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Cognitive Technologies (COGTS) Preferences among Teacher Educators in South-East Zone of Nigeria

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Abstract

The study sought to determine teacher educators' preference of cognitive technologies in the teaching and learning process. Five research questions and four hypotheses guided the study. Descriptive survey design was adopted and it sought information from teacher educators in the south-east geo-political zone of Nigeria. The simple random sampling with non-replacement balloting technique was used to select 351 teacher educators. Instrument was a 15 item questionnaire with a reliability index of 0.87. Data generated were analysed using mean, percentages and chi-square. The results show that teacher educators prefer the use of the following cognitive technologies: Google, Yahoo, Ms Power Point, Ms Word and Ms Excel. Preference in the use of these cognitive technologies differed significantly based on years of experience and educational qualification. Recommendations made include the need for colleges of education to mount in-school seminars and workshop to equip teacher educators on appropriate use of more of these cognitive tools in teaching and learning to facilitate deep learning in student teachers.

Key Words: Cognitive Technologies, Preference, Teacher Educators, Behaviourism, Cognitivism and Constructivism

Introduction

Technology has permeated all aspects of the curriculum and in view of the current trends in teaching and learning, for curriculum to be effectively implemented it must be technologically driven. It is in this context that teacher-educators are expected to models effective use of cognitive technological tools in instructional delivery to teacher trainees. Current research studies on the use of technology in learning and instruction delivery by Jonassen & Reeves

(2001), Kim & Reeves (2007), Elliot & Washington (2010) emphasized the use of technology as cognitive tools rather than objects as in behaviourists' pedagogy.

Cognitive technology/tools are perceived as thinking tools that amplify, extend, and even reorganize human mental powers; which when used in instructional delivery help learners construct their own understanding and assume ownership of their knowledge, rather than reproduce the teacher's knowledge. These perceptions of cognitive tools are quite different from the traditional conceptions of instructional technologies; because presently in using cognitive tools, information is not preset rather learners are required to use these media for representing and expressing what they know or their understanding rather than the preset ideas of the instructional designer/teacher. Put differently, in using cognitive tools in instructional delivery today, learners function as designers whereby they use technologies as tools for analyzing the world, accessing information, interpreting and organizing their personal knowledge, and representing their understanding of the concept taught to others. Kim & Reeves (2007, p. 224), add that cognitive tools are technologies that learners interact and think with as they construct new knowledge and bring their expertise to the task as part of the joint learning system. Little wonder Jonassen & Reeves (2001) argue that most software tools such as word-processing, spreadsheet, database, and computer-aided design (CAD) programs have failed to improve teaching and learning significantly because they have not been used as cognitive tools by learners to solve life problems/challenges, neither are they used to pursue personal learning goals, or accomplish authentic tasks; rather they are largely relegated to the service of a traditional behaviourist pedagogy. By using computer tools as objects in the classroom, as postulated in behaviourist's pedagogy, the trainees are just taught the command sets of these software (e.g. spreadsheet) instead of making them use it to solve authentic life problems and this has not only hindered the intellectual growth of most student teachers but also made them not to see the relevance and value of these software in addressing real life issues. This is the problem of the study , especially in view of the rapid growth of technology and its use in all aspects of life which makes it mandatory that teachers must not only have vast knowledge of these tools but also should be fluent in its use.

Literature Review

Scholars are of the view that cognitive tools support reflective thinking, which is necessary for meaningful learning because the knowledge and application of cognitive tools are situated in realistic contexts in the course of the lesson and this makes learning real and meaningful to the learners. In addition, using of cognitive tools in meaningful context actively engages learners in learning, as well as make them think deeply, reflect on their comprehension and conceptualization of information rather than memorizing facts presented by their teacher. This is why cognitive tools are learner controlled (in the sense that learners construct knowledge themselves using the tools rather than memorizing knowledge what the teacher said) rather than teacher controlled. From this perspective, cognitive tools are essential learning resources that engage learners or groups of learners to make maximum use of their cognitive potential. Supporting this Robertson, Elliot & Washington (2010, p. 279) agreed that learners make use of software applications in ways that allow them engage in higher order thinking and at the same time focus on the creation of new software applications that are specifically designed as a cognitive tool.

Cognitive tools/technologies are current educational technologies that are deliberately designed for educational purposes. They fall within Information and Communication Technologies (ICTs) which according to Ibe-Bassey (2009) includes network, computer, communication and mobile technologies. They also include but not limited to search engines

graphic organizers and concept maps projected using MS Power Point or represented in Ms Word, Spreadsheets, mapping tools, instructional simulation and games and other presentation tools like Excel. Robertson et al (2007) identified the following as roles of cognitive tools/technologies: information seeking, information presentation, knowledge organization and knowledge integration.

In the same vein, Lajoce (1993) in Shim & Li (2006) identified the following as functions of cognitive tools:

- Support cognitive processes of memory and metacognitive process.
- Share the cognitive head by providing support for lower level cognitive skills so that resources are left over for higher order thinking skills.
- Allow the learner to engage in cognitive activities that would be out of their reach otherwise.
- Allow the learners to generate and test hypothesis in the context of problem solving.

In summary, Jonassen (2006), Shim & Li (2006) present the cognitive tools for teachers in the table below as follows:

TYPE	DESCRIPTION	EXAMPLES
Database	i. Are useful for supplementary learning of concept – rich content, such as that in geography, social studies, and the sciences ii. Support the storage and retrieval of information in an organized manner structure is inherent in all knowledge, so using a database that helps learners to structure what they know will facilitate understanding.	Database Management System (DBMS)
	1. Are computerized, numeric record keeping system 2. Qualitatively change educational processes that require manipulation or speculation with number and are easy to adapt and modify 3. Support speculation, decision making, and problem solving, and they are often used in what, if analyses 4. Are versatile tools that are most effective in solving quantitative problems	EXCEL
CONCEPT MAP	1. Are spatial representation of concepts and their interrelation slop that stimulate knowledge structures that humans store in their minds 2. Are also effective for planning other kinds of productions and knowledge bases	INSPIRATION

Furthermore, Schneider (2010) categorised cognitive tools into: writing and communication tools, special purpose drawing and writing tools, highly special and professional tools and tools that model some kind of behaviour and let the learner freely interact with those worlds simulations and micro worlds. Jonassen & Carr (2000) in Kim & Reeves (2007) identified the following classes of "mind tools; semantic organization tools, dynamic modelling tools,

visitation tools, knowledge construction tools and socially shared cognitive tools. These categories of learning tools facilitate deep learning; help students learn about, from and mostly with technology where they are actively involved and constructing knowledge using higher order thinking skills. Joassen (1994) argued that when students learn with technology, it becomes a mind tool designed to function as intellectual partners with the learner in facilitating learner engagement, critical thinking, creativity and other higher order learning skills.

Kommers, Jonassen & Mayers (1992) Lajoie & Derry (1993) and Orhum, Haylers, Bowerman & Vivet (1997) identified logo, micro world semantic nets, concept mapping, idea processors as examples of computer based cognitive tools that can effectively facilitate the development of meta-cognitive awareness and self-regulatory skills in learners. Supporting this, Otunla & Jinadu (2013) posited that computer based cognitive tools serve as catalysts for facilitating the development of meta-cognitive awareness and generalized self-regulatory skills. Little wonder, Maryland Teacher Technology Standards (2012, p.) argued that the ability to:

- assess students' learning/instructional needs to:
- identify appropriate technology material and media,
- determine their most appropriate instructional use,
- select and apply research-based practice for integrating technology into instruction,
- select and use appropriate technology,
- support content-specific students' learning outcomes,
- develop an appropriate assessment for measuring students' outcome through the use of technology,
- manage a technology enhanced environment, and
- maximize students' learning are all indicators of teachers' proficiency in the use of technology and in teaching and learning.

Rogers (2000) identified personal productivity aids, enrichment add-in and paradigm-shifts as the three levels of adoption categories in the use of technology and further lists: innovators, early adopters, early majority, late majority and laggard or die hard as five levels of adopters in the use of technology integration. Rogers argued that not much has been done in the adoption of technology for paradigm shifts. Ifegbo, Onwuagboke & Ukegbu (2015) supported Roggers (2000) but added that low adoption of technology in teaching and learning has adversely affected the drive to realign the education system in Nigeria to global best practice, more especially as it affects high adoption of technology for personal productivity aids and enrichment add-ins. Cognitive tools/technologies fall within this paradigm –shifts categories in the use of technology as posited by Rogers (2000).

Edu. Tech Wiki (2016) pointed out that thirty years of educational research has shown that various interactive technologies are effective in education as phenomena to learn both "from" and "with". Also Jonassen & Reeves (1996) preliminary findings suggested that in the long run cognitive technologies when properly identified and adequately utilized, would have more potential in enhancing teaching and learning. Edu Wiki further added that the real power of interactive learning is to improve achievement and performance which can be realized when

people actively use computers as cognitive tools rather than simply interacting with them as tutors or data repositories.

However, challenges in the use of cognitive tools abound as Edu Tech Wiki argued that the use of cognitive tools often requires expertise which learners may not necessarily have and assessment of learned materials using cognitive tools is done in different context because cognitive tools being professional tools require the learning of the related practice before it can be easily used and assessed. Another challenge is that knowledge of some cognitive tools is not transferable. However, this challenges can be resolved if learners are adequately exposed to any of such tools that is within the learners reach and use.

Theoretical Framework: Behaviourism, Cognitivism and Constructivism

The three major learning theories relevant to designing and interacting with educational technology tools are behaviourism, cognitivism and constructivism. Specifically, cognitivism and constructivism are the two theories that lend credence to the theoretical framework of this study. Cognitivism and cognitive science while retaining the empirical framework of behaviorism went further to explain how human brain works to promote learning with a focus on the fact that the learner thinks as he/she learns. Cognitive and social constructivism focus on how learners construct new knowledge based on previous experience and knowledge through effective interaction and collaboration with peers and others. The use of cognitive tools in instructional delivery leans more on constructivism. Constructivism is concerned with how learners collaboratively construct meaning and knowledge and how they bring what they already know / their previous experiences to bear on the new task before them; as well as how they organize and reorganise these experiences into knowledge structures (such as schemata and mental models) and beliefs on which basis they interpret the objects and events they encounter in the world. Furthermore, Termos (2012) added that constructivist learning environment require students to use their prior knowledge and experience to formulate new, related and/or adaptive concepts in learning. Consequently, the teacher cannot transfer his/her knowledge to the learners because they do not share the same experiences and interpretations of realities, hence, teachers' role in a constructivist's classroom is facilitative and the learners are active to be able to take ownership of their learning..

Active learning of course involves problem-based learning, and inquiry –based learning that are facilitated using cognitive technologies/tools. Active learning theory further lends credence to this study as confirmed by Edu Tech Wiki (2016) that elaborately discussed the role of instruments within an activity system. Students in a constructivists' classroom interact with other learners, their teacher or even support staff and objects which in most cases are cognitive tools in order to achieve deep learning. This is why in teaching and learning context that encourages experiential learning or active learning and deep learning is usually mediated through the use of tools, rules and division of labour. Learners collaborate and negotiate meaning with other learners/teachers and interact with their environment to create their own interpretations of reality using varied cognitive technologies/tools. It thus implies that the extent of teacher-educators' knowledge and use of these tools in teaching and learning determine their user preference of these tools.

The foregoing discussion formed the background of the study as the study sought out to determine the teacher educators' preference in the use of cognitive technologies in the teaching and learning process. The study is delimited to fifteen cognitive technologies which can be seen in table 1 and four teacher educator variables: sex, years of experience, area of specialization and educational qualification**.**

Research Objectives

Specifically, the study focuses on the following;

- to determine the teacher educators' user preferences of cognitive technologies
- to find out whether the user preference differ based on sex,
- to find out whether the user preference differ based on years of experience,
- to find out whether the user preference differ based on area of specialization and
- to find out whether the user preference differ based on qualification.

Research Questions

(i) What are the cognitive technologies that the teacher educators prefer to utilize?

(ii) To what extent does teacher educators' user preference of cognitive technologies differ based on sex?

(iii) To what extent does teacher educators' user preference of cognitive technologies differ based on years of experience?

(iv) To what extent does teacher educators' user preference of cognitive technologies differ based on areas of specialization?

(v) To what extent does teacher educators' user preference of cognitive technologies differ based on qualification

Hypotheses

1. Teacher educators' user preference of cognitive technologies does not differ significantly based on sex.
2. Teacher educators' user preference of cognitive technologies does not differ significantly based on years experience.
3. Teacher educators' user preference of cognitive technologies does not differ significantly based on areas of specification.
4. Teacher educators' user preference of cognitive technologies does not differ significantly based on educational qualification.

Methodology

The study is a descriptive survey comprising of all the 2,450 teacher educators in the South-East geo-political zone of Nigeria across the Colleges of Education. Through the use of Watson (2001) the sample size of 351 was selected through the use of simple random sampling using balloting without replacement. Teacher Educators Cognitive Technologies user preference Questionnaire tagged TECTUPQ served as the instrument used for data collection. The part A sought for personal information while part B was designed to elicit answers from the research questions based on the variables chosen for the study. The instrument was validated by three experts from Curriculum / instruction and educational measurement and evaluation. Their inputs were reflected in the final draft. The instrument was further subjected to test-retest and data generated yielded an index of 0.87 using Persons Product Moment Correlation Coefficient. This index was adjudged to be reliable since the index is high.

To elicit responses, options were provided for the respondents to choose the one that best represents their opinion. Options were on a-four-point scale namely: most preferred, more preferred, preferred and less preferred and weighted 4, 3, 2 and 1 respectively. Four research-assistants were utilized and the questionnaires were administered and retrieved through a face-to-face contact, Data generated were analyzed using mean (reference mean 2.5), simple percentage and Chi-Square test of independence.

Results and Findings

Research Question 1: What are the cognitive technologies that the teacher educators prefer to utilize?

In order to answer the research question, data collected were analysed using mean as shown in Table 1.

Table I: Mean responses of teacher educators cognitive Technologies user preference

S/N	Items	Most Preferred	More Preferred	Preferred	Less preferred	x
1	Google	800	160	102	60	3.19
2	Yahoo	1200	105	32	-	3.80
3	Atls visa	168	60	120	229	1.64
4	Flickr	112	96	140	221	1.62
5	Tumblr	128	120	124	217	1.67
6	Ms Power Point	812	240	76	30	3.29
7	Ms Word	860	108	80	60	3.15
8	Pinterest	208	132	110	200	1.85
9	MsExcle	768	360	38	20	3.37
10	Inspiration	-	-	42	331	1.06
11	Hyper Author	-	57	104	280	1.25
12	Teleconferencing	88	42	66	282	1.36
13	Video Conferencing	40	33	60	300	1.23
14	Pod Casting	248	96	104	205	1.86
15	On Line Discussion	112	45	56	280	1.40

Source: field survey 2017.

The above table shows teacher educators' mean responses on user preference of cognitive technologies. In items 1, 2, 6, 7, 9 which focused on teacher educators' user preference of Google, Yahoo, Ms Power Point, Ms Word and Ms Excel, have mean of 3.19, 3.80, 3.29, 3.15 and 3.37 respectively. These mean were found to be greater than the reference mean 2.5, they were therefore accepted as being high.

Items 3, 4, 5, 8, 10, 11, 12, 13, 14 and 15 have mean responses of 1.64, 1.62, 1.67, 1.85, 1.06, 1.25, 1.36, 1.23, 1.86 and 1.4 respectively. These mean responses were found to be below the reference mean 2.5 therefore, they were rejected. The conclusion is that teacher educators prefer to use the following cognitive technologies: Google, Yahoo, Ms PowerPoint, Ms Word and Ms Excel.

Research Question 2: To what extent are teacher educators' user preference of cognitive technologies differs based on sex.

In order to answer the research question, data collected were analysed using simple percentage as shown in table 2.

Table 2: Percentage responses of male and female teacher educators' user preferences of cognitive technologies

Sex	Most Preferred		More Preferred		Preferred		Less Preferred		Total	
	F	%	F	%	F	%	F	%	F	%
Male	45	(12.8)	16	(4.4)	22	(6)	88	(25.8)	171	(49)
Female	47	(13.2)	20	(5.8)	20	(5.8)	93	(27.2)	180	(51)
Total	**92**	**(26)**	**36**	**(10.2)**	**42**	**(11.8)**	**181**	**(52)**	**351**	**(100)**

Source: field survey 2017

The above table shows that 45 or 12.8% of male teacher educators most preferred cognitive technologies, 47 or 13.2% of their female counterparts also most preferred it. 16 or 4,4% of male respondents preferred cognitive technologies more and 20 or 5.8% female respondents also preferred it more. A total of 181 or 52% of both male and female teacher educators less preferred the use of cognitive technologies. This large number and the accompanying high percentage were seen as significant because 52% is greater than the reference percentage of 50%. The conclusion is that teacher educator less preferred the use of cognitive technologies irrespective of their sex.

Research Question 3: To what extent does teacher educators' user preference of cognitive technologies differ based on years of experience?

In order to answer the research question, data collected were analysed using simple percentage as shown in table 3.

Table 3: Percentage responses of teacher educators' user preference of cognitive technologies by years of experience

Years of Experience	Most Preferred		More Preferred		Preferred		Less Preferred		Total	
	F	%	F	%	F	%	F	%	F	%
5 -10	52	(15.8)	24	(7)	15	(4.2)	57	(16.6)	168	(48)
11+	40	(11.7)	12	(3.4)	27	(7.6)	124	(35.4)	183	(52)
Total	**92**	**(26)**	**36**	**(10.2)**	**42**	**(11.8)**	**181**	**(52)**	**351**	**(100)**

Source: field survey 2017

Above table shows that 52 or 15.8 % of teacher educators within 5 – 10 years of experience most preferred, 24 or 7% more preferred, 15 or 4.2% preferred while 57 or 16.6% less preferred the use of cognitive technologies. 40 or 11% of teacher educators with 11+ years of experience most preferred, 12 or 3.2% more preferred, 27 or 7.6% preferred while 124 or 35.4% less preferred the use of cognitive technologies. Since 124 respondents within 11+ years of experience less preferred the use of cognitive technologies, the conclusion is that respondents within 11+ less preferred it.

Research Question 4: To what extent does teacher educators' user preference of cognitive technologies differ based on areas of specialization?

In order to answer the research question, data collected were analysed using simple percentage as shown in table 4.

Table 4: Percentage responses of teacher educators' preferences of cognitive technologies by area of specialization

Year of Specialization	Most Preferred		More Preferred		Preferred		Less Preferred		Total	
	F	%	F	%	F	%	F	%	F	%
Science	30	(8.5)	13	(3.7)	13	(3.7)	42	(11.8)	102	(29)
Arts	30	(8.5)	10	(2.8)	15	(4.2)	69	(19.6)	124	(35.4)
Social Science	32	(9)	13	(3.7)	14	(3.9)	70	(20)	125	(35.6)
Total	**92**	**(26)**	**36**	**(10.2)**	**42**	**(11.8)**	**181**	**(52)**	**351**	**(100)**

Source: field survey 2017

The table shows that 30 or 8.5%, 30 or 8.5% and 32 or 9% of teacher educators from Science, Arts and Social Science respectively most prefer to use cognitive technology while +42 or 11.8%, 69 or 19.6% and 70 or 20% respectively, less prefer to use cognitive technologies. A total of 92 or 26% of teacher educators from all areas of specialization most preferred the use of cognitive technologies while 181 or 52% less preferred it. The conclusion is that a high number and percentage of teacher educators irrespective of area of specialization less prefer the use cognitive technologies.

Research Question 5: To what extent does teacher educators' user preference of cognitive technologies differ by educational qualification?

In order to answer the research question, data collected were analysed using simple percentage as shown in Table 5.

Table 5: Percentage responses of teacher educators' user preferences of cognitive technologies by educational qualification

Educational Qualification	Most Preferred		More Preferred		Preferred		Less Preferred		Total	
	F	%	F	%	F	%	F	%	F	%
MSc/Med	36	(10.2)	12	(3.2)	14	(3.9)	118	(33.6)	180	(51.3)
PhD	56	(15.8)	24	(7)	28	(7.9)	63	(18.4)	171	(48.7)
Total	**92**	**(26)**	**36**	**(10.2)**	**42**	**(11.8)**	**181**	**(52)**	**351**	**(100)**

Source: field survey 2017

The above table shows that 36 or 10.2% of teacher educators with MSc/MEd most preferred the use of cognitive technologies, 12 or 3.2% more preferred, 14 or 3.9% preferred while 118 or 33.6% less preferred it. 56 or 15.8% of teacher educators with PhD most preferred, 24 of 7% more preferred, 28 or 7.9% preferred while 63 or 18.4% less preferred the use of cognitive technologies. Though 56 or 15.8 most preferred the use of cognitive technologies an appreciable number of 63 or 18.4% less preferred it. The conclusion is that both teacher educators with MSc/M Ed and PhD less preferred the use of cognitive technologies.

Test of Hypotheses

To test these hypotheses data collated were analysed using chi-square for table 6.

Hypothesis 1: Teacher educators' user preference of cognitive technologies does not differ by sex.

Table 6: Chi-square result of male and female teacher educators' user preference of cognitive technologies

Sex	Most Preferred	More Preferred	Preferred	Less Preferred	Total	X^2_{cal}	$X^2_{0.05}$	df	Decision
Male	45	16	22	88	171				Not
Female	47	20	20	93	180	0.46	7.82	3	Significant
Total	**92**	**36**	**42**	**181**	**351**				

Source: field survey 2017

Since X^2_{cal}= 0.46 is less than $X^2_{0.05}$ = 7.82 at degree of freedom 3, we accept null hypothesis and concluded that teacher educators' user preference of cognitive technologies does not differ by sex.

Hypothesis 2: Teacher educators' user preference of cognitive technologies does not differ, significantly by years of experience.

To test these hypotheses data collated were analysed using chi-square for table 7

Table 7: Chi-square result of teacher educators' user preferences of cognitive technologies based on years of experience

Year of Experience	Most Preferred	More Preferred	Preferred	Less Preferred	Total	X^2_{cal}	$X^2_{0.05}$	df	Decision
5 – 10	52	24	15	57	168				
11+	40	12	27	124	183	30.37	7.82	3	Significant
Total	**92**	**36**	**42**	**181**	**351**				

Source: field survey 2017

Since X^2_{cal}= 30.37 is greater than $X^2_{0.05}$ = 7.82 at degree of freedom 3, we reject null hypothesis and concluded that teacher educators' user preference of cognitive technologies differs significantly by years of experience in favour of respondents with 5 – 10 years of experience.

Hypothesis 3: Teacher educators' user preference of cognitive technologies does not differ significantly based on area of specialization

To test these hypotheses data collated were analysed using chi-square for table 8.

Table 8: Chi-square result of teacher educators' user preference of cognitive technologies based on area of specialization

Area of Specialization	Most Preferred	More Preferred	Preferred	Less Preferred	Total	X^2_{cal}	$X^2_{0.05}$	df	Decision
Science	30	13	13	42	102				Not
Arts	30	10	15	69	124	5.3	9.49	4	Significant
Social Sci.	32	13	14	70	125				
Total	**92**	**36**	**42**	**181**	**351**				

Source: field survey 2017.

Since X^2_{cal}= 5.3 is less than the $X^2_{0.05}$ = 9.49 at degree of freedom 4, we accept null hypothesis and conclude that teacher educators' user preferences of cognitive technologies do not differ significantly based on area of specialization.

Hypothesis 4: Teacher educator user preference of cognitive technologies does not differ significantly based on educational qualification.

To test these hypotheses data collated were analysed using chi-square for table 9

Table 9: Chi-square result of teacher educators' user preferences of cognitive technologies based on educational qualification

Educational Qualification	Most Preferred	More Preferred	Preferred	Less Preferred	Total	X^2_{cal}	$X^2_{0.05}$	df	Decision
MSc/MEd	36	12	14	118	180				
PhD	56	24	28	63	171	39.2	7.82	3	Significant
Total	**92**	**36**	**42**	**181**	**351**				

Source: field survey 2017.

Since X^2_{cal}= 39.2 is greater than the $X^2_{0.05}$ = 7.82 at degree of freedom 3, we reject null hypothesis and conclude that teacher educators' user preference of cognitive technologies differ significantly based on educational qualifications.

Discussion

The study involves teacher educators' user preference of cognitive technologies with particular reference to sex, years of experience, areas of specialization and educational qualifications. A sample size of 351 teacher educators in colleges of education in the south-east geo-political zone of Nigeria served as the respondents.

Research question 1 in Table1 shows that their preference falls within personality productivity aids and enrichment add-ins (Google, Yahoo, Ms PowerPoint, Ms Word and Ms Excel) as against (Atlas visa, Flickr, Tumblr, Pinterest, Inspiration, Hyper Author, Teleconferencing, Pod Casting, On Line Discussion) which fall within the paradigm-shift adoption category that would even facilitate learner interaction and collaboration. This corroborates Rogers (2000) and Ifegbo et al (2015) that report teacher educators' use of current educational technologies mostly for personality productivity aids and for enrichment add-ins.

On research question 2 and hypothesis 1 that addressed user preference of cognitive technologies based on sex, the results showed no difference in user preference among male and female teacher educators. Research question 3 and hypothesis 2 discussed user preference based on years of experience and it was found that years of experience are significant in their user preferences. The results show that a large number of teacher educators less preferred the use of cognitive technologies. This led to the rejection of the hypothesis since the calculated $X^2$of 30.37 was greater than the table X^2=7.82 at df 3. The conclusion is that the alternative hypothesis was upheld. This supports Otunla & Jinadu (2013) who argued that university lecturers' adoption of cognitive technologies for effective science delivery were not often used by younger lecturers. On user preference based on areas of specialization the result shows no significant difference while on preference based on years of experience as there was a significant difference. This led to the acceptance of hypothesis 3, signifying that area of specialization is not a determining factor of teacher educators' user preference of cognitive technologies. Hypothesis 4 was rejected at 0.05 level of significance. The conclusion is that educational qualification is implicated in teacher educators' user preference of cognitive technologies.

Conclusion

The benefits of using cognitive technologies cannot be over emphasized given the current best practice in teaching and learning that require seeking, presenting, organizing, integrating and

connecting new information to facilitate deep learning. The results show that teacher educators prefer the use of the following cognitive technologies: Google, Yahoo, Ms Power Point, Ms Word and Ms Excel against Atlas visa, Flickr, Tumblr, Printerest, Inspiration, Hyper Author, Teleconferencing, Pod Casting as their user preference of cognitive technologies differed significantly based on years of experience and educational qualification.

Recommendations

Based on the findings of this study the researchers recommend the following:

- Colleges of education should mount in-school seminars and workshop to equip teacher educators on the need to widen their knowledge and usage of cognitive tools in teaching.
- National Council for Colleges of Education should ensure that the learning environment in colleges are adequately equipped for constructivist-based teaching and learning, where social interaction, engagement and transactional activities rely heavily on the use of cognitive technologies.
- Colleges of education should be adequately equipped to implement this new imperative in teaching and learning

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