Effect of Teaching Competencies with Technology Integration among Basic Science Teachers in Uyo Local Government Area, Akwa Ibom State, Nigeria

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ABSTRACT

This study investigated teaching competencies and classroom technology integrated among secondary school teachers. Three research questions were posed and one hypothesis formulated and analysed at $p \leq 0.05$ level of significance. Survey design was utilized, fifty basic science teachers served as sample. Prepared questionnaire with a reliability coefficient of 0.94 was the instrument used for the study. Data were analysed with mean and t-test. Results show that basic science teachers have teaching competencies and technology integration in the classroom such as for locating, evaluating and collecting information tools and information sources to increase productivity, promote creativity and facilitate academic learning. Results also indicate some obstacles to technology integration such as unavailability of equipped computer laboratories and lack of adequate encouragement to basic science teachers to integrate technology for classroom communications. Recommendations are made to include the need for government to provide adequately equipped computer laboratories in secondary schools; school administrators to organize retraining programmes especially for female basic science teachers on technology integration in classroom communications.

KEYWORDS: Teaching, Competence, Technology, Integration and Basic Science

Introduction

Science education, in which Basic Science is at the grassroots, is vital for the development of any nation. This is why all nations pay particular attention to the teaching and learning of Basic Science in school. Science education in Nigeria concentrates on the teaching of science concepts, methods of teaching, and addressing misconceptions held by learners regarding science concepts (Kola, 2018). However, as important as science is, the performance of science students over the years has not been encouraging, and this calls for investigations. Effective teachers are vital to the education system. Schools and their communities have always sought out the best teachers they could get, with the belief that their students' success depends on them. The effectiveness or ineffectiveness of teaching is very closely linked to teaching competence. A competent science teacher, for instance, would create classroom

conditions and a climate that are conducive to students learning. Teaching competency includes dimensions like content knowledge, instructional planning, student motivation, presentation and communication skills, evaluation competencies, and classroom management skills. What makes a teacher effective is the manifestation of all these dimensions in an integrated manner.

Technology integration is not just having diverse pieces of equipment in the classroom. Having the equipment but not knowing how to use it for productivity does not accurately address the requirements for technology integration. Proficient use of technology should also address what a teacher does with that equipment to make instruction in the classroom more effective and efficient.

Previous research has reported the positive impact of technology integration on teaching and learning. For example, Sherry, Jesse and Acosta (2017) suggested from their study a positive impact of technology integration on students' meta-cognitive skills, application of skills, etc. Learning to integrate technology so as to enhance instruction can be a challenging task. An observation of teachers in most schools today is that many, including science teachers, are not computer literate, probably because they did not grow up using modern classroom technologies, and to learn how to use them now would require more time and effort than they would want to invest at this point in their teaching careers (Kadel, 2015). On the other hand, the classroom teachers who did grow up with much of the modern classroom technology may know how to use it but may not yet have learned how to implement it productively in the classroom to enhance instruction.

Tryggvi (2017) defines technology as referring specifically to interactive computer/network-based information and communication technology (ICT), which includes telephones (primarily cellphones and smartphones), computers, and iPod- and iPad-like devices. Tryggvi describes at least three distinctly different uses of the term "technology integration" in literature:

1. **Technology integration in Learning (TiL):** This refers to how learners use technology to support their learning on a personal level. It extends beyond the classroom to learners' use of technology to interact with a range of knowledge communities, including their school peers, online groups with mutual interests, various online sources of information, etc. We commonly engage in this sort of technology integration in our everyday lives. For example, when we look something up on Wikipedia or post a question on an online forum, we are engaging in this type of integration. It is often a "just-in-time" (JIT) mode of learning, where we seek out the information that we need at the time that we need it, and thus tends to be closely related to learners' real-world experiences. It may entail finding relevant information online or calling or texting a knowledgeable individual. This type of integration is almost nonexistent in educational contexts but is an increasingly important aspect of individuals' everyday sense-making and meaning-making.

2. **Technology integration in the classroom (TiC):** This refers to the use of technology to support planned and structured educational activities in school-based environments. This is what we often assume is meant by the term "technology integration" in the literature. It may often mimic TiL, but differs in that the use of the technology is usually under manufactured circumstances.

Furthermore, TiC generally does not allow the learner to freely explore the topic that is being considered due to limitations imposed on the use of the technology involved, ex. limited access to certain sources of information by way of filtering, limitations on the type of technology to be used, and time constraints imposed by instructors' lesson plans.

3. **Technology integration in instructors' duties (Til):** This refers to the use of technology by instructors to plan, manage, and deliver instruction in classroom or online settings. This is arguably the most common type of technology integration in education today. Till includes teachers' use of technology to plan and deliver lessons (ex. instructional computer-based slideshows (PPT, whiteboards)), accessing information for creating lesson plans and activities, collecting and analysing data on learners' progress, and communicating with learners and important stakeholders (like parents).

To better prepare students for the science and technology of the 21st century, the current science education reforms demand that science teachers integrate technology and inquiry-based teaching into their instruction (American Association for the Advancement of Science, 1993; National Research Council (NRC), 1996, 2000).

Science teachers experience various constraints, such as lack of time, equipment, pedagogical content knowledge, and pedagogical skills, in implementing reform-based teaching strategies (Crawford, 2000; Roehrig & Luft, 2014, 20116). One way to overcome the barriers and reform teaching is to participate in professional development programmes that provide opportunities for social, personal, and professional development (Bell & Gilbert, 2004). Professional development programmes in which teachers collaborate with other teachers, reflect on their classroom practices, and receive support and feedback have been shown to foster teachers' professional development. It is the problem of this study to investigate the teaching competencies and technology integration possessed by Basic Science teachers in secondary schools in Ikwuano local government area.

This study set out to investigate the perception of Basic science teachers in the following:

1. Competences in technology integration.
2. Obstacles and incentives to successful classroom technology integration and
3. Difference in perception of male and female teachers in technology integration.

The following research questions are posed to guide the study:

1. What are the perceptions of basic science teachers on their competencies to technology integration?
2. How do basic science teachers perceive obstacles and incentives in relation to successful classroom technology integration?
3. To what extent do male and female basic science teachers differ in their classroom technology integration?

The following null hypothesis was set for analysis at 0.05 level significance:

HO_1: There is no significant difference in male and female teachers' perception of classroom technology integration.

Method

The study utilized survey design. The participants of this study were fifty basic science teachers randomly drawn from four public schools served as sample for the study. Questionnaire adapted from Almekhlafi respondent mode of the questionnaire was a modified four-point likert scale of strongly Agree, Agree, Disagree and Strongly disagree. Data were analyzed using mean and t-test. Mean scores above 2.50 indicate Agree and less than 2.50 Disagree.

Result and Discussion

Result in answer to Research question 1: What are the perception of basic science teachers on their competencies to technology integration? Is shown on Table 1.

Table 1: Teachers' Perception of their Competences in Technology Integration

S/N	ITEM	MEAN	SD	REMARK
1	Proficiency in the use of common input and output devices can make informed choices about technology systems.	2.457	0.700	Disagree
2	Can use technology to locate, evaluate and collect information from a variety of sources.	2.850	0.733	Agree
3	Can use technology tools and information resources to increase productivity, promote creativity and facilitate academic learning.	2.971	0.664	Agree
4	Can use content-specific tools (e.g software, simulation, environmental probes, graphic calculators, and exploratory environmental, Web tools) to support learning and research.	2.771	0.731	Agree
5	Can collaborate in constructing technology-enhanced models, preparing publications and producing other creative works using data and report results.	2.714	0.750	Agree
6	Can use technology tools to process data and report results.	2.714	0.750	Agree
7	Have a strong understanding of the nature and operation of technology systems.	2.371	0.690	Disagree
8	Understand the legal, ethical, cultural and societal issues related to technology.	2.457	0.700	Disagree
9	Can choose learning and technology resources adequate for science lessons.	2.600	0.775	Agree
10	Can use technology resources to facilitate higher order and complex thinking skills, including problem solving, critical thinking, informed decision-making knowledge construction and creativity.	2.771	0.646	Agree
11	Competence in troubleshooting common computer problems	2.257	0.741	Disagree
12	Can use technology in the development tools in the development of strategies for solving problems in the real world.	2.514	0.612	Agree
13	Have knowledge to discuss health and ethical issues related to technology.	2.600	0.774	Agree
14	Can use technology tools and resources for managing and communicating information (e.g., finances, schedules, addresses, student assessments, correspondence).	2.686	0.718	Agree

15	Can evaluate and select new information resources and technological innovations based on their appropriateness to specific tasks.	2.629	0.646	Agree
16	Can use a variety of media and formats, including telecommunications to collaborate, publish and interact with peers, experts, students and other audiences.	2.543	0.611	Agree
17	Can discuss diversity issues related to electronic media.	2.229	0.690	Disagree
18	My opinion is that most students have so many other needs that technology use is a low priority.	2.171	0.923	Disagree

Result on Table 1 show that basic science teachers perceive themselves as having competencies in many aspects of technology integration. The result of this study could be as a result of increased awareness on importance of technological communications in education. This finding is in line with Bauer and Kenton (2015) who found that teachers were highly skilled in technology and had the competencies required for successful technology integration. This result is contrary to the findings of Ndirika and Elekwa (2014) who carried out a similar study on science teachers and found that teachers were only competent in minor computer skills and majority were only competent in utilizing technology for reference materials. Results however indicate that teachers do not have competency in discussing diversity issues related to electronic media, troubleshooting computer problems, proficiency in the use of common input and output devices and cannot make informed choices about technology systems. Interestingly though, many of the basic science teachers do not agree that technology use is a low priority for students.

Table 2: Obstacles and Incentives Related to Successful Technology Integration in Classroom

S/N	ITEM	MEAN	SD	REMARK
1	Teacher does not have much time to prepare and implement them.	2.371	0.770	Disagree
2	Teachers do not have enough encouragement to use them.	2.714	0.825	Agree
3	Qualified staffs for the computer laboratories are not available to help.	3.057	0.873	Agree
4	Equipped computer labs are not available in schools.	3.343	0.838	Agree
5	Technologies are not available in schools.	3.143	0.912	Agree
6	Free or discounted computers are available for teachers use.	2.257	0.817	Disagree
7	Teachers participate in special workshops related to technology integration.	2.486	0.612	Disagree
8	Additional resources are made available to science teachers for their classroom technology integration.	2.086	1.067	Disagree
9	School recognition programme is available for science teachers who integrate technology.	1.943	0.873	Disagree
10	Free software is made available for teachers and students use.	1.514	0.562	Disagree

Result on Table 2 show how teachers perceive obstacle and incentives related to successful technology integration in classroom. The results show that basic science teachers perceive lack of encouragement, unavailability of equipped computer labs, qualified staff and appropriate technology, as obstacles to technology integration in science classroom. Pertaining to incentives, the teachers are not in agreement that there are incentives for technology integration available to them.

The result of this study corroborates the findings of Flores (2012) who concluded that teachers face many barriers in their quest to incorporate technology such as time scheduling administrative support, equity and the lack of resources. However basic science teachers used in this study do not perceive time as a barrier to technology integration.

Table 3: t-test Analysis of Gender Difference in Perception of Technology Integration among Basic Science Teachers

S/N	ITEM	MEAN (F)	MEAN (M)	t	p-VALUE	REMARK
1	Proficiency in the use of common input and output devices can make informed choices about technology systems.	2.4457	3.267	3.739	0.000	Significant (S)
2	Can use technology to locate, evaluate and collect information from a variety of sources.	2.857	3.533	3.235	0.002	S
3	Can use technology tools and information resources to increase productivity, promote creativity and facilitate academic learning.	2.971	3.400	2.233	0.030	S
4	Can use content-specific tools (e.g software, simulation, environmental probes, graphic calculators, and exploratory environments, Web tools) to support learning and research.	2.771	3.133	1.438	0.157	Not Significant (NS)
5	Can collaborate in constructing technology enhanced models, preparing publications and producing other creative works using data and report results.	2.714	3.067	1.612	0.114	NS
6	Can use technology tools to process data and report results.	2.714	3.600	4.170	0.000	S
7	Have a strong understanding of the nature and operation of technology system.	2.371	3.000	2.997	0.004	S
8	Understand the legal, ethical, cultural and societal issues related to technology.	2.457	3.333	4.396	0.000	S
9	Can choose learning and technology resources adequate for science lessons.	2.600	3.400	4.800	0.000	S
10	Can use technology resources to facilitate higher order and complex thinking informed decision-making, knowledge construction and creativity.	2.771	3.467	3.689	0.000	S

11	Competence in troubleshooting common computer problems.	2.257	3.267	4.477	0.001	S
12	Can use technology in the development tools in the development of strategies for solving problems in the real world.	2.514	3.467	4.725	0.000	S
13	Have knowledge to discuss health and ethical issues related to technology.	2.600	3.267	2.863	0.016	S
14	Can use technology tools and resource for managing and communicating information (e.g., finances, schedules, addresses, student assessments, correspondence).	2.686	3.267	2.882	0.006	S
15	Can evaluate and select new information resources and technological innovations based on their appropriateness to specific tasks.	2.623	3.333	3.782	0.000	S
16	Can use a variety of media and formats, including telecommunications to collaborate, publish and interact with peers, experts students and other audiences.	2.543	3.333	4.434	0.000	S
17	Can discuss diversity issues related to electronic media.	2.229	3.000	3.856	0.003	S
18	My opinion is that most students have so many other needs that technology use is a low priority.	2.171	3.133	3.666	0.001	S

Results on Table 3 show a significant difference, in almost all the items, between the male and female teachers' perception of their competence in technology integration in science classrooms, with the males having higher means in each case. HO1 is therefore rejected. This result is similar to the finding of Hong & Koh (2017) who found that female teachers were more anxious than male teachers toward hardware.

Conclusion

This study shows that male basic science teachers was perceive to have competence in lot of technology integration skills than female teachers.

Recommendations

1. School administrators should organize retraining programmes especially for female science teachers on technological operations where they perceive incompetence.
2. Adequate incentives should be given to basic science teachers who make positive effort to integrate technology in classroom communications.
3. Government should provide secondary schools with well-equipped computer laboratories enables basic science teachers effectively integrate technology in classroom communications.

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