# Modeling Technology Preparedness as an Antecedent of Mathematic Pre-service Teachers' Self Efficacy, Perceived Usefulness and Intention Toward Use of Information Technology in Nigeria

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## ABSTRACT

This study test a specified model of information technology (IT) preparedness as antecedent of pre-service teachers' self efficacy, perceived usefulness, and intention toward IT use for teaching in Nigeria. Survey method was employed for prosecuting the study. The participants of the study comprise of 200 pre-service teachers studying Mathematics education in one of the Nigerian universities. The instrument used for data collection was adapted and subjected to validation and reliability check. A factor analysis revealed four constructs and their reliability indexes were .73, .87, .90 and .91 Cronbach alpha respectively. The data of the study was subjected to factor analysis, confirmatory factor analysis and finally fitting the specified model of the study with AMOS 20 statistical package. The finding showed that IT preparedness positively predicts pre-service teachers' IT self-efficacy, perceived usefulness and in-turn predicts their intention towards use of IT for future classroom practice. Based on this finding, the study suggests among others the holistic deployment of IT resources among teacher educator for pre-service teacher training.

**Keywords:** *Technology preparedness, pre-service teacher, perceived usefulness, Self efficacy, intention to use, Nigeria*

## INTRODUCTION

*……"The creation of an enduring educational system capable of preparing people to live in the changing world is one of the crucial tasks of modern society" (Kinelev, 2000)……*

The paradigm shift in what constitutes effective and efficient teacher in the contemporary world has created a challenge into teacher preparation for the world of work in the last few decades. There is no doubt to the fact that in the present knowledge society, information technologies (IT) have been the driven force in all facet of human endeavor, education inclusive. The invention of information technology resources and their use in the classroom has created the need for knowledgeable teachers to utilize the tool in a most effective way for instructional delivery. Hence, preparing student-teacher on how to integrate information technology in a professional way for implementing school curriculum has created additional skills for teacher preparation programme (Groove, 2008).

Looking at the framework of Technology, Pedagogical and Content Knowledge (TPCK), what constitutes an effective technology use for teaching activities requires an understanding of how IT tools relate

to content to be taught and the pedagogy activities that follow. Due to this, understanding the applicability of IT for pedagogies activities is crucial to skill and competence to be attained by who becomes a teacher.

The Nigeria government realizing the importance of IT for everyday life encourages educational institution to restructure their curriculum and classroom facilities so as to bridge the gap in IT use for teaching and learning. This was spelt out in the National Policy on Education which stated the need for integration of IT into the main stream of the Nigerian educational system (FRN 2013). Yusuf (2005) had eelier advocated for inclusion of ICT policy in all levels of Nigerian educational system, of which teachers' preparation programme should include a robust information technology training.

Over the years, the issue of teacher education has been a subject of concern due to the dynamic nature of the skill requirement for professional teacher. According to Ng'eno, Githua and Changeiywo (2013) teachers are very important in children's intellectual and social development therefore, they are to perform their role in a way that it will help learners acquire high level of skill and competence. The most essential skill needed in today world of work is Information technology skill and the teacher should be the gate-keeper when it comes to its use for instruction (Shittu, Gambari, & Alabi, 2015). Attesting to the dynamism of teachers' skills, Magliaro (2007) posited that as new technology emerges and its use for teaching and learning process increases so also there will be an increase in the need for teacher professional development. Buttressing this assertion, Cheng and Zhan (2012) said for a teacher training programme to be effective, the student teacher must be exposed to technological knowledge as this will give him/her the opportunities to relate technology knowledge with pedagogy and the content.

Corkett and Benevides (2015); Ajayi (2011); Puckett, Judge and Brozo (2009) in their various studies stated that for pre-service teachers to possess self-efficacy in the use of technology for teaching, teacher education programme must inject technological skills vis-a-vis pedagogical practice into pre-service teachers' course of study. Corkett et al. (2015) suggested a way forward for the integration of technology into teachers' education programme is to motivate and encourage teachers while in training as well as involve in analysing new media so as to determine how the new technology can be drafted to support students' learning.

Yildrin and Kiraz, (1999); Reynold and Morgan, (2001); Oigara and Wallace, (2012) in their various studies stress the importance of technology training and mentoring as a major factor that could enable teacher develop positive attitude toward technology, which will invariably encourage them to use it to enhance classroom instruction. Another salient point on student teacher preparedness to use technology as identified by Bullock (2004) was the state of the technology skill demonstrated by those assigned to mentor the teacher in training. The skill and ability to mentor effective use of technology may enable or disable pre-service teachers' use of technology. Groove (2008) submitted that preparing pre-service teacher with the skill of using technology for pedagogy related activities is a complex process with so many mediating factors.

Pre-service teachers' professional competence in the use of modern tools continues to attract researcher's interest due to their role in the society. As a result, studies on the impact of how these professionals are train for the utilization of technology for pedagogy and content delivery became the focus of research. While studies of Brzycki and Dudt (2005) as well as Sulton (2011) concluded that teacher training programme are less effective to prepare pre-service teacher to acquire the proficiency needed for integration of technology for teaching in a most effective way, Fleming, Motamedi and May (2007) were of the view that the more hand-on demonstration on technology integration a pre-service teacher is exposed to, the more confidence they developed in using instructional technology skill after their graduation from teacher training school.

Evidence from literature shows that a well prepared pre-service teacher may be well disposed to integration of IT for teaching, while less prepared with insufficient skill in technology use may choose not to use IT for teaching. Literature also revealed that factor influencing decision to use or not to use IT for teaching goes beyond how pre-service teacher undergoes his/her training. Thus, this study therefore sets to gain insight into relationship between anticipated outcome and expectation on technological preparedness of pre-service teachers' future use of IT for teaching and learning. Particularly, the study aims to find out whether how their preparation for integration of IT while in teacher training school may have influence on their self efficacy, perceived usefulness and the intention to use IT for their future professional engagement.

**The Objective of the Study**

The major objective of the study is to empirically understand the degree of influence the training in the use of IT will have on pre-service teachers' self-efficacy, perceived usefulness of IT and their final

adoption of IT for teaching, the following conceptual model in figure (1) were developed to be tested in the study.
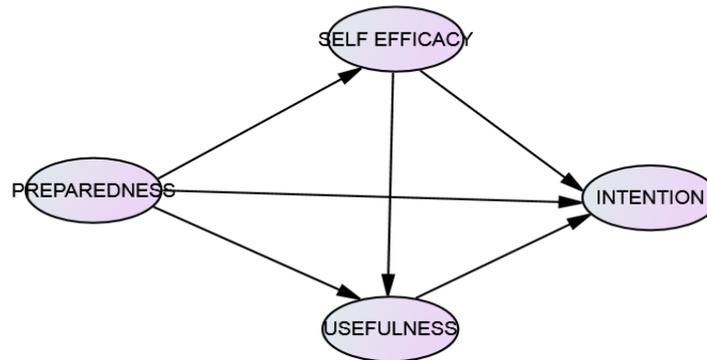


**Figure 1: Conceptual model of the study**

Based on the conceptual model in figure (1) above, the following alternate hypotheses were drawn to be tested through the data of the study.

**Hypotheses of the Study**

**H1:** How Pre-service teachers are prepared will positively influence their self-efficacy in the use of information technology for teaching

**H2:** How Pre-service teachers are prepared will positively influence their perceived usefulness of information technology for teaching

**H3:** How Pre-service teachers are prepared will positively influence their intention towards the use of information technology for teaching

**H4:** Perceived usefulness of IT will positively influence pre-service teachers'intention toward the use of information technology for teaching

**H5:** Computer self-efficacy will positively influence pre-service teachers' intention toward the use of information technology for teaching

**H6:** Computer self-efficacy will positively influence pre-service teachers' perceived usefulness of information technology for teaching

**Literature Review and Theoretical Framework**

Over the years, most studies used Technology acceptance model (TAM) developed by Davis (1989) to gauge user intention toward use of information technology. Almost all these studies confirm the explanatory strength of TAM as a model that can be used to understand users reason for accepting or rejecting IT system (Sharp, 2006; Slylianoa & Jackson, 2007; Teo, 2009; Shi & Huang, 2009). As acceptable as the model appears, some criticisms are still trailing the parsimony of TAM. For instance Venkatesh (2000) pointed out that TAM constraint was its simplicity. Prior to that Mathieson (1991) reported the predictive power of TAM, but said its limitation is that it cannot be generalized beyond the context of a study. Literature has shown that it is difficult to identifiy determinant of individual intention toward acceptance of technology. This explains why researchers are consistently seeking to understand user intention toward the use of technology from different theoretical lens.

In pursuant of knowledge of what inform users to perceive technology to be easy, Venkatesh and Davis (1996) conducted a study which discovered that computer self-efficacy is a strong antecedent and determinant of perceived ease of use. Teo (2009) studied pre-service teacher acceptance of technology in Singapore and revealed that computer self-efficacy has a direct and strong effect on Singaporean pre-service teachers' behavioural intention towards IT. The study stress that computer self-efficacy has more impact on perceived usefulness than perceived ease of use.

In a related study on mathematics pre-service teacher professional training, development, accessibility of technology and it influence on belief, usefulness, and ease of use by Getenent (2013) the finding of that study showed that pr-eservice teacher held positive belief about the use of computer but their belief does not translate to their teaching. Similarly, another study by Teo, (2007) was on what predict pre-service teachers' intention to use web 2.0 technologies for future classroom. The result revealed that positive attitude and perception of perceived usefulness are significant predictors of pre-service teachers' intention toward web technologies.

Also, a study of pre-service teachers' belief and integration of technology for future classroom use by Anderson, Groulx and Maninger (2011) revealed that technological abilities largely contributed to intention regarding frequent use of technology in the future. The pre-service teachers' constructive beliefs were moderately correlated with their self efficacy and value belief as well as their intention. A study by Ng'eno, Githua and Changeiywo (2013) on mathematics teacher perception of their preparedness to use IT for secondary school mathematics instruction in Kenya revealed that mathematic teachers' perceived themselves to be less prepared to integrate IT resources for mathematics instruction. Hoswever, the study by Wong, Kamariah, Ramlar, Rahani and Tang (2003) on pr-eservice teacher IT preparedness at University of Putra Malaysia, showed that the student teachers are highly prepared and this significantly influence their attitude towards technology use.

## METHODOLOGY

The study used quantitative research method through descriptive survey approach for prosecuting the study. Based on the study objective which aims to specify and fit a model to explain the antecedent of technology preparedness of pre-service teacher in the setting of the study, series of statistical analysis were computed. The data collected for the study was subjected to descriptive statistic (mean and standard deviation) so as to ascertain the normality of the data for structural equation modeling.

Other analysis includes subjecting the data to factor analysis and confirmatory factor analysis, after which the data was finally fitted into the model earlier specified for the study with SEM using AMOS 20 statistical package.

### Population and Sample of the Study

The target population of the study is made up of all Mathematics pre-service teachers in one of the Federal Universities in Nigeria. A purposive sampling method was used to sample two hundred (200) students used as the participants of the study. The sample was considered adequate for structural equation model development (Teo, 2008). Out of the 200 questionnaire administered, 146 questionnaires were fully filled, returned and finally used for data analysis. Among the participants, 88 (59.6%) were male, while 58 (39.4%) were female.

### Instrument Validity and Reliability

The instrument used for data collection was adapted and modified for the study. The instrument consistsed of 35 items measuring the four construct of the study. The construct validity of the instrument was computed, which led to item reduction. In doing this, the data was subjected to factor analysis, using principal component analysis with Varimax rotation for extraction. The Kaiser-Meyer-Olkin measure of sampling (KMO) was found to be adequate with .81 values which is above the .60 recommended (Nunnaly 1976). Barllet's test of Sphericity value was significant (p=0.00), the Eigen value was greater than one as the entire percentage of variance explained was found to be greater than 56%. The factor loading of the items used was loaded within the range of .56 and .76. The reliability of the four extracted constructs' were subjected to internal consistent check with Cronbach Alpha, and an alpha level of .73, .87, .90, and .91 was obtained. The data demonstrated high internal consistency, since it is above .60 thresholds (Nunnaly, 1976).

The table below showed the loading, the mean and standard deviation as well as the reliability of the items used for the study.

**Table 1: Valid items and their Corresponding Loadings, Mean, Standard Deviations and Alpha Values**

| Items | Item Measure | Loading | M | SD | Alpha |
|---|---|---|---|---|---|
| PRE3 | Failure to use IT for teaching by instructor may not affect my willingness to use it | .56 | 4.41 | 1.70 | |
| PRE4 | Preparing us for IT for teaching should start when we undergo teacher training | .60 | 4.81 | 1.85 | |
| PRE5 | How our teacher integrate IT for pedagogy activities will prepare us for its use in future | .57 | 4.98 | 1.61 | |
| PRE6 | The way I receive my training with IT will assist me to use IT for teaching others | .65 | 4.93 | 1.75 | .73 |
| PU4 | IT make teaching and learning more interesting | .62 | 5.32 | 1.67 | |
| PU5 | Information Technology is worthwhile | .56 | 5.22 | 1.55 | |
| PU6 | Information Technology gives opportunity to learn more | .63 | 5.43 | 1.42 | |
| PU7 | IT use for teaching can increase productivity | .74 | 5.37 | 1.47 | |
| PU8 | IT use for teaching can improve effectiveness | .75 | 5.25 | 1.62 | .87 |
| SE4 | I am skillful in presentation package (e.g powerpoint) | .76 | 4.71 | 1.70 | |
| SE7 | I can locate and run an application program | .72 | 5.09 | 1.67 | |
| SE8 | I can organize electronic files into folder | .66 | 4.99 | 1.65 | |
| SE9 | I can use spreadsheet to make prediction | .59 | 4.99 | 1.63 | .90 |
| BI2 | I will frequently use IT for teaching in future | .70 | 5.19 | 1.56 | |
| BI3 | I will strongly recommend other to use IT for teaching and learning | .74 | 5.06 | 1.59 | |
| BI4 | Baring any challenge, I can predict that I would use IT for teaching | .71 | 5.03 | 1.72 | |
| BI5 | If IT facility is provided in my school, I will take maximum advantage of using IT for teaching | .73 | 5.23 | 1.73 | .91 |

### Analysis of the Measurement Model

The measurement model of the study was checked in term of convergent and discriminant validity. The convergent validity is the extent to which the indicators of the entire variable are theoretically correlated. This was observed in the factor loading which is the product of factor analysis. All the loading exceed .50 in Table 1 above. The discriminant validity was checked through the examination of correlation matrix of all the variables of the study. A rule of thumb prescribes that .85 correlation or larger indicated poor discriminant validity in structural equation model (SEM) development which is an indication of existence of multicollinearity (David, 1998; Park, 2009). In this study, all the correlations in Table 2 are less than .85, which suggests that the latent variable are correlated but not too highly related hence, an adequate discriminant validity of the measurement was obtained (Kline, 2005). Thus, the validity (convergent and discriminant) of the measurement model is ascertained.

**Table 2: Correlation Matrix between construct**

| | PRE | PU | SE | BI |
|---|---|---|---|---|
| PRE | 1.00 | | | |
| PU | .478 | 1.00 | | |
| SE | .236 | .349 | 1.00 | |
| BI | .428 | .688 | .48 | 1.00 |

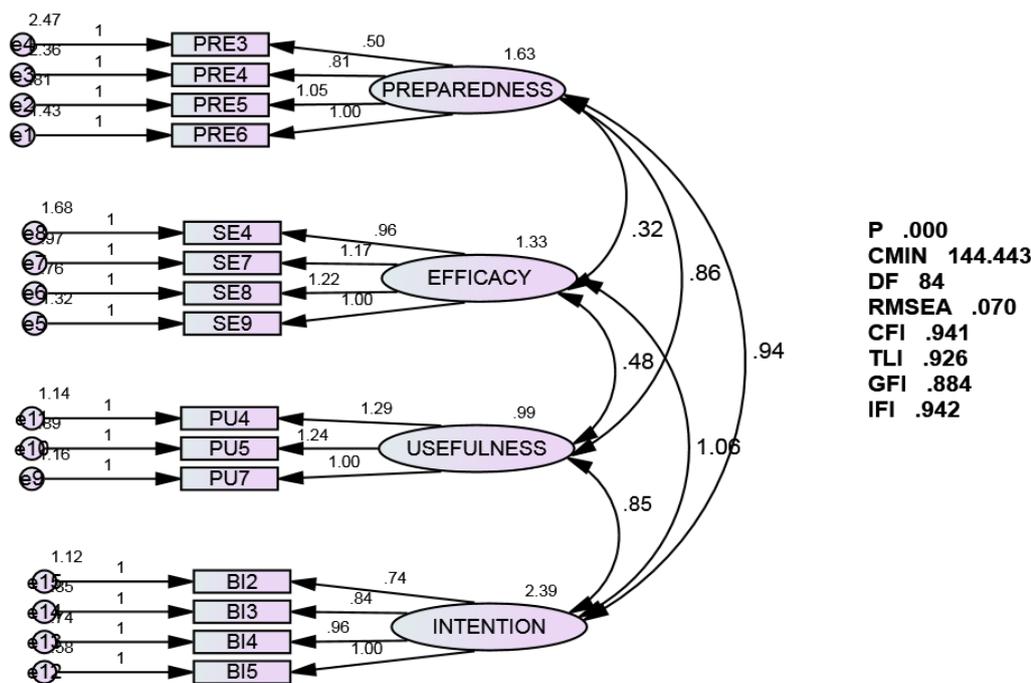### Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was used for examine the pattern of interrelationships among various constructs (Teo, 2011). To test the propose relationship of the latent variable of the study prior to fitting the data to the specified model, a confirmatory factor analysis was computed. Also, in this study the measurement model was checked for misspecification through confirmatory factor analysis.

To examine the CFA, multiple statistic model fit was used. The fit indices suggested by Hu and Dentler (1999), Hair et al. (2010) and Teo (2011) guide the researcher in determining appropriateness of CFA computed. Adhering to this suggestion, the first test of model fit involves Chi-Square test. Since Chi-Square is extremely sensitive to sample size, the chi-square normalized by degree of freedom (x²/df) was also used. Furthermore, one incremental index and one absolute index are important to be included as part of model fit indices (Hair et al. 2010).

In this study, RMSEA was selected as it provides consistent results. Other fit indices are CFI, TLI, GFI respectively. As a common practice, acceptable fit is indicated by value greater than .90 for CFI, TLI, and GFI, while a value close to .06 is recommended for RMSEA before it is accepted. This means that there is good fit between hypothesized model and observed data (Hu & Bentler, 1999; Liman & Ismail, 2015).

The computed CFA in Figure 2 below shows that Chi-square (147) =144.443; P-value = .000; RMSEA = .70; CFI = .941; TLI = .925; and IFI = .942, the output revealed that the data was consistent with the model.



**Figure 2: Confirmatory factor analysis of the initial Structural Equation Model**

The structural equation model analysis in Figure 3 below shows the regression weight of information technology preparedness of pre-service teacher as an antecedent of their perceived usefulness, self-efficacy and intention toward use of IT for teaching function. The overall result of the statistical analysis of the model demonstrated adequate fit with Chi-square = 144.443; df= .084; p= 0.000; RMSEA= 0.070; CFI= 0.94; TLI= 0.92; and IFI= 0.94. The estimate of the hypothesized model was free from offending value. The entire paths coefficient is statistically significant with critical ratio (CR>1.96).

The effect size of IT preparedness → self- efficacy showed a beta (β=.19, p < .005), based on this finding, (H1) the hypothesis earlier stated that pre-service teacher IT preparedness will positively influence their self-efficacy on IT use for teaching stand validated. IT preparedness → perceived usefulness showed a beta (β= .48; p < .005), this finding supported (H2) the hypothesis that pre-service teacher IT preparedness

will positively influence their perceived usefulness of the use of IT for teaching. IT preparedness → intention showed a beta (β= .22; p < .005), the finding equally supported the earlier hypothesis (H3) that pre-service teacher IT preparedness will positively influence their intention towards use of IT for teaching. Self-efficacy → intention showed a beta (β= .48; p < .005), this finding also supported the assumption that (H4) pre-service teacher self-efficacy on IT will positively influence their intention toward use of IT for teaching. Perceived usefulness → intention showed a beta (β= .21; p <.005), based on this finding, the hypothesis (H5) that perceived usefulness of IT by pre-service teacher will positively influence their intention toward the use of IT for teaching stand validated. Lastly, self-efficacy → perceived usefulness showed a beta (β= .26; p < .005), this finding validated the hypothesis (H6) that self-efficacy will positively influence perceived usefulness of IT for teaching among pre-service teachers. The analysis further revealed that the three exogenous variables (preparedness, self-efficacy, and perceived usefulness) collectively explained 66% variability on pre-service teachers intention towards IT use for teaching function, while IT preparedness and self efficacy collectively explained 47% variability. Finally, the data of the study was fitted to the specified model.
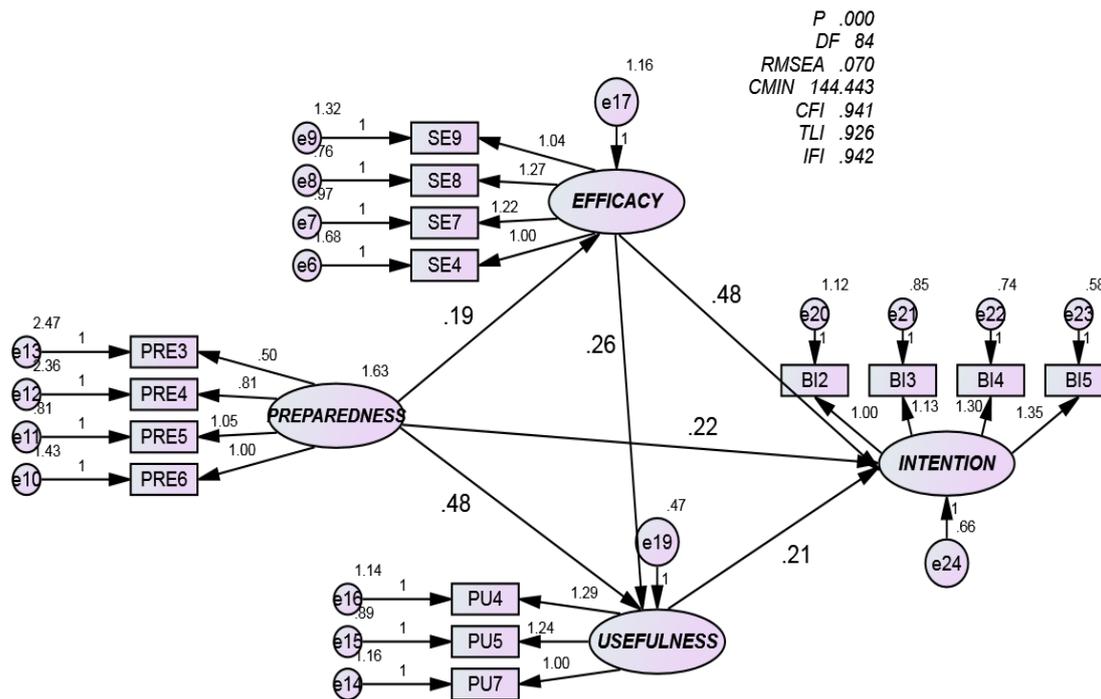


**Table 3: Hypotheses Testing Results**

| Hypotheses | Path | Findings | Results |
|---|---|---|---|
| H1 | IT Preparedness → Self-efficacy | Positive | Supported |
| H2 | IT Preparedness → Perceived Usefulness | Positive | Supported |
| H3 | IT Preparedness → Intention | Positive | Supported |
| H4 | Perceived Usefulness → Intention | Positive | Supported |
| H5 | Self- Efficacy → Intention | Positive | Supported |
| H6 | Self- Efficacy → Perceived Usefulness | Positive | Supported |

## DISCUSSION AND CONCLUSION

The finding from the study has further brought to fore the anticipatory outcome of Mathematics pre-service teachers' views on antecedent of technology use in their professional training programme. The study revealed that pre-service teacher professional training in the use of IT for teaching will have a lasting and significant effect on their self-efficacy, perceived usefulness and their intention towards IT use for future professional practice. The study underscores the importance of their IT preparedness while in training as a precondition and antecedent to their self-efficacy and perceived usefulness of IT in their future classroom.

Similarly, the study also explain the influence of primary role of self-efficacy on perceived usefulness which stand as an outcome and antecedent of how pre-service mathematics students are prepared to take up IT for teaching and learning. Aside the primary and positive influence of IT preparedness on both PU and CSE, IT preparedness also has direct and indirect influence on pre-service teachers' intention.

The finding of this study was in support of findings of Teo, (2009); Birch and Irvine (2009); Anderson and Groulx (2011) on the significant influence of self-efficacy and perceived usefulness as a predictor of student teachers' intention toward the use of technology for future classroom use. The study has further confirmed the position of Chung and Zhan (2012) that stated the importance of effective training programme as precondition for pre-service teacher self-efficacy in content, pedagogy and technology knowledge. Furthermore, the finding of the study supports Getenent's (2013) study that revealed the influence of professional training on Mathematics pre-service teachers' belief, perceived usefulness and ease of use of technology for teaching. The study was in agreement with Anderson et al. (2011) study which revealed that pre-service teacher belief and integration of technology is a function of earlier technological abilities which they have acquired during professional training.

The revelation from the study attests to the importance of IT preparedness in teacher educational professional training. The study to a certain degree was consistence with findings on similar pre-service teachers' studies in other settings and nations. The study has shown that IT preparedness helps predict pre-service teachers' perceived usefulness, self-efficacy, which in-turn predict their intention toward IT for teaching; both direct and indirect influence was observed.

With this finding, it is therefore expedient on teacher educators to consider way of improving their IT use in teacher professional training so as to increase student self efficacy and perceived usefulness. Finally, the study confirms that the more the deployment of IT for pre-service teacher training, the more pervasive the effect on pre-service teacher intention towards IT uses in future professional practice after graduation.

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