development of teacher perceptions toward ICT use in e-course design.

Table 6. Post Hoc tests (DLS) for the effect of treatment on perception scale of experimental group and control group

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[a]
Experimental	Control	12.099*	1.198	.000
Control	Experimental	-12.099*	1.198	.000

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 5 shows that the effect size $\eta^2 = 0.641$ is large on teacher perceptions toward ICT integration in teaching, which means that the effect is significant. This large effect may be due to the activities and techniques which are used in the blended learning program to develop teacher perceptions. The results found that effect of the blended learning environment on the teacher perceptions was greater than the effect of the traditional learning environment on teacher perceptions.

Discussion

The findings of this study indicated that teacher perceptions towards ICT integration in e-course design were above average in both groups. Since the teachers had already acquired the necessary skills for effective usage and implementation of ICT, the new technologies introduced influenced teacher perceptions towards ICT integration. This result is compatible with the findings of the previous studies that show that ICTs can have a positive impact on the way teachers teach, thus improving pedagogy (Hennessey, Harrison, & Wamakote, 2010). Harris (2002) concluded that the benefits of ICT will be gained "…when confident teachers are willing to explore new opportunities for changing their classroom practices by using ICT" (p. 458). Gulbahar & Guven (2008) found that the main barriers to the implementation of ICT as perceived by the teachers are the mismatch between ICT and the existing curricula, which they teach to their students; they also indicated that teacher preparation necessitates not merely providing additional training opportunities, but also aiding them in experimenting with new ICT-based approaches before using it in their classrooms.

Thus, teacher preparation in the field of instructional technology design is important to achieve the aim of integrating ICT in education and to change teacher beliefs about using technology in education. Issues such as a lack of knowledge and skills on how to integrate ICTs effect teacher perceptions and beliefs towards ICT integration into the curriculum, therefore, teachers have to learn how to use these new technologies in their teaching. In the studies done by Geçer and Dağ (2012), El-Deghaidy and Nouby (2008), Onyia and Onyia (2011), and Al Bataineh (2014) teachers reported that they are ready to use ICT in their teaching; and they would like to attend a course related to ICT in education. The research found that, although teachers believe that ICTs have the ability to improve class-room learning, the teachers still felt the need for further training about integrate ICT tools in classroom.

When Tables 4 and 5 are analysed, it is observed that there are differences between the groups in the adjusted mean of the perception scale. That is, the mean on perception towards ICT integration of the experimental group, which was trained by blended learning, was higher than the control group which was trained by traditional methods. This could be attributed to the fact that the teachers who were trained through the blended learning approach expressed their satisfaction with

enhanced interaction and flexibility, which this environment affords along with the opportunities for continuous improvement. This result is compatible with the findings of the studies done by Abidoye (2015) and Eryilmaz (2015). Blended learning provided teachers with a better learning environment through a variety of multi-media resources which enhance self-learning strategies, encourage more activity and additional contributions to discussions, and allow reflection on their perception toward ICT use (Graham 2006; Lim & Sudweeks, 2006).

The study of Cavas, Cavas, Karaoglan, and Kisla (2009) found that prior computer experience is one of the important factors that affect teacher perceptions toward ICT in education, which in turn affects the adoption of ICT in teaching. The study results of Gebremedhin and Fenta (2015) indicated that there is a significant relationship between the teacher perceptions towards ICT integration and the quality of courses they teach. This probably explains the improved perception of the control/traditional learning group towards ICT integration. According to the activities and the assignments, which were delivered through email to teacher groups, in order to follow up their improvement, the teachers in the control/traditional learning group pointed out that one of the barriers to ICT use in instructional design is the lack of technical knowledge about the software given to them in the training program (the content of the curriculum included some software which helps teachers to prepare an e-course, e.g., CourseLab, video editor, etc.). But those barriers were not faced by the experimental/blended learning group who used web-based and distance education methods, as a complementary tool to face-to-face teaching, which encouraged the teachers to use multiple web-based tools and share information and resources. Moreover, the teachers' projects which were presented during the discussion sessions indicated that the experimental group had good instructional design, clear objectives, content and course organization presented in small units, and motivation and variety.

Conclusion

There are many studies which state that teacher perceptions towards ICT integration is an important factor in the success of technology integration in education (Mohamed, Salam, & Bakar, 2014). Furthermore, the teachers' ability and willingness to integrate ICTs into their teaching is largely dependent on the professional training and development that they receive (Selinger & Austin, 2003; Watson, 2001; Williams, 2003). So, the main aim of blended learning in professional development is to combine the best features of traditional methods with the best features of e-learning through redesigning some lectures into new online learning activities, such as tutorials, self-testing exercises, and online group collaborations. Blended learning offers flexibility in learning methods and supports extensive interaction between trainer and trainee. It can manage learning using a software application based on internet technologies that support management and delivery of distance learning content and services. Also, it allows inexpensive management and modification of learning resources (Prodromou & Avouris, 2006).

This paper presented the important issues that must be addressed by in-service teacher professional development programs if schools and other educational institutions are to fully exploit the potential of computers and the Internet as educational tools. Furthermore, teachers must be prepared for changes in technology. In particular, the number of computers in secondary schools has greatly increased in the last ten years in Yemen. ICT can improve student performance and can make a change in the nature of core subject practice and pedagogy, but only with proper guidance. This study helps to determine teacher professional development needs for proper ICT integration in classrooms.

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Appendix
The Perception Scale towards ICT integration

Dear teacher;

Thank you for taking time to complete this questionnaire. Please For each of the following give your perceptions towards ICT integration in instructional design.

Please, use the scale:

1= strongly disagree
2= disagree
3= undecided
4= agree
5= strongly agree

Your thoughtfulness and candid responses will be greatly appreciated. And your responses will be kept completely confidential.

NO	ITEMS	SCALE				
		1	2	3	4	5
1.	It is easy for me to manage a course by using internet applications.					
2.	I think that the internet applications and resources are available for my subjects.					
3.	I am aware of the opportunities that computer offer.					
4.	I believe that the communication tools (e.g., mail, forum, Blog, and chat) will make communication with my peers and students easier.					
5.	I can evaluate and select new information resources and technological innovations based on their appropriateness to specific tasks.					
6.	I think that I can use ICT for instructional design and class room activities more effectively day by day.					
7.	I can discuss diversity issues related to electronic media.					
8.	I think that ICT integration includes supporting various student learning styles and to personalise learning.					
9.	I believe that using content-specific tools (e.g., software, simulation, graphing calculators, Web tools) to support learning.					
10.	I think that using ICT in learning increases the interest of students toward courses.					
11.	I think that using ICT for instructional design increases the quality of courses.					
12.	I think that ICT usage makes it easier to prepare course materials.					
13.	It is hard for me to explain the use of computer applications to my students.					

NO	ITEMS	SCALE				
		1	2	3	4	5
14.	I think that there is inadequacy of the courses of technology offered to teachers.					
15.	I think technology makes effective use of class time.					
16.	I think I can use a variety of media and formats, including telecommunications, to collaborate, publish, and interact with peers, experts, and other audiences.					
17.	I think that using technology makes it easier to locate, evaluate, and collect information from a variety of sources.					
18.	I think that the use of technology tools and information resources for increased productivity, promote creativity, and facilitate academic learning.					
19.	I think that there is lack of interest of teachers in technology usage.					
20.	I could use ICT if I had online support on instructional technology design.					
21.	I believe that acquiring the skills to ICT integration in teaching will be easy to me.					
22.	I believe that using ICT will be a frustrating experience.					
23.	I believe that I can improve my English language skills using the benefits of ICT.					
24.	My peers often ask me for advice or information on ICT integration in instructional design.					
25.	I think that ICT is incompatible with all the courses I teach.					

Biographies

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