

TEACHING WITH TECHNOLOGIES: THE PREPAREDNESS OF PRE-SERVICE SCIENCE TEACHERS

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ABSTRACT: *The study investigated the preparedness of pre-service science teachers towards teaching with technology. A descriptive survey research design was used for the study. A simple random sampling technique was used to draw a sample of 150 students from the population of 620 pre-service science teachers of the University of Port Harcourt. A Teaching with Technology Readiness Indicator (TWTRI) was developed by the researcher to obtain the readiness level of the pre-service science teachers. The instrument reliability was determined through test-retest method and a stability coefficient of 0.87 was obtained. Two experts in the field of Educational Technology and another two in the field of Measurement and Evaluation confirmed the validity of the instrument. Four research questions were answered with the use of mean and four corresponding hypotheses were tested using independent sample t-test. The results of the study showed that the pre-service science teachers were prepared for teaching with technologies with respect to technological skills, attitude, anxiety and self-efficacy. There was no significant difference in the preparedness of male and female pre-service science teachers. Continuous professional development, proper planning, selection of adequate technology and provision of technology infrastructure were recommended.*

KEYWORDS: teaching with technology, technology integration, technological skills, and preparedness.

INTRODUCTION

The introduction of digital technologies into education and the pervasive use of Information and Communication Technologies (ICTs) in homes and in schools has brought a transformation in the education system and teaching with technologies is inevitable to all teachers at all levels. Teacher education programmes must prepare teachers to use the technologies that their students use at home and out of home for knowledge gathering and dissemination (Iderima, 2019). The widespread use of digital technologies and the enormous power they have for the creation, presentation and distribution of information have made these technologies a must for teachers (Kpolovie & Iderima, 2016).

When technology is systematically selected and utilized, it has the potential to promote and propagate effective teaching practices and to accelerate, amplify, and expand the impact of powerful principles of learning (U.S. Department of Education, 2017). Technology has the potential to transform and reform teaching and learning when used effectively and efficiently. Teaching with technology has the following benefits: 1) it develops technology skills in the learners, 2) it enhances teaching and learning, 3) it expands access to quality education, 4) it increases students' motivation by capturing their attention and tapping into their interest and passion and 5) it promotes learner-centered pedagogy (ibid).

To realize the full benefits of using technology to teach in our classrooms, educators need to be prepared to use the technologies effectively and efficiently to attain predefined learning outcomes. On this ground, United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2011) articulates the following skill set for integrating technology into the classroom: policy, curriculum and assessment, pedagogy, the use of technology in the classroom, school organization and administration and teacher professional learning. Also, the International Society for Technology in Education (ISTE) (2017) has provided the various standards for using technology in the classroom. The standard for educators include: Learner, Leader, Citizen, Collaborator, Designer, Facilitator and Analyst.

UNESCO (2011), Puentedura (2009) and Florida Center for Instructional Technology (2018) have provided frameworks to show that the attainment of these skills is in successive stages. The implication of the forgoing is that teachers can be located at different levels or stages of the technology integration ladder. The early stages are the stages of enhancement where teachers begin to adopt technology for teaching. While the later stages are the stages of transformation where teachers use the technologies in creative and transformative ways to do what could not be achieved without technology.

Teachers need to meet these standards and skill sets to effectively integrate technology into the classroom. Inappropriate use of technology will hinder learning. Learning can only be promoted with technology when the appropriate technologies are applied for a given learning objective in the right context. Teachers must have the requisite knowledge, skills and attitude to effectively and efficiently utilize technology in the classroom as several studies have shown.

Teachers can start small but eventually progress and get better as they mature and become more confident in the use of technology for teaching. A teacher can be at the entry level and progress gradually to the transformation level over time. Therefore, teacher preparedness for teaching with technologies could be at different levels, from entry to transformation. All that the teacher needs is to acquire the necessary knowledge, skills and attitude to start teaching with technology and gradually progress as she improves on these skills. Teachers are at different stages of technology integration at different times. That is to say that teachers progress to successive stages as they journey through the technology integration pathway.

LITERATURE

According to Nagel (2013) the challenges of teaching with technology include: professional development, resistance to change, Massive Open Online Courses (MOOCs) and other new models for schooling, delivering informal learning, failures of personalized learning and failure to use technology to deliver effective formative assessments. On their part, Habibu, Al Mamun and Clement (2012) stated that the major barriers to teaching with technology are: lack of genuine software, inadequate computer in the classroom, low speed internet, lack of motivation from both teacher and student side to use ICT, lack of proper training skills, unavailability of latest ICT equipment, lack of expert technical staff, poor administrative support, poor course curriculum etc. Also, Ramorola (2013) found that the challenges affecting teaching with technology include: unavailable technology policy, insufficient technology equipment, a lack of teachers qualified in technology integration, and maintenance and technical problems. For effective teaching with technology, teachers need to overcome these major challenges through adequate preparation.

The literature on the assessment of the preparedness of teachers on teaching with technologies (Spaulding (2013), Cuhadar (2018), Afful, Acquaye and Ngman-Wara (2017)) shows that researchers do not have a common set of variables to measure the preparedness of pre-service teachers. Most of the studies reviewed (Balajadia (2015), Singh and Chan (2014), Al-Awidi and Aldhafeeri (2017), Sedega, Mishiwo, Awuitor and Nyamadi (2018), Ogan-Bekiroglu and Karabuz (2017) and Yildirim (2005)) used few factors or dimension of readiness to investigate the preparedness of pre-service teachers. In order to have a more useful result, there is need to investigate critical factors for preparing to teach with technology. This study responds to this call as it used very critical factors to assess the preparedness of pre-service teachers especially pre-service science teachers for teaching with technology. This research was designed to bridge the gap between theory and practice in the area of integrating technology to teaching and learning by investigating the preparedness of pre-service science teachers of technology holistically.

Research Questions

1. To what extent do pre-service science teachers have the technological skills for teaching with technology?
2. What is the attitude of pre-service science teachers towards teaching with technology?
3. To what level do pre-service science teachers have the self-efficacy for teaching with technology?
4. What degree of anxiety do pre-service science teachers have towards teaching with technology?

Hypotheses

1. There is no significant difference in the technological skills of male and female pre-service science teachers.
2. There is no significant difference in the attitude of male and female pre-service science teachers towards teaching with technology.
3. There is no significant difference in the level of self-efficacy of male and female pre-service science teachers in teaching with technology.

4. There is no significant difference in the level of anxiety of male and female pre-service science teachers have towards teaching with technology.

METHODOLOGY

The study adopted the descriptive survey research design. According to Nwankwo (2006), a descriptive survey research design is a design in which the researcher collects data from a large sample drawn from a given population and describes certain features of the sample which are of interest to the researcher. He further stated that usually, the findings from the sample are generalized to the population from which the sample was drawn. A descriptive survey research design involves the gathering of facts about an investigative situation, state or event. It uses questionnaire which is usually graded in frequency or percentage on identified variables. It aims at describing in a systematic manner the facts and characteristics of a given population (Osaat, 2009; Kpolovie, 2010).

The population of the study comprised all the pre-service science teachers in the University of Port Harcourt. Male and female students are evenly distributed in the programme. A sample of 150 students was used for the study. A simple random sampling technique was used to draw the sample from the population.

The research instrument for this study was a 40 - item questionnaire – a Teaching with Technology Readiness Indicator (TWTRI) - developed by the researcher. The instrument was divided into four sections having 10 items each. The four sections of the instrument are design to address the following areas: technological skills, attitude, anxiety, self-efficacy, which are used to answer the four research questions raised in the study. Each item has four (4) options – Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD).

Face and content validity of the instrument was determined by two experts in the field of Educational Technology and two experts in the field of Measurement and Evaluation. The reliability of the instrument was determined through test-retest method for a measure of its stability. The stability coefficient of the instrument was 0.87. The coefficient value is high enough to guarantee the use of the instrument. The research questions were answered using Mean and Standard deviation while the hypotheses were tested using independent t-test at 0.05 alpha.

RESULTS

Table 1: Descriptive statistics showing the extent to which pre-service science teachers possess the technological skills for teaching with technology

Factor	N	Mean	SD	REMARK
Technological skills	150	3.04	0.21	Average

Table 1 shows the mean score of the technological skills of pre-service science teachers for teaching with technology. The pre-service science teachers have a mean score of 3.04. This mean

score indicates that the pre-service science teachers have an average level of technological skills for teaching with technology.

Table 2: Descriptive statistics showing the extent to which pre-service science teachers possess the attitude of pre-service science teachers towards teaching with technology.

Factor	N	Mean	SD	REMARK
Attitude	150	3.55	0.43	Positive

Table 2 shows the mean score for the attitude of pre-service science teachers towards teaching with technology. The mean score for the attitude of pre-service science teachers towards teaching with technology is 3.55. The mean score of 3.55 represents high positive attitude.

Table 3: Descriptive statistics showing the level of self-efficacy pre-service science teachers have towards teaching with technology.

Factor	N	Mean	SD	REMARK
Self-efficacy	150	3.61	0.353	High

Table 3 shows the mean score for the level of self-efficacy of pre-service science teachers have for teaching with technology. The mean score of level of self-efficacy of pre-service science teachers is 3.61. This mean score of 3.61 indicates a high level of self-efficacy.

Table 4: Descriptive statistics of the level of anxiety pre-service science teachers have towards teaching with technology.

Factor	N	Mean	SD	REMARK
Anxiety	150	1.88	0.479	Low

Table 4 shows the mean score of the level of anxiety pre-service science teachers have towards teaching with technology. The mean score of the level of anxiety pre-service science teachers have towards teaching with technology is 1.88. The mean score of 1.88 indicates low level of anxiety.

Table 5: t-test analysis of the difference in the level of technological skills of male and female pre-service science teachers for teaching with technology.

Gender	Mean	T	Df	Sig. (2- tailed)	REMARK
Male	3.06	0.386	148	0.761	No Significance
Female	3.02				

Table 5 shows that p (0.761) is greater than the alpha (0.05) with t = 0.368 at df=148. P(0.761) greater than the alpha (0.05) means that the difference is statistically insignificant. Therefore, the null hypothesis of “there is no significant difference in the technological skills of male and female pre-service science teachers for teaching with technology.” is accepted.

Table 6: t-test analysis of the difference in the attitude of male and female pre-service science teachers towards teaching with technology.

Gender	Mean	T	Df	Sig. (2- tailed)	REMARK
Male	3.55	0.103	148	0.918	No Significance
Female	3.54				

Table 6 shows that p (0.918) is greater than the alpha (0.05) with $t = 0.103$ and $df = 148$. This means that the difference is not statistically significant. Therefore, the null hypothesis of “there is no significant difference in the attitude of pre-service science teachers towards teaching with technology.” is accepted.

Table 7: t-test analysis of the difference in the level of self-efficacy of male and female pre-service science teachers towards teaching with technology.

Gender	Mean	T	Df	Sig. (2- tailed)	REMARK
Male	3.58	-0.697	148	0.487	No Significance
Female	3.62				

Table 7 shows that p (0.487) is greater than the alpha (0.05) with $t = 0.536$ at $df = 148$. This means that the difference the mean scores of male and female pre-service science teachers is not statistically significant. Therefore, the null hypothesis stating that “there is no significant difference of the level of self-efficacy of pre-service science teachers towards teaching with technology.” is accepted.

Table 8: t-test analysis of the difference in the level of anxiety of male and female pre-service science teachers towards teaching with technology.

Gender	Mean	T	Df	Sig. (2- tailed)	REMARK
Male	1.89	0.227	148	0.821	No Significance
Female	1.87				

Table 8 shows that p (0.821) is greater than the alpha (0.05) with $t = 0.227$ at $df = 148$. This means that the difference between the male and female mean scores is statistically insignificant. Therefore, the null hypothesis which states that “there is no significant difference in the level of anxiety male and female pre-service science teachers have towards teaching with technology.” is accepted.

DISCUSSION

The pre-service science teachers have an average level of technological skills for teaching with technology. This means that the pre-service science teachers are moderately ready for teaching with technology in terms of their technological skills. The result is not surprising since the students of today are digital natives. This result agrees with the findings of Francisca and Samsudin (2018) and Singh and Chan (2014). No significant difference was found in the technological skills of male and female pre-service science teachers for teaching with technology. This is expected since

both male and female students are exposed to same kinds of technology. This is in agreement with Francisca and Samsudin (2018).

The pre-service science teachers are positively disposed towards teaching with technology in terms of their attitude. This result agrees with the findings of Francisca and Samsudin (2018) and Spaulding (2013). Also, there is no significant difference in the attitude of pre-service science teachers towards teaching with technology. This result corroborates the findings of Francisca and Samsudin (2018).

The pre-service science teachers have little anxiety towards teaching with technology and therefore well prepared for teaching with technology. The result agrees with Francisca and Samsudin (2018). In addition, there is no significant difference in the level of anxiety of male and female pre-service science teachers towards teaching with technology. This is in agreement with Francisca and Samsudin (2018).

The pre-service science teachers have high level of self-efficacy for teaching with technology and therefore adequately prepared for teaching with technology. The result agrees with the findings of Francisca and Samsudin (2018) and Afful, Acquaye and Ngman-Wara (2017). The result shows that there is no significant difference of the level of self-efficacy of pre-service science teachers towards teaching with technology. This corroborates the findings of Francisca and Samsudin (2018).

Implications

Our main aim of this study was to investigate the level of readiness or preparedness of pre-service science teachers on the integration of technology in classroom teaching and learning. In doing this, critical factors were used to assess the level of preparedness in integrating technology in classroom practices. The findings are of critical importance to institutions of teacher education, serving and pre-serving teachers, and other stakeholders in the education sector.

Institutions offering teacher education programmes at various levels should endeavour incorporate the use of technology in their curriculum to equip upcoming teachers with the requisite skills to use technology in their teaching. Pre-service teachers need to be well prepared in their various training programmes to use technology to teach in order to be effective teachers in the 21st century. There is an urgent need to provide pre-service teachers with the skills of using technology to teach our 21st century learners who are digital natives. These learners grow up with technology and they use these technologies both to play and to learn. The digital learners will eventually graduate out of school to meet the world of work which is technology driven.

Inappropriate use of technology in the classroom by teachers will hinder learning, therefore, teaching with technology should be properly planned and systematically implemented. Proper planning is essential in the effective use of technology to facilitate learning. Educators should adequately plan their lessons before incorporating technology into the instruction.

Effective instructional delivery with technology should follow a carefully guided selection of the appropriate media and technology. In integrating educational technologies into a lesson, the teacher should systematically select the technology that is appropriate for the lesson objectives, learners, and instructional context. Delivery technology must suit the given instructional situation to be effective. So educators should be properly guided in the selection of media and technology.

CONCLUSION

Teaching with technologies arguably comes with a lot of prospects and opportunities. It also presents a range of challenges for both the teacher and the student. To overcome these challenges the teacher must make adequate preparation and must be seen to be adequately prepared to teach with technologies. Adequate preparation to teach with technologies is multidimensional and multifaceted. To be adequately prepared or ready for teaching with technologies, the teacher requires some cognitive and attitudinal skills. Some of the skills include: technological skills, attitude towards teaching with technology, anxiety towards technology and teaching with technology self-efficacy. Pre-service science teachers have shown readiness to teaching with technology. They possess the basic technology skills, attitude and efficacy for teaching with technology.

Pre-service teachers have shown good level of readiness to integrate technology into their teaching. This integration cannot happen if the necessary infrastructure is not provided. The technologies should be provided at the schools so that the teachers can use them to improve their teaching. The availability of these technologies is a necessary condition for the effective integration of technology into teaching and learning.

Finally, continuous professional development is necessary to continue to teach with technology. Technologies change very fast, such that before you fully grasp a particular technology another has taken over. Such a situation requires continuous professional development and lifelong learning to keep abreast with new developments.

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