PRE-SERVICE TEACHERS PERCEIVED TECHNOLOGICAL, PEDAGOGICAL, CONTENT KNOWLEDGE AND SELF-EFFICACY ON THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGY

Oladosu, K. K., Abd-el-Aziz, A. A., IBIRONKE, E. S., Alasan, N. J. Makanjuola, T. W
Department of Educational Technology, Faculty of Education, University of Ilorin
oladosu.kk@unilorin.edu.ng

Abstract

The study was carried out to determine Pre-Service Teachers perceived knowledge and self-efficacy on the use of information and communication at the University of Ilorin. The study adopted a descriptive research design of the survey type to elicit relevant information from the respondents. The population for the study comprised all Pre-Service Teachers in the Faculty of the Education University of Ilorin. Purposive sampling was employed to select 400 Level Pre-Service Teachers because they have undergone various types of' teacher training and information and communication technology courses and have also undergone the mandatory teaching practice exercise. A total of 150 respondents returned their questionnaire for analysis out of 200 questionnaires administered. The findings of the study revealed that respondents have adequate knowledge about Technological Knowledge, Content Knowledge Pedagogical Knowledge and Self-Efficacy with mean scores of 3.25, 3.40, 3.37 and 3.28 respectively > 2.50. The hypotheses tested revealed that there was no significant difference between technical knowledge and self-efficacy (t= 0.93, P >.05,) there was no significant difference between pedagogical content and self-efficacy (t = 0.45 >.05). The study recommended that pre-service education should be more ICT driven as this will facilitate ICT utilization during teaching practice and beyond.

Introduction

Information and Communication Technology (ICT) have brought about the new form of literacy, which goes beyond the ability to read and write into the ability to choose appropriate technologies to conduct and carry out various activities, running on various electronic platforms. Information and communication technology is defined as a set of technological tools and to manage resources, communicates, create, disseminate, store and manage information within and outside the education sector (Adeyemo, 2010). Information and communication technology are impacting positively on every aspect of human existence, a convergence of information, information processing, the conduct of business and determine the status of the nation (Adewa- Ogulebgen and Iyamu 2005). Yusuf (2005) asserted that ICT does not only influence the teaching and learning process but revolutionizing the education system as well as promoting the growth of 21st-century skills among teachers and students. The promotion of 21st-century skills among teachers and learners requires adequate implementation and integration of required ICT skills and competencies into the school curriculum of the various levels of education especially teacher education programmes. Teacher education programme means education for students in colleges of education and faculty of education in universities before they are certified as teachers. One of the goals of a teacher in Nigeria as stated in National Policy on Education is to encourage the spirit of enquiry and creativity in teachers, it is also meant to provide teachers with the intellectual and professional background that will be adequate for their assignments and make them adaptable to changing situation (Federal Republic of Nigeria, FRN, 2013). Students undergoing these training are primarily referred to as pre-service teachers. Nakpodia and Urien, (2011) pointed out that pre-service teachers' education programme is designed to imbibe knowledge, attitude, believes and skills needed for effective classroom functioning. To ensure 21st-century effective teaching, pre-service teachers must have the knowledge and skills of the subject contents, strategies to teach

the content and ability to integrate technology into the teaching process. Besides, Aninwene, (2011) asserted that existing teacher education curricular in Nigeria are no longer suitable, adequate and relevant to the needs of contemporary society. For pre-service teachers' education to be meaningful and functional, Crompton (2015) advocated that effective use of technology by pre-service teachers is a requisite function of the education institution to provide during training programmes. Teacher education institutions need to integrate technology into every aspect of the teacher education programme as it plays a significant role in the acquisition of ICT competence by pre-service teachers for their prospective teaching practices (Aslan & Zhu, 2016). In other to promote the use of ICT among pre-service teachers during training, the constructs of Technology, Pedagogy and Content Knowledge (TPACK) was introduced by Koehler and Mishra, (2006).

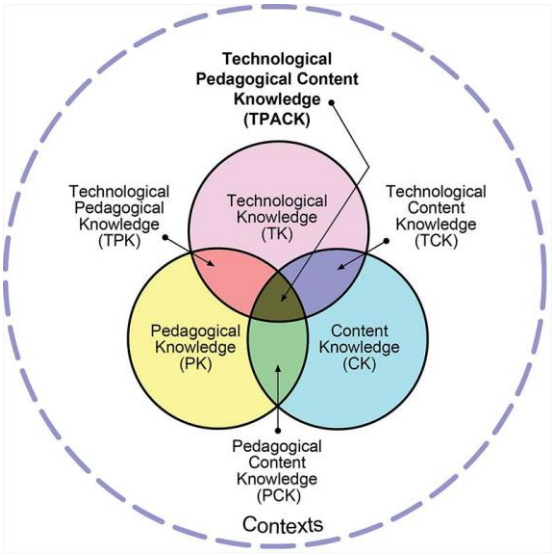


Figure 1: Technology Pedagogy, and Content Knowledge, Mishra and Koehler (2006)

The figure above depicts pedagogical knowledge, content knowledge and technological knowledge as distinct variables which have direct relevance and impact on pre-service teachers' education, furthermore, these variables have different points of intersection, bringing about, Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK) and Technological Pedagogical Content Knowledge (TPACK). The focus of this study is entrenched in the first three levels of the TPACK constructs, the pedagogical knowledge (PK), content knowledge (CK) and technological knowledge (TK) as distinct variables which have direct relevance and impact on pre-service teachers' education.

Pedagogical knowledge (PK) refers to methodologies and strategies pre-service teachers have acquired before being posted on teaching practice. Koehler (20063) defined PK is a set of skills that teachers must have developed in other to manage and organize teaching and learning activities for intended learning outcomes. This requires a deep understanding of theories of learning and how they apply to the students in classroom settings. Content Knowledge (CK) is referred to as requisite information pre-service teachers' has acquired based on subject area specialization content and students are expected to learn from. Koehler (2006) asserted that CK is the subject area in which teachers instruct. Technological knowledge (TK) refers to relevant information at the disposal of the pre-service teacher to select appropriate technologies in congruence with methods selected and content to be taught. Raman (2014) referred TK as knowledge of technology that constantly changes including the ability to process information, communication, and solving problems in daily life and work. This entails the ability to identify appropriate technology for content and appropriate setting for content delivery. Koehler and Mishra (2009) emphasized that effective technology integration depends on understanding the relationships among these components of knowledge

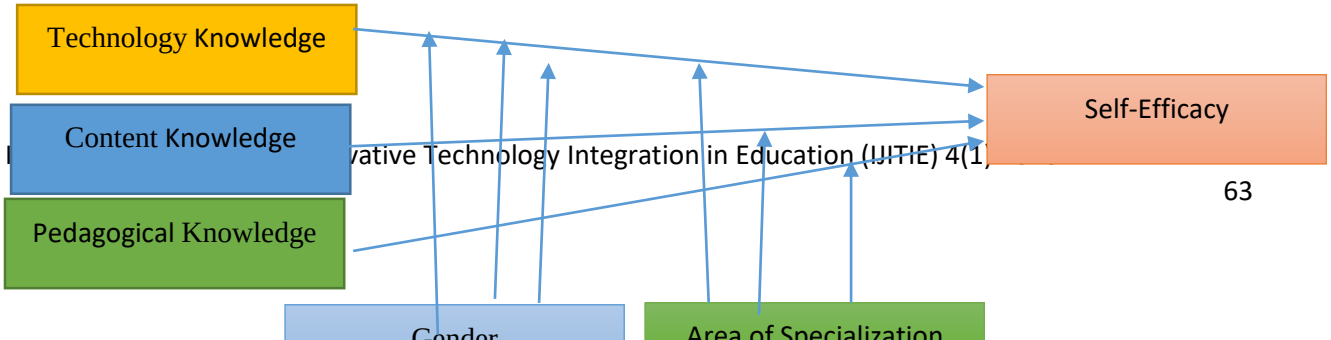
and it requires continually creating, maintaining and re-establishing dynamic equilibrium among all components. Thus, teachers are required to develop competencies not only in each of these three main knowledge domains but also in the interrelationships among them. It is expected that, if pre-service teachers are well ground and grounded with these competencies during training, it will boost the self-efficacy on the use of ICT during teaching practice.

Self-efficacy is the extent to which an individual believes in his ability to carry out specific activities in other to attain a given goal or objective. Bandura (2007) defined self-efficacy as the confidence an individual has in his ability to do the things that he strives to do. Olalekan and Stanley (2018) defined self-efficacy as the outcome of the belief that one has confidence and ability to execute actions required to deal with a given situation in which he has been trained. This implies that, for self-efficacy to achieved, the individual would have been trained on how to go about related tasks. Contextually, self-efficacy is the extent or the ability to which an individual pre-service teacher believes in his ability and skills to deliver instructional content through the use of information and communication technology as a result of training. Thomas, Martha and Pass (2014) posited that pre-service teachers with higher self-efficacy find ICT resources easy to use. Timothy (2009) also reported a significant relationship between self-efficacy and use of technology among pre-service teachers in Turkey. Self-efficacy and use of technology among pre-service teachers in Turkey

Technological, content and pedagogical knowledge are important constructs in the preparation of pre-service teachers into the teaching profession of the 21st century, adequate information and training will guarantee an improved self-efficacy in the utilization of ICT during a professional career. It was observed during field assessment of pre-service teachers that these teachers do not make use of ICT during teaching practice and this could have an effect on the preparation of respective students for demands and requites of the 21st century. This formed the basis on which pre-service teachers training and self-efficacy in ICT utilization researched in to.

There are demographic factors that could determine an individuals technology, pedagogy, content knowledge and self-efficacy, factors such as age, gender, cognitive ability, technology experience, area of study or specialization and so on. For the article, gender and area of specialization are considered variables of interest. Gender is the biological identification of an individual as male or female. Gender issues in the adoption, acceptance, TCP, TPACK and integration of technology is yet to assume a definite status or direction. Omar and Firat (2019) reported that male teachers have higher technological knowledge than their female counterparts. In another context, Wang, Teo and Russo (2012) reported gender had no moderating effect on perceived usefulness and attitude towards computer use among pre-service teachers in Malaysian. Scherer and Siddiq (2015) averred that gender disparity exists in technology-related self-efficacy. Area of specialization refers to the different courses of study an individual chose to build a career path, this could be in various branches of social sciences, sciences and education in Nigerian nomenclature. Pre-service teachers' area of study determines the determine the self-efficacy needed, Omar and Siddiq (2019) pointed out that, teachers in different disciplines may have different self-efficacy requirements for technology integration in education.

The study proposes a model in other to understand the interaction that could be existing between Technological, Content Pedagogical knowledge, self-efficacy, gender and area of specialization.



Objectives of the Study

The study determined pre-service teachers perceived TCP Knowledge and self-efficacy on the use of Information and Communication Technology. Specifically, the study:

1. Determined the influence of gender on pre-service teachers' perceived technology knowledge and self-efficacy to use ICT for instruction
2. Examined the influence of gender on pre-service teachers' perceived content knowledge and self-efficacy to use ICT for instruction
3. Determining the influence of gender on pre-service teachers perceived pedagogical knowledge and self-efficacy to use ICT for instruction
4. Determined influence pre-service teachers' area of specialization on technological knowledge and self-efficacy to use ICT for instruction
5. Examined influence of preservice teachers' area of specialization on content knowledge and self-efficacy to use ICT for instruction
6. Examined influence of preservice teachers' area of specialization on pedagogical knowledge and self-efficacy to use ICT for instruction.

Research Hypotheses

H_{O1}: there is no significant difference between male and female pre-service teachers' technological knowledge and self-efficacy to use ICT for instruction
H_{O2}: there is no significant difference between male and female pre-service teachers' content knowledge and self-efficacy to use ICT for instruction
H_{O3}: there is no significant difference between male and female pre-service teachers' pedagogical knowledge and self-efficacy to use ICT for instruction
H_{O4}: there is no significant difference among pre-service teachers' area of specialization technological knowledge and self-efficacy to use ICT for instruction
H_{O5}: there is no significant difference among pre-service teachers' area of specialization content knowledge and self-efficacy to use ICT for instruction
H_{O6}: there is no significant difference among pre-service teachers' area of specialization pedagogical knowledge and self-efficacy to use ICT for instruction

Methodology

Design

The study is a descriptive research of the survey type

Population, Sampling and Sampling Technique

The population for the study comprised of all Pre-Service Teachers in the Faculty of the Education University of Ilorin. Purposive sampling was employed to select 400 Level Pre-Service Teachers because they have undergone various types of teacher training and information and communication technology courses and have also undergone the mandatory teaching practice exercise. Simple random sampling was used to select participants from the Departments of; Health Education, Human Kinetics, Educational Technology, Science Education, Counsellor Education, Adults and Primary Education, Arts Education, Educational Management and Social Sciences.

Research Instrument

The research instrument for this study was a structured questionnaire titled pre-service teachers training and self-efficacy in the use of ICT for teaching at the University of Ilorin. The research instrument was divided into 5 sections. Section A contained demographic information of the respondents, section B contained 7 questions to elicit a response on pre-service teacher's technological knowledge, and section C contained 5 items on content knowledge, while 7 items were listed in section D to elicit a response on student teacher's pedagogical knowledge. 5 items were listed in section E on the student teacher's self-efficacy. The research instrument was pilot tested on twenty pre-service teachers to ascertain the reliability of the instrument, Cronbach Alpha at 0.05 was used to determine the reliability. Section B of the questionnaire was computed to be 0.50: Section C was calculated to be 0.58: Section D was calculated to be 0. 60 and reliability for the pre-service teacher's self-efficacy in section E was computed to be 0.60. The claim of Gleim and Gleim (2003) that the closer the Cronbach Alpha's coefficient is closer to 1.0 the greater the internal consistency of the items in the scale. This shows that the structured questionnaire is reliable.

Data Analysis Technique

Inferential statistics were employed to analyze the participant's responses. The research hypotheses 1-3 were tested using T-test while research hypotheses 4-6 were analyzed using ANOVA.

Results

H_{o1}: There is no significant difference between male and female pre-service teachers' technological knowledge and self-efficacy in the use of ICT for teaching at the University of Ilorin.

Table 1: T-test analysis on the significant difference between the male and female pre-service teachers Technological Knowledge and Self-efficacy in the use of ICT for teaching at the University of Ilorin.

Gender	NO	Mean	SD	df	t	sig	Remark
Male	49	40.61	8.69				
				148	1.32	.093	Accepted
Female	101	38.56	8.97				

From table 1, it can be deduced that there is no significant difference in the male and female pre-service teachers Technological Knowledge and Self-efficacy on the use of ICT for teaching. This is reflected in the result df (148), t= 1.32, p >.05. This means the null hypothesis which stated that there is no significant difference in the male and female pre-service teachers was accepted even though there is difference between mean scores male and female pre-service teachers, male X 40.61>38.56. This implies the male pre-service teacher has higher technical knowledge and self-efficacy than their female counterparts.

H_{02}: There is no significant difference between the male and female pre-service teachers' content knowledge and self-efficacy in the use of ICT for teaching at the University of Ilorin

Table 2: T-test analysis on the significant difference between the male and female pre-service teachers' content knowledge and self-efficacy in the use of ICT for teaching at the University of Ilorin.

Gender	NO	Mean	SD	df	t	sig	Remark
Male	49	41.02	7.73				
				148	1.13	724	Accepted
Female	101	39.62	6.73				

From table 2, it can be deduced that there is no significant difference in the male and female pre-service teachers content knowledge and self-efficacy in the use of ICT for teaching base on this study. This is reflected in the result df (148), t=-1.13, p>.05. Thus the hypothesis is accepted. This means the null hypothesis which stated that there is no significant difference in the male and female pre-service teachers content knowledge and self-efficacy in the use of ICT base on this study is accepted. The mean scores indicated the male pre-service teachers have higher content knowledge and self-efficacy compared to their female counterpartscounterparts.

H_{o3}: There is no significant difference between the male and female pre-service teachers' pedagogical knowledge and self-efficacy in the use of ICT for teaching in the University of Ilorin.

Table 3: T-test analysis on the significant difference between the male and female pre-service teachers' pedagogical knowledge and self-efficacy in use of ICT for teaching in University of Ilorin.

Gender	N0	Mean	SD	df	t	sig	Remark
Male	49	34.06	4.29				
				148	1.56	.452	Accepted
Female	101	32.81	4.70				

From table 3, it can be inferred that there is no significant difference in the male and female pre-service teachers' pedagogical knowledge and self-efficacy in the use of ICT for teaching base on this study. This is reflected in the result df (148), t= 1.56, p>.05. This means the null hypothesis which stated that there is no significant difference in the male and female pre-service teachers' pedagogical knowledge and self-efficacy in the use of ICT base is accepted. The means scores reflected no significant difference in both the male and female pedagogical knowledge and self-efficacy.

H_{04}: There is no significant difference between pre-service teachers Technological Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin.

Table 4, Anova analysis on significant difference between pre-service teachers Technological Knowledge and Self-efficacy in use of ICT for teaching based on area of specialization in University of Ilorin

Groups	Sum of Squares	df	Mean Square	F	Sig.	Remark
Between Groups	784.06	8	98.00	1.25	.273	Accepted
Within Groups	11034.77	141	78.26			
Total	11818.83	149				

Table 4 shows that there is no significant difference between pre-service teachers Technological Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin. This is reflected in the result: F (8,141) = 1.25, p>0.05. Thus, the hypothesis is accepted. By implication, there is no significant Therefore there is no significant difference between pre-service teachers Technological Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin. It shows that nevertheless of their area of specialization pre-service teacher possess the ability to deliver their lessons using appropriate technological skills and tools.

H_{o5}: There is no significant difference between pre-service teachers Content Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin.

Table 5, Anova analysis on significant difference between pre-service teachers Content Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin

Groups	Sum of Squares	df	Mean Square	F	Sig.	Remark
Between Groups	470.49	8	58.81	1.18	.313	Accepted
Within Groups	7002.54	141	49.66			
Total	7473.04	149				

Table 5, shows that there is no significant difference between pre-service teachers Content Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin. This is reflected in the result: F (8,141) = 1.18, p>0.05. Thus, the hypothesis is accepted. By implication, there is no significant difference between pre-service teachers Content Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin. It shows that nevertheless of their area of specialization pre-service teachers possess Content Knowledge.

Table 4: Anova analysis on significant difference between pre-service teachers Pedagogical Knowledge, self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin

Groups	Sum Of Squares	df	Mean Square	F	Sig.	Remark
Between Groups	272.73	8	34.09	1.67	.110	Accepted
Within Groups	2873.00	141	20.37			
Total	3145.74	149				

Table 5, shows that there is no significant difference between pre-service teachers Pedagogical Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin. This is reflected in the result: F (8,141) = 1.67, p>0.05. Thus, the hypothesis is accepted. By implication, there is no significant difference between pre-service teachers Pedagogical Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin. It shows that irrespective of area of specialization pre-service teachers possess the ability to deliver their lessons using appropriate methodologies and technologies.

H_{o6}: There is no significant difference between pre-service teachers Content Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin

Table 6, Anova analysis on significant difference between pre-service teachers Content Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin

Groups	SS	df	MS	F	Sig.	Remark
Between Groups	470.49	8	58.81	1.18	.313	Accepted
Within Groups	7002.54	141	49.66			
Total	7473.04	149				

Table 12 shows that there is no significant difference between pre-service teachers Content Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin. This is reflected in the result: F (8,141) = 1.18, p>0.05. Thus, the hypothesis is accepted. By implication, there is no significant difference between pre-service teachers Content Knowledge and Self-efficacy in use of ICT for teaching base on area of specialization in University of Ilorin. It shows that irrespective of area of specialization pre-service teachers possess Content Knowledge and self-efficacy to deliver instructional content through the use of ICT.

Discussion

The overall result of this study revealed that there was no significant difference between male and female pre-service teachers Technological, Content and Pedagogical knowledge. This support the findings of Taner and Salih (2017) who reported no significant difference between male and female pre-service teachers among all the TPACK constructs. However, differences were recorded in means scores of male and female pre-service teachers technology knowledge, and self-efficacy, content knowledge and self-efficacy, there was no difference between mean score of pedagogical knowledge and self-efficacy. This negate the findings of Oz (2015) who reported the female respondents had higher PK score compared to their male counterparts. There was no significant difference among the constructs of Technological Knowledge, Content Knowledge of the TPACK and Self-efficacy to use ICT for instruction and pre-service teachers' area of specialization. This finding corroborates Khalid, Karim, Husnin (2018) findings, which revealed that special education pre-service teachers had the highest mean score between Sports and recreation, TESL respondents, this implies that pre-service teachers have required pedagogical knowledge.

Conclusion

Based on the findings of this study, it can be concluded that TPC constructs of the TPACK and Self-efficacy to utilize ICT for learning among pre-service teachers is adequate. However, pre-service teacher education programmes should emphasize more on the integration of ICT at all levels of the TPACK constructs. This will serve as a boost towards ICT utilization self-efficacy.

References

Aduwa-Ogiegbenam, S.E. & Iyamu, E.O. (2005). Using information and communication technology in secondary school Nigeria: Problem and Prospects. *Education Technology and Society,* 8(1), 104-112.

Aninwene, E. O. (2011). Form in school music: The music teacher education perspective in Nigeria. In A.O. Abolade, C. M. Ogbodo, & B. U. Maduewesi (Eds), Contemporary issues in Nigerian Education (556-570).Onitsha: West and Solomon Publishing Coy Ltd.

Aslan, A., & Zhu, C. (2016). Influencing factors and integration of ICT into teaching practices of pre-service and starting teachers. *International Journal of Research in Education and Science*, *2*(2), 359-370.

Bandura, A. (2007). Much ado over a faulty conception of perceived self–efficacy grounded in faulty experimentation. *Journal of Social and Clinical Psychology*, *26*(6), 641-658.

Crompton, H. (2015). Pre-service teachers' developing technological pedagogical content knowledge (TPACK) and beliefs on the use of technology in the K-12 mathematics classroom: A review of the literature. In *Technological pedagogical content knowledge* (pp. 239-250). Springer, Boston, MA.

Federal Republic of Nigeria, (FRN, 2013). National Policy on Education. Nigeria Educational Research Development, NERDC Press, Abuja, Nigeria.

Gliem, J. A., & Gliem, R. R. (2003). Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education.

Khalid, F., Karim, A. A., Husnin, H. (2018). Pre-service teachers' preparedness on integrating pedagogy, content and technology knowledge. *Journal of Advance Research in Dynamical & Control System, 10(12), pp1467-1473.*

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education*,9(1), 60–70.

Nakpodia, E. D., & Urien, J. (2011). Teacher education in Nigeria: Challenges to educational administrators in the 21st Century. *The Social Sciences*, 6(5), 350-356.

Olalekan, A. A., & Stanley, O. U. (2018). Computer self-efficacy and attitudes towards internet usageamong library and information science postgraduate students in two library schools in Nigeria. *American Journal Educational Research and Reviews,* 3(24), 0001-0013

Omar, S, & Fira, S. (2019). Investigation of the self-efficacy of teachers in technological pedagogical content knowledge and their use of information and communication technologies. *World Journal of Education.* 9(1), 196-208.

Oz, H. (2015). Assessing Pre-service English as a foreign language teachers' technological pedagogical content knowledge. *International Education Studies.* 8(5), 119-130

Raman, A. (2014). TPACK Confidence of Pre-service Teachers in Universiti Utara Malaysia. *Mediterranean Journal of Social Sciences*, *5*(22), 167.

Scherer, R., & Siddiq, F. (2015). Revisiting teachers' computer self-efficacy: A differentiated view on gender differences. *Computers in Human Behavior*, *53*, 48-57.

Altun, T., & Akyildiz, S. (2017). Investigating student teachers technological pedagogoical content knowledge (TPACK) levels based on some variables. *European Journal of Education Studies.* 3(5), 467-485

Thomas, B. I., Egbro, M. O. & Osaide, S. O. (2014). Teachers' self-efficacy beliefs in the use of an aspect of ICT for secondary school biology teaching. *The International's Research Journal of Sicience and IT Management.* 3(4), 24-28.

Timothy, T. E. O. (2009). Examining the relationship between student teachers' self-efficacy beliefs and their intended uses of technology for teaching: A structural equation modelling approach. *The Turkish Online Journal of Educational Technology*, *8*(4), 7-13

Wong, K. T., Teo, T., & Russo, S. (2012). Influence of gender and computer teaching efficacy on computer acceptance among Malaysian student teachers: An extended technology acceptance model. *Australasian Journal of Educational Technology*, *28*(7),

Yusuf, M. O. (2005). Information and communication technology and education: Analysing the Nigerian national policy for information technology. *International education journal*, *6*(3), 316-321.