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Use of Infographics as Teaching and Learning Tools: Survey of Pre-Service Teachers' Knowledge and Readiness in a Nigerian University

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Abstract

As technology continues to drive the 21st Century, educational systems are not left out as teachers are expected to learn new technologies and their applications in education. Pre-service teachers in Nigerian universities are expected to, among other training, be conversant with modern pedagogies to prepare them for their profession. Given the fact that pre-service teachers can only use the skills they possess, this study examined their knowledge and readiness to use infographics as teaching and learning tools. The design was descriptive. The study sample comprised of three hundred and thirteen (313) final year pre-service teachers in a University of Education in Nigeria. "Knowledge and Readiness to Use Infographics Tools Questionnaire (KRUITQ)" (r = .84) was used for data collection. Data were analyzed using Mean, Standard Deviation, and One-Way ANOVA. The study found that pre-service teachers do not know about infographics as educational tools, and therefore not ready to use them during in-service. There were also no significant differences in knowledge and readiness across gender. Based on these, the teacher education curriculum needs to be upgraded to incorporate training on modern digital technologies for teaching and learning as necessitated by constant changes in the 21st Century education system.

Keywords: infographics, pre-service teachers, knowledge, readiness, university

INTRODUCTION

Universities play prominent roles that engender unprecedented developments in society. They are the citadels of knowledge. This is why, all over the world, especially in developed nations, university education is taken very seriously because its products, in form of learned citizens, are germane to the

socio-economic and technological advancement of such nations. Given this, university education is viewed as an important investment in human capital development, the contribution of which is tantamount to human and socio-economic growth and development of societies. This connotes that the fundamental contributions of universities to society lie in creating and forwarding "useful knowledge", and engaging with society on the application of the knowledge (Boulton & Lucas, 2011). This brings to fore, the roles and usefulness of well-trained, 21st Century pedagogically informed, and professionally sound teachers in transferring knowledge to learners in the society through effective teacher education programmes.

In Nigerian universities, teacher education is a form of thorough training given to intending teachers for them to acquire content knowledge, pedagogical skills and values which they are expected to effectively transfer to learners during their in-service. It is an educational programme in which content area and pedagogical skills are particularly transferred to trainee teachers so that they are well prepared concerning the requirements of the teaching job (Jekayinfa, *et. al.*, 2012; Jekayinfa, 2000). Due to the importance of teacher education in producing a well-groomed teaching workforce for the upbringing of conscious citizens who can contribute to the socio-economic and sustainable developments of the country, all Faculties of Education in Nigerian universities were mandated by the Federal Republic of Nigeria (2014), to produce highly encouraged, effectively motivated, and efficient classroom teachers who are versed in the skills of enquiry and creativity in teachers. They are to further produce teachers who will be committed to the achievement of national objectives based on their well-developed intellectual and professional backgrounds. This is in addition to producing teachers who will be highly committed to the teaching profession at large. Among other important skills that are expected of pre-service teachers to possess to become professional teachers, pedagogical skills (sound knowledge of different teaching methods and supporting facilities), stand out.

There has been a general concern about not just what students learn, but particularly about *how* they learn it (Boulton & Lucas, 2011). This is particularly important due to the significant changes in the pedagogies of the 21st Century which are dependent on the effectiveness and efficiency provided by Information and Commination (ICT) tools such as Web 2.0, smartphones, digital technologies, and so on in education (Mynbayeva, Sadvakassova & Akshalova, 2018; Myamesheva, & Anarbek, 2015). The significant changes in the pedagogies of the 21st Century have produced many modern methods including but not limited to project-based, problem-based, flipped classroom, project-based learning, thinking-based, gamification, design thinking, learning, and competency-based learning approaches, among others. These methods are pointers to the fact that instructional methods of the 21st Century have shifted significantly from the conventional approaches to modern approaches. These modern methods are particularly important because they put students at the centre of their learning, thereby affording them the opportunity of active participation. They also allow students to be responsible for their learning, make informed decisions about the dimensions of their learning process, and also perform self-regulation. In this wise, teachers become facilitators of learning. In addition, modern methods allow seamless integration of ICT tools and other digital technologies which further enhance their effectiveness in improving students' outcomes (Ogunsola, Adelana & Adewale, 2021). One

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digital technology which has been reported to be an effective support for further enhancing pedagogies, thereby making teachers' work easier, while learning is further simplified for students from abstraction to concreteness is known as infographics tools (Lavin, Korte, & Davies, 2010).

Infographics in Education

Infographics, according to Amin, *et al.,* (2014) combine the two words "information" and "graphics". Several definitions have been given to infographics. It is a form of data visualization aiming at simplifying complex information (Smiciklas, 2012); it is a combination of texts and graphics which quickly convey qualitative and quantitative data to students (Toth, 2013); a medium of communicating properly organized, and systematically designed visual contents to students (Lapum & St-Amant, 2016); and a visual mode of presenting instructional contents to students through text images, videos, diagrams, and charts, among others for easier and faster comprehension of contents (Al-Mohammadi, 2017). It could be deduced from the foregoing that the sole aim of utilizing infographics in an instructional environment is to clearly and seamlessly convey different dimensions of knowledge to students by visual medium (Meeusah & Tangkijviwat, 2013; Çifçi, 2016). This further implies that infographics in education can clearly and rapidly transfer contents to students visually (Smiciklas, 2012; Dunlap & Lowenthal, 2016).

The two basic types of infographics are interactive and static. Static infographics usually involve the use of images and texts to represent and present learning concepts considered to be challenging to students through visual elements, including but not limited to charts, maps, and graphics. Static infographics normally serve as fixed resources since they do not involve students interacting or manipulating the contents of the infographics directly (Shaltout & Fatani, 2017). On the other hand, interactive infographics require that students interact with content through watching videos, or a selection of visual elements. Hence, they are considered interactive because they demand that students manipulate them in one way or the other (Ismaeel & Al Mulhim, 2021). Regardless of the type, infographics normally include an introduction, the contents to be passed across to students, and a concluding part. All of these parts are constructed to adequately convey a particular message to students, or tell a specific story in such a way that learning can take place (Krum, 2013). To effectively develop, deploy and use infographics effectively, factors including but not limited to determining the purpose, elements to be used, type of infographics, and the mode of presenting the contents effectively to students to effective learning, must be considered (Ozdamli & Ozdal, 2018).

Infographics have been referred to as a genre of multiple representations, which involves using diverse visually stimulating tools and texts, to properly construct and knowledge in a particular subject (Gebre & Polman, 2016; Polman & Gebre 2015; Wu & Puntambekar, 2012). Multiple representations in this context influence the cognitive styles of students, prompting researchers to suggest ways of utilizing infographic-based instructional approaches in diverse disciplines (VanderMolen & Spivey, 2017; Sudakov, *et al.*, 2016). The cognitive style also affects students' affective, cognitive, intellectual, psychological behaviours, and their overall learning outcomes, being a constant aspect of learning performance. It is, therefore, a key predictor of how students interact with information, and their

overall learning (Ismaeel & Al Mulhim, 2019; Chiang, 2016; Riding & Rayner, 2013; Shahsavar & Hoon, 2011). Given this, infographics must be used such that they do not interfere negatively with students' cognitive styles since they are cognitive tools that students learn with, not just from (Wu & Puntambekar, 2012; Gebre, 2018).

LITERATURE REVIEW

Studies reporting infographics as effective learning tools reported that: communicating content visually is a vital aspect of support system for cognitive processes to motivate learners, and solve complex problems, thereby ensuring that learners' behaviour is sustainably maintained (Amin, *et al.,* 2014); infographics tools transfer knowledge about a topic faster and more effectively than ordinary texts, although this depends on the quality and presentation mode of the infographics (Naparin & Saad, 2017); and that, infographics support faster retention and recall of contents, (Shively & Maine, 2013). Supporting these findings, Williams (2013) reported that seventy-five of the data processed by the human brain come from contents in visual forms.

However, effective use of infographics tools in education will not be possible if there are no well-trained teachers to develop and deploy them to ensure the anticipated learning outcomes amongst students (Küsel, Martin & Markic, 2020). This prompted the need to study trainee teachers' knowledge and readiness to utilize infographics tools for teaching and learning when they become in-service teachers. According to Bandura (1986), the reason for behaving and making decisions in a particular way is best indicated by a person's personal beliefs. Therefore, trainee teachers' knowledge and readiness to use the model, about their personal beliefs, must have been constructed during their teacher training programme in the university, for them to form personal opinions about the tools before becoming in-service teachers.

Researchers (e.g. Hewson & Kerby, 1993) unanimously agreed that students have personal beliefs about … learning, which influence their learning strategies and behaviours (Küsel, Martin & Markic, 2020). Studies (e.g. Vagg, *et. al.*, 2020; Henderson, Selwyn, & Aston, 2017; Seluakumaran, Jusof, & Husain, 2011) have reported students' positive experience and interaction with multimedia resources; some exposure to, and positive perception of multimedia as being adequate for practical learning.

Students' readiness, according to Borotis and Poulymenakou (2004), involves students' mental and physical preparedness to use digital technologies in education. Warner, Christie and Choy (1988) were the first to describe students' readiness for using technology tools in education. They divided readiness into three; students' likeness to use a form of instructional delivery, their confidence in electronic communications, and their ability to engage in self-directed learning.

Researchers (Blayone, 2018; Engin, 2017; Kaymak & Horzum, 2013; Lau & Shaikh, 2012; Dray, et. *al.*, 2011; Kerr, Rynearson, & Kerr, 2006; Schrum & Hong, 2002), have reported students' need to be ready to benefit from technology tools, and this is because their readiness, which is also influenced by

gender and other factors, positively affects self-confidence, learning experiences satisfaction, and learning outcome. Tomte and Hatlevik (2011) have also reported that access to the use of the Internet, peer influence, among others, and are responsible for differences in the use of information and communication tools based on gender. Earlier, and contrary to this finding, Schumacher and Martin (2001) reported that females are less experienced in ICT tools usage, and therefore more likely than their male counterparts to have negative attitudes towards computer usage (Akinoso, 2018).

Research Focus

Generally, education is germane to nation-building. Hence, to a great extent, the quality of education depends on the professional competencies of teachers, who are considered to be at the forefront of educational initiatives and innovations (Yadeta & Assefa, 2017). This connotes that the quality of teachers in any educational system in any nation is proportional to the quality of education given to citizens of such nation. Professional teachers who are well-versed in modern pedagogies, in addition to their effective usage, are in the best position to assist the nation in achieving its objectives of secondary education, one of which is the Sustainable Development Goal (SGD) 4 of the UNESCO, which is to facilitate an "inclusive and equitable quality education which promotes learning opportunities that is lifelong for all". Since students are the direct beneficiaries of any educational programme, it, therefore, becomes imperative for their teachers to be aware of modern pedagogies, and also be ready to use them effectively, for sound and the seamless transfer of knowledge. If Nigerian teacher-trainees are not well-informed of modern methods, particularly the use of infographics as learning support tools while in teacher training programmes, it is likely that they might not use the tools when they become in-service teachers. And this might make their students disadvantaged on the gains of infographics tools in enhancing their learning outcomes since a higher percentage of students benefit from visual content (Williams, 2013).

Researchers (e.g. Yadeta & Assefa, 2017; Suratno, 2013; Ferreira, & Ono, 2010; Gulamhussein, 2013 & Harwell, 2001) have called for the need for teacher education institutions to support pre-service teachers with well-designed programmes to help their effective pedagogical development because the use of multimedia or infographics tools as pedagogical support in education continues to be a subject of serious discussion amongst school administrators, educationalists, and researchers in education. On these premises, the ability of pre-service teachers in Nigeria to use infographics as learning tools will depend on their prior knowledge of the tolls and their readiness to use them based on their knowledge.

The following research questions were raised and answered in the study:

1. What is the extent of pre-service teachers' knowledge of infographics as learning tools?
2. Will there be any significant difference in pre-service teachers' knowledge of infographics as learning tools based on gender?
3. What is the extent of pre-service teachers' readiness to use infographics as learning tools?
4. Will there be any significant difference in pre-service teachers' readiness to use infographics as learning tools based on gender?

MATERIALS AND METHODS

The need to examine teacher-trainees knowledge, and their readiness to utilize infographics as learning tools is germane at this time in the 21st Century where learners need to uptake large junk of information in less time. Since infographics as learning tools are effective and have been applied widely in other climes of the world, there is the need to examine if teacher-trainees in Nigeria, who are expected to be versed in the use of learning support facilities, are adequately trained to be knowledgeable and ready to use it during their in-service. The study is also vital at a time in which modern pedagogies continue to be a subject of discussion among researchers (Blayone, 2018; Engin, 2017; Kaymak, Horzum, 2013; Lau & Shaikh, 2012; Dray, Lowenthal, Miszkiewicz, Ruiz-Primo, & Marczynski, 2011; Kerr, Rynearson, & Kerr, 2006 Schrum & Hong, 2002).

The descriptive (survey) research design of the non-experimental type was adopted in the study because there was no randomization of respondents in the study. Also, there was no variable manipulation in the study because the variables were studied as they already existed. The sample of the study consisted of three hundred and thirteen (313) final year students of Education in a University of Education in Nigeria. Final year students were considered because, as pre-service teachers, they have been well-trained and extensively instructed over the course of four years, on several pedagogical methods and skills, in addition to resources for learning facilitation, which they are expected to use when they get into the teaching profession. The 313 pre-service teachers were selected through an online-based instrument that was shared with them on a dedicated platform for final year students in the university. The instrument was posted on their platform, in addition to giving them the necessary on the instrument and their willingness to participate in the study. In the end, 313 students filled the form and submitted it.

The researcher-developed and validated instrument used for data collection in the study was titled "Knowledge and Readiness to Use Infographics Tools in Education Questionnaire (KRUITEQ)", with a reliability coefficient of .84. The reliability was done using Cronbach Alpha. The instrument, which contained 13 items, was divided into three sections (demographic, knowledge and readiness). The instrument was designed on the 4-point Likert scale of Strongly Disagreed (1t), Disagreed (2), Agreed (3), and Strongly Agreed (4), respectively. It was designed using Google forms because it was reaching out to the students online as against face-to-face medium which is still largely limited in Nigerian universities to the Covid-19 virus disease. The form was shared online with the students on their online platform which was meant for the final year Educational Technology students. The online platform was created for student-to-students and student-lecturers interaction. Only 313 final year students responded to the form and submitted it after filling it online.

Analysis of the data collected in the Google forms instrument was carried out using Mean (2.5 and above as benchmark for positive response and less than 2.5 for negative response) and Standard Deviation. These were used to answer research questions 1 and 3. The 2.5 mean benchmarks were calculated by summing together the point of each of the response formats and diving by 4 since there

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were four responses provided. The responses were – Strongly Disagreed (1 point), Disagreed (2 points), Agreed (3 points), and Strongly Agreed (4 points). One-Way ANOVA was used to answer research questions 2 and 4, respectively. The analyses were carried out using SPSS version 26.

RESULT

What is the extent of pre-service teachers' knowledge of infographics as learning tools?

The results in Table 1 showed that the pre-service teachers sampled in the do not know infographics as learning tools. This is evident in the Means of all the items which are less than 2.5. In addition to these, the Average Mean is 1.59, which is less than the benchmark mean of 2.5. This revealed that the pre-service teachers are not knowledgeable about infographics as learning tools.

Table 1: Mean and standard deviations on the knowledge of pre-service teachers on the use of infographics tools for teaching and learning

I know that:	Mean	Std.	Remark
Infographics involve the use of pictures or other visual materials to represent contents the teacher wants to share with students in class.	1.62	1.112	Negative
Infographics are highly motivating and stimulating, thereby assisting to simplify learning.	1.54	1.074	Negative
Infographic materials enhance creative and imaginative skills in students due to the visuals involved.	1.56	1.073	Negative
Infographics help to simplify and present complex contents in very easy manner because of the pictures, and data involved which are easier to understand.	1.57	1.090	Negative
The pictures involved in Infographics causes distraction in class.	1.65	.663	Negative
Infographics are good for learning because they show what to be learnt in an effective story form.	1.65	1.134	Negative

Average Mean = 1.59

Will there be any significant difference in pre-service teachers' knowledge of infographics as learning tools based on gender?

Results in Table 2 revealed no significant difference ($F_{312} = 1.340 > p$ (.248) > 0.05) in pre-service teachers' knowledge of infographics tools during teaching and learning based on gender. This showed that the lack of knowledge on infographics as learning tools in education amongst the respondents sampled in the cuts across gender, as both male and female pre-service teachers do not know about the teaching support facility. Figure 1 also present the mean plot that showing no significant difference in pre-service teachers' knowledge of infographics tools for teaching and learning based on gender.

Table 2: ANOVA result showing no significant difference in pre-service teachers' knowledge of infographics tools for teaching and learning based on gender

Knowledge of infographics tools for teaching and learning	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22.409	1	22.409	1.340	.248
Within Groups	5201.246	311	16.724		
Total	5223.655	312			

Significant at p<0.05

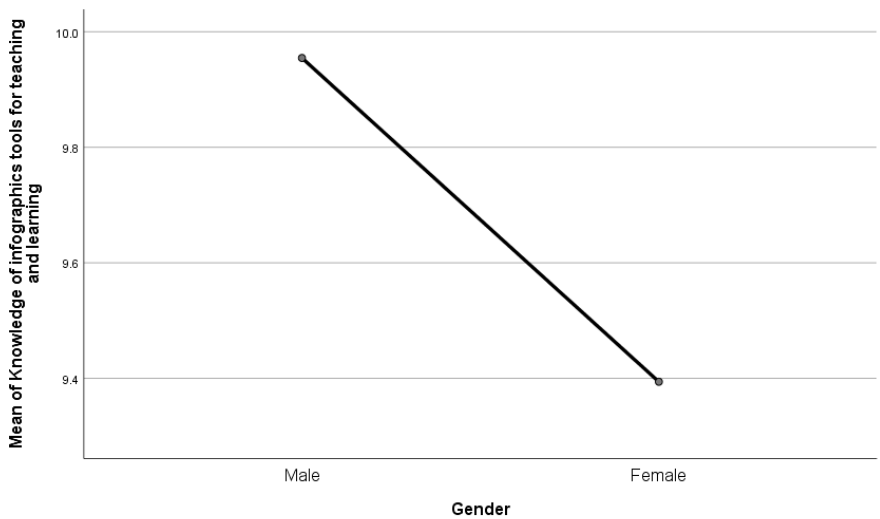

Figure 1: Mean plot showing no significant difference in pre-service teachers' knowledge of infographics tools for teaching and learning based on gender

What is the extent of pre-service teachers' readiness to use infographics as learning tools?

Results in Table 3 revealed that the pre-service teachers who participated in the study are not ready to use infographics as learning tools. This might not be unconnected with their lack of knowledge of the model. The result is confirmed by all the items in the Table showing Means of less than 2.5, which is the benchmark mean. Also, the Average Mean is 1.55 showed that the pre-service teachers are not ready.

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Table 3: Mean and standard deviations on the readiness of pre-service teachers to use infographics tools for teaching and learning

I am ready to use Infographics tools in my teaching because:	Mean	Std.	Remark
Infographics are good tools for making learning simple for students in the class.	1.55	1.055	Negative
Infographics tools are better because they appeal to students' sense of sight.	1.54	1.083	Negative
Visual representations of contents by the teacher through infographics tools make learning to be better simplified.	1.62	1.112	Negative
Learning with infographics tools takes less time due to the graphics that communicate contents faster.	1.55	1.055	Negative
The use of infographics tools as instructional support is more efficient than other methods.	1.53	.930	Negative

Average Mean = 1.55

Will there be any significant difference in pre-service teachers' readiness to use infographics as learning tools based on gender?

Results in Table 4 showed that there is no significant difference ($F_{312} = .575 > p$ (.449) > 0.05) in pre-service teachers' readiness to use infographics tools during teaching and learning based on gender. The lack of knowledge on infographics as learning tools could have triggered negative readiness among the male and female pre-service teachers. Figure 2 also show mean plot showing no significant difference in pre-service teachers' readiness to use infographics tools for teaching and learning based on gender

Table 4: ANOVA result showing no significant difference in pre-service teachers' readiness to use infographics tools for teaching and learning based on gender

Readiness to use infographics tools for teaching and learning	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.905	1	6.905	.575	.449
Within Groups	3735.178	311	12.010		
Total	3742.083	312			

Significant at p<0.05

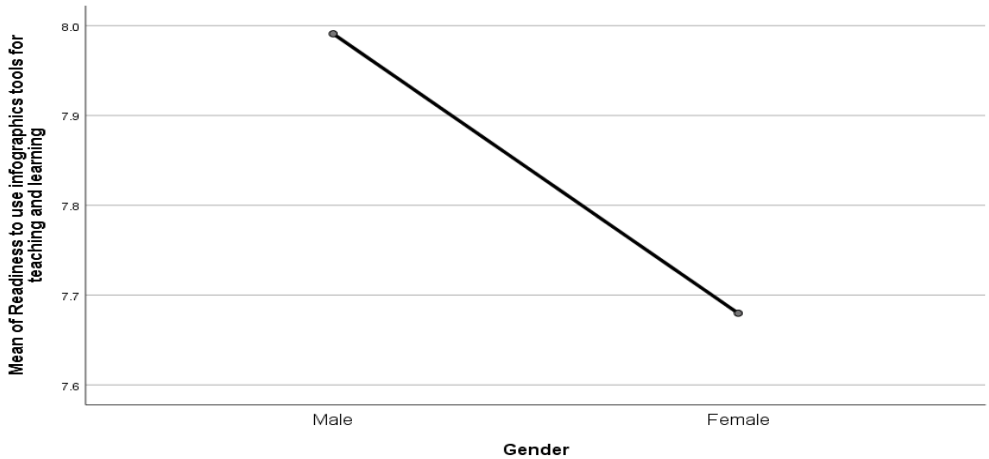

Figure 2: Mean plot showing no significant difference in pre-service teachers' readiness to use infographics tools for teaching and learning based on gender

DISCUSSION

The findings from the study have shown that the pre-service teachers investigated in the study do not have any knowledge of infographics as learning tools in the classroom. This also cuts across gender as there is no significant difference in male and female pre-service teachers' knowledge of infographics as learning tools. This shows that teacher-trainees are not aware that infographics tools are a visual presentation of supposedly difficult to understand concepts to students in such a way that facilitates clearer, faster and better understanding (Ozdamli & Ozdal, 2018; Dur, 2014; Li, Carberry, *et. al.*, 2014) and that they also assist students in constructing their knowledge without the barrier of time and space (Almarabeh & Amer, 2015). It should be noted that effective use of infographics tools in education will not be possible if there are no well-trained teachers to develop and use them in the classrooms to facilitate effective learning and improved learning outcomes amongst students (Küsel, Martin & Markic, 2020).

Infographics as learning tools in education come in handy to teachers who are versatile with the benefits of digital technology usage in teaching and learning. However, without adequate knowledge of modern learning tools by pre-service teachers, such as infographics which can clearly and seamlessly convey different dimensions of knowledge to students by visual medium, especially through text images, diagrams, and charts, among others for easier and faster comprehension of contents (Al-Mohammadi, 2017; Çifçi, 2016; Meeusah & Tangkijviwat, 2013), learners who are the direct beneficiaries of teaching may be consequentially missing out on the gains of such an important visual learning tool in the 21sr Century. With regards to gender, females have been reported to be less experienced in ICT tools usage, and therefore are more likely than their male counterparts to have negative attitudes towards the tools (Schumacher & Martin, 2001; Akinoso, 2018).

In addition to the above findings, the result also showed that concerning readiness, pre-service teachers are not ready to use infographics as learning tools. This is also as the finding has shown that based on readiness across gender, there is no significant difference in pre-service teachers' readiness to use infographics tools during teaching and learning. This finding might be connected with their no-knowledge of infographics status. Just as Bandura (1986) reported, people always have a reason for behaving and making decisions in a particular way based on their personal beliefs. Given this, the non-readiness of pre-service teachers might be based on the fact that they do not know infographics as learning tools since such have not been constructed during their teacher training programme in the university. Researchers have unanimously agreed that students' have personal beliefs about learning, which influence their learning strategies and behaviours (Küsel, Martin & Markic, 2020 e.g. Hewson & Kerby, 1993). Readiness to use infographics or other digital learning tools is based on students' mental and physical preparedness (Borotis & Poulymenakou, 2004). Readiness is essential to use technology, though this is also influenced by gender and other factors (Blayone, 2018; Engin, 2017; Kaymak, Horzum, 2013; Lau & Shaikh, 2012; Dray, et. *al.*, 2011; Kerr, Rynearson, & Kerr, 2006; Schrum & Hong, 2002), just as it has been reported that access to the use of the Internet, peer influence, among others, and are responsible for differences in the use of information and communication tools based on gender (Tomte & Hatlevik, 2011).

CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, it was concluded that pre-service teachers do not have any knowledge of infographics as learning tools in the classroom and that across gender, there is no significant difference in their knowledge of infographics as learning tools as well. Based on readiness to use infographics, it was concluded that pre-service teachers are not ready to use infographics as learning tools, and across gender, there is no significant difference in their readiness to use infographics tools during teaching and learning.

The findings of this study have implications for teacher education in the Faculties of Education in Nigerian universities. Because of this, the teacher education curriculum planning unit of the National Universities Commission (NUC), university administrators and other relevant stakeholders in education need to work together to ensure that relevant courses are developed as a matter of urgency to include Infographics and other modern pedagogies as part of the training for pre-service teachers. Also, lecturers should be trained on the newly included courses to update their knowledge so that when they get back into the classrooms (physical or virtual), they will be empowered to adequately train the trainee teachers. This is expected to produce teachers who are versed in 21st Century pedagogies and other important instructional supports for their learners when they get to the in-service level.

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