INNOVATIVE TEACHING METHODS ADOPTED BY ELECTRICAL AND ELECTRONIC TRADE TEACHERS IN NIGER AND KATSINA STATES, NIGERIA

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Abstract

The study investigated the innovative teaching methods adopted by Electrical and Electronic Trade (EET) teachers in Niger and Katsina states. The population for the study was 124 (65 Old and 59 Young) EET teachers. Two research questions were raised and two hypotheses tested at .05 level of significance guided the study. The instrument for data collection was a 52-items Innovative Teaching Methods Questionnaire (ITMQ) developed by the researchers. The ITMQ was validated by three experts in the Department of Industrial and Technology Education, Federal University of Technology Minna, Niger State. A pilot test of the instrument was carried out at Government Technical College Kajuru, Kaduna state. The reliability coefficient of the instrument was obtained using Split-Half Method and the Pearson Product Moment Correlation yielded an index of 0.83. Data collected was analyzed and Mean and Standard deviation were used to answer the research questions while Z-test analysis was used to test the hypotheses at .05 level of significance. Findings revealed that innovative teaching methods that were recommended by experts in Technical Education as effective for the teaching of EET were not adopted by the teachers. Also, Lack of conducive school environment to practice innovation, EET teachers' unawareness of innovative teaching methods, difficulty of adoption among others were factors affecting the adoption of innovative teaching methods by EET teachers. Based on these findings therefore, it was recommended among others that EET teachers should be encouraged to undergo further training on pedagogies to acquire research skills needed to practice innovative teaching methods.

Index Terms: Innovation, Innovative Teaching Methods, Traditional Teaching Method, Electrical and Electronic Trade.

Introduction

Electrical and Electronic Trade (EET) is one of the Technical Vocational Education and Training (TVET) courses that are offered at technical college level in Nigeria. It is the foundation of electrical and electronic technology education. According to the National Board for Technical Education (NBTE, 2004) minimum standards, EET is objectively designed to reflect the functional philosophy of TVET. Therefore, while seeking to achieve academic excellence and promote the furtherance of knowledge, EET also seeks to aid the acquisition of appropriate skills, abilities and competencies

necessary for preparing individuals who shall live and contribute to the economic development of their society.

EET includes all the courses that have direct relationship with the servicing and repairing of electrical and electronic equipment and appliances. These according to the Federal Republic of Nigeria (FRN, 2004) include: Appliances Repairs; Electrical Installation and Maintenance Work; as well as Electronic Work; which implies that the scope is wide. Moreover, the field of EET requires concrete understanding of abstract electrical and electronic theories and circuit structures. Zacharia (2007) observed that electrical and electronic circuits are dominated mainly by non-linear analysis of complicated circuits which are mathematically complicated, extremely abstract and difficult to teach using traditional teaching methods. This is more so in Nigeria, considering the type of EET students in technical colleges. They are new to the world of electrical and electronic technology. They need to be brought home in terms of mind set, attitude and interest, using innovative teaching methods, to understand the difficult concepts of EET. In addition, the characteristic wide scope, coupled with the dynamic electrical and electronic technological advancement from the use of analogue systems to more complex digital systems are making the course much more difficult to teach.

This may be why Ogwo and Oranu (2006) stated that technical teachers need to use skilled methods and techniques of teaching for effective learning to take place. Also, Trigwell (2010) explored the connections between teaching and learning, identifying the importance of innovative teaching methods. His recent research suggested that when teachers focus on what students are doing in their courses and encourage innovative teaching/learning activities such as self-directed learning, debate and questioning, which promotes active student/teacher interaction; their students are more likely to adopt a deep approach to critical thinking which facilitates learning depending on the course of study. This implies that EET teachers need to assess various innovative teaching methods in relation to the goals of the program they teach, the characteristics of their students, the learning environment, as well as their own strengths as teachers. However, a crucial step in identifying the right innovative teaching method is to become aware of it (Entwistle, 2010).

Awareness may not be the only factor affecting the adoption of innovative teaching methods. It may be that most teachers have not received any formal pedagogical training towards innovations in teaching (Britnell, 2010). In other words, some teachers may not have the required research skills that are needful to experiment new teaching methods that are more effective. Other teachers may have wrong belief and bad attitude towards innovation. Also, networking, including sharing of ideas through conferences and workshops, has a huge potential for cross-fertilization and experimentation of innovative teaching methods (Yvonne, 2009). Which means that to assist EET teachers to fully engage in innovative teaching practices, systemic support and recognition for formal networks and partnerships must be forthcoming. Furthermore, it is not certain whether innovative teaching methods may spread faster through formal or informal networks. This is because most EET teachers may have access to innovative teaching methods, not on the basis of scientific research by experts; but through subjective observation of their peers who are older or younger in the same profession

(Rogers, 2003). As such, one may therefore wonder whether older EET teachers adopt innovative teaching methods faster than their younger colleagues.

Lau and Sim (2008) found that older teachers frequently incorporate innovative teaching methods such as computer technology in the classroom more than their younger peers in the same profession. This is the case in advanced countries due to older teachers' possession of higher ICT competencies and classroom management skills (Russell, O'Dwyer, Bebell, and Tao, 2007). However, this may not be true in developing countries like Nigeria where younger EET teachers seem to be more interested in the use of computer and similar technologies. Obviously, conclusion on this assumed tendency of innovativeness between older and younger EET teachers is subject to further research on innovation.

Rogers (2003) defined innovation as an idea, practice, or method that is perceived as new by an individual or other unit for adoption. Therefore, innovative teaching methods refer to techniques of teaching that are different from traditional or conventional methods. In a traditional classroom, students are passive listeners. They come to the classroom unprepared and just listen to the teacher and take notes. Traditional method of teaching may be the norm in the teaching of EET in Nigerian technical colleges. This teaching method lacks active interactions between teachers and students, and between students themselves (Abida and Muhammad, 2012); which reduces retention, interest and academic performances (Amaral and Garison, 2002). On the other hand, innovative teaching methods in electrical and electronics may not be brand new but rather are new applications of existing approaches that appear novel to others because they have not yet been widely adopted. These methods are often tried in an effort to make the teaching of EET more effective or to tackle an instructional problem or obstacle with an overall desire of improving students' understanding of electrical and electronic concepts.

Sequel to the concern of stakeholders in TVET, literature has it that many innovative teaching methods are being discovered by pedagogues for the effective teaching of EET and related courses. For instance, Raymond and Ogbuanya (2014) revealed that cognitive and traditional task analysis-based instructional guides were effective in improving students' skills achievement in electronics work which is a component of EET; but cognitive task analysis-based instructional guide was more effective than traditional task analysis-based instructional guide. A possible explanation of their finding is the fact that in cognitive task analysis, skills are analyzed in substantially more detail based on their cognitive components such as knowledge, mental processes and decisions that are required for task performance. Also, in a separate study, Atsumbe, Raymond and Ajunwa (2015) discovered that the use of animation technique has a positive effect on technical college students' academic achievement and retention in basic electricity. Animations refer to computer generated images that illustrate an event, sequence or process. This innovative technique could be used to present abstract ideas; for instance, the movement of electric current in a conductor.

Correspondingly, Neo and Neo (2001) observed that many institutions around the globe are moving towards the use of innovative teaching methods such as problem-

based learning as a way of producing graduates who are creative and can think critically, analytically, and solve problems. In problem-based teaching according to Hal (2001), students work with classmates to solve complex and authentic problems which develop their knowledge and retention. Therefore, since traditional approaches do not encourage students to question what they have learnt or to connect with pre-requisite knowledge, this method is seen as an innovative remedy to encourage students to learn via real-life problem, which is in line with the objectives of EET.

In the same way, Doris and Rosa (2014) posited that cooperative learning, case study and site visits are veritable tools for increasing students' interest and participation as well as achieving better grades in the learning of electrical and electronics power and control systems. These methods are powerful student-centered teaching methods that could impart students with critical thinking, communication and interpersonal skills since students work together to share ideas and discoveries. Likewise, Tumba, Chinda and Andeyarka (2014) asserted that technical college students that were taught using cooperative method had more interest and team work spirit in Radio, Television and Electronic Servicing Trade, which is a trade area under EET, compared to those students taught using traditional teaching method.

Similarly, in the quest to promote effective teaching of technical courses such as EET demonstration and project method of teaching have been helpful. While demonstration method is attention inducer in practical classes (Mundi, 2006), project-based learning challenges students to apply core academic skills to solve authentic problems in real work situation (Renata, 2008). May be EET teachers have adopted these innovative methods so that the demonstration will help in the development of students' psychomotor domain; while the project method will build their thinking skills considering the requirements of EET that is full of abstract ideas and requires a lot of critical thinking and practical skills performance. In the same passion, Olaitan (1982) explained that instructional methods relevant for the teaching of TVET courses are project, discussion, demonstration, excursion or field trip and homework. Perhaps these methods have been adopted for effective teaching of EET since the programme is designed specifically to train individuals who will eventually be useful in industry or setup their own workshop in accordance with the stated objectives of TVET in the National Policy on Education (FRN, 2004).

TVET is perceived as an engine for the growth and progress of the Nigerian society. It is meant not only to impart knowledge, employable skills and inculcates values, but is also supposed to be responsible for building human capital which shall raise, drive and set technological innovation and economic growth. However, in recent time Olajide (2015) observed that TVET in Nigeria has rather been widely scored very low by researchers of technology education. This may be attributed to the purported gab between research findings on innovative teaching methods and the application of such techniques by technical teachers. It is important to stress that to achieve educational objectives in a technical high school in Greece; Alexandros (2012) discovered that the adoption of innovative teaching methods such as inquiry-based simulations, explorations and guided discovery tremendously improved electronic students' academic performances.

Unfortunately, despite all these and many other triumphant revelations on innovative teaching methods for the effective teaching of EET; it is not certain whether teachers are employing their use in technical colleges. Therefore, EET graduates' deficiency in employability skills, work place skills, and job generation competencies could be partly blamed on their teachers' over reliance on traditional teaching methods. Hence, the following question arises: what are the innovative teaching methods adopted by Electrical and Electronic Trade teachers in Niger and Katsina states?

Objectives of the Study

The objectives of the study were to find out the:

1. Innovative teaching methods adopted by Electrical and Electronic Trade teachers in Niger and Katsina states;
2. Factors affecting the adoption of innovative teaching methods by Electrical and Electronic Trade teachers in Niger and Katsina states.

Theoretical Framework

The Diffusion of Innovations Theory: This theory was put forward by Rogers (2003). It states that diffusion of innovation is the process by which it is communicated through certain channels over time among the members of a social system. The four main elements or factors in the diffusion of innovation are: 1. the innovation itself; 2. communication channels; 3. time; and 4. the social system (context).

According to Rogers, the factors of an innovation, which include: Relative advantage; Compatibility; Complexity; Trial-ability; and Observability; determine its rate of adoption. Relative advantage has to do with, for example, innovative teaching methods that are perceived to be more effective than their traditional counterparts. Compatibility on the other hand refers to the degree to which these innovative teaching methods are perceived as being consistent with the existing values, past experiences, and needs for potential adoption. Meaning, if an innovative teaching method is compatible with the stated objectives of EET, then uncertainty will decrease and the rate of adoption of the innovation will increase. Thus, even what the innovative teaching method is called should be meaningful to EET teachers. This is part of the complexity attribute. Therefore, complexity is the degree to which an innovative teaching method is perceived as difficult to understand and use. Thus, according to this theorist, excessive complexity of an innovation is an alarming obstacle to its adoption. For, instance, animation teaching technique may require EET teachers to posses skills in the use of computer, which entails different levels of complexity or difficulty to adopt. Trial-ability is the degree to which an innovative teaching method may be experimented or trial tested; while observability is the degree to which innovative teaching methods are visible to others. This signifies the importance of experimentation of innovation and peer interaction between teachers and other concerned stakeholders that are involved with the creation and adoption of innovative teaching methods through effective communication.

Communication is the process by which participants create and share information with one another in order to reach a mutual understanding. According to

Rogers, Mass media channels such as radio and TV broadcastings are effective in creating knowledge of innovations; whereas interpersonal channels, that may be achieved during conferences, workshops and seminars are effective in forming and changing attitudes toward a new idea, and thus in influencing the decision to adopt it with time. In terms of time or rate of adoption, Rogers categorizes adopters into five groups, which include: (a) Innovators, which for instance, are experienced pedagogues or EET teachers that experimented new teaching methods and become the first to adopt it. This category of teachers must be ready to cope with the uncertainties that surround the adoption of new ideas. The next category is the (b) Early Adopters; then the (c) Early Majority; (d) Late Majority and the (e) Laggards. The 'laggards' cannot take risk. They suspect innovative ideas and hence, they are the last to adopt it within the social system.

A social system is defined as a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal. The members or units of a social system may be individuals, informal groups, organizations, and subsystems. To this end, the EET teachers, EET Heads of Department in technical colleges, principals, directors and other important stakeholders play significant role in the adoption or rejection of innovative teaching methods. Therefore, this theory can be used to exemplify the step-by-step stages of the adoption of innovative teaching method by EET teachers. This is because, Rogers illustrated the likelihood of diffusion of innovation within a social system such as technical colleges and pointed out the possibility of some retraining factors that may affect this diffusion or adoption. This is in line with the specific objectives of the present study; hence, the theory is adopted.

Research Questions

The following research questions guided the study:

1. What are the innovative teaching methods adopted by Electrical and Electronic Trade teachers in Niger and Katsina states?
2. What are the factors affecting the adoption of innovative teaching methods by Electrical and Electronic Trade teachers in Niger and Katsina states?

Research Hypotheses

The following hypotheses, tested at 0.05 level of significance were further used to guide the study:

1. There is no significant difference between the mean ratings of old and young EET teachers on innovative teaching methods adopted by Electrical and Electronic Trade teachers in Niger and Katsina states;
2. There is no significant difference between the mean rating of old and young EET teachers on factors affecting the adoption of innovative teaching methods by Electrical and Electronic Trade teachers in Niger and Katsina states.

Methodology

A descriptive survey design was adopted for this study. According to Fraenkel and Wallen (2003), descriptive survey is used to investigate a given state of affairs as

fully as possible. The design was considered appropriate as the present study sought to determine the 'state of affairs' of the innovative teaching methods adopted by EET teachers in Niger and Katsina states. The population for the study consisted of all the 124 EET teachers (65 Old and 59 Young Teachers) from technical colleges in Niger and Katsina states offering EET at National Technical Certificate (NTC) level; hence, there was no need for sampling. Data was collected using a 52-items questionnaire developed by the researchers and known as Innovative Teaching Methods Questionnaire (ITMQ). The ITMQ was made up of three sections: A, B and C. Section A was used to seek for information on EET teachers' years of teaching service so as to differentiate between old and young teachers in line with the research hypotheses formulated. Sections B and C on the other hand were used to solicit information to answer research questions 1 and 2. Therefore, Section B was on the innovative teaching methods adopted by EET teachers. It contained 34 items covering 21 innovative teaching methods sourced from available literature that are relevant to the effective teaching of EET in Technical colleges. Section C was on the factors affecting the adoption of innovative teaching methods by EET teachers and it contains 18 items. Both sections (B and C) were structured using five point rating scales of Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD). These ratings weighted 5, 4, 3, 2 and 1, beginning from the highest to the lowest respectively.

The instrument (ITMQ) was content validated by three experts in Electrical and Electronic Technology Education from Federal University of Technology Minna, and their comments and suggestions were considered in preparing the final draft of the instrument. The instrument was trial tested in Government Technical College Kajuru in Kaduna state (outside the main study area) and data collected was used to determine internal consistency of the items of the instrument using split-half method. The Pearson Product Moment Correlation yielded an index of 0.83. The ITMQ was later administered to the subjects by the researchers and a 100% return rate was recorded. The data collected was analyzed. Mean and Standard Deviation were used to answer the research questions. Mean scores of 3.00 and above were considered Agreed; while mean scores of 2.99 and below were considered Disagreed by the respondents, in accordance with the research questions. Furthermore, Z-test was used to test the hypotheses. Decision was made by comparing the Z-calculated value with that of Z-critical at .05 significance level. Hypotheses were rejected when Z-cal was found to be greater than Z-critical otherwise accepted.

Results

Research Question 1

What are the innovative teaching methods adopted by Electrical and Electronic Trade teachers in Niger and Katsina states?

Table 1: Mean Responses of EET Teachers on Innovative Teaching Methods Adopted

SN	Items	$\bar{X}_{YT}$	SD_{YT}	$\bar{X}_{OT}$	SD_{OT}	Remark
1.	Cognitive task analysis-based instructional methods is used to teach electronic work	2.34	0.99	1.36	0.56	Disagreed
2.	Self-directed learning is used to teach electrical and electronic concepts	2.59	0.68	2.00	0.79	Disagreed
3.	Meaningful and active Interaction between students is facilitated	2.84	0.97	1.73	0.96	Disagreed
4.	Questioning teaching method is employed in the teaching of electrical and electronic concepts	2.75	0.80	2.21	0.90	Disagreed
5.	Active interaction between teachers and students is encouraged in electronic classes	2.69	0.76	1.46	0.56	Disagreed
6.	Teachers encourage debate of ideas related to electrical and electronic concepts between students	2.99	0.79	1.99	0.95	Disagreed
7.	Teachers control students during collaborative task performances in electronic workshops	2.75	0.99	1.45	0.75	Disagreed
8.	Problem-based learning is facilitated in electrical and electronic teaching	2.87	0.97	2.58	0.89	Disagreed
9.	Traditional task analysis-based instructional methods is employed to teach electronic work	1.00	0.95	1.13	0.79	Disagreed
10.	Students are tasked with case study assignments to understand electrical installation work	2.42	0.97	2.62	0.99	Disagreed
11.	Teachers use cooperative learning as a teaching method in electrical principles and practice	1.97	0.89	1.00	0.97	Disagreed
12.	Students are taken for excursions to various electrical and electronic industries from time to time in line with course objectives	2.73	0.86	2.53	0.76	Disagreed
13.	Students are employed in joint activities to articulate their opinions, predictions and interpretation of electrical and electronic tasks and concepts	2.25	0.89	2.93	0.98	Disagreed
14.	Students are encouraged to apply core academic skills and creativity to diagnose and repair electrical appliances in real	1.78	0.78	1.00	0.97	Disagreed

	world situation					
15.	Teachers assign electrical and electronic project works to students	2.37	0.98	2.64	0.96	Disagreed
16.	Teachers act as facilitators rather than disseminators in electronic practical classes	2.59	0.99	2.11	0.95	Disagreed
17.	Team members in any electrical instructional transaction are obliged to rely on each other to achieve the goal of task performance	2.84	0.95	2.00	0.98	Disagreed
18.	Students that carry out electronic appliances repair in cooperation are held responsible for individual task performances and mastery	2.35	0.87	1.77	0.89	Disagreed
19.	Guided-discovery teaching method is employed in electronic repair task performances	2.79	0.89	2.06	0.96	Disagreed
20.	Computer generated graphics are used to illustrate electronic related relationships that cannot be done by pictures	2.75	0.97	2.21	0.92	Disagreed
21.	Students' critical thinking skills are developed through posing, investigating and asking questions that are related to electrical concepts	2.70	0.82	1.87	0.95	Disagreed
22.	Teachers engage in step-by-step demonstration of electrical and electronic practical task performances before tasking students	2.09	0.98	1.43	0.94	Disagreed
23.	Students' inquisitiveness and discoveries in electrical and electronics are promptly responded to	2.30	0.90	2.12	0.86	Disagreed
24.	Teachers employ the use of inquiry-based learning to teach electronic work	2.99	0.94	1.96	0.89	Disagreed
25.	Teachers manage students' multiple suggestions and discoveries at the same time	2.69	0.95	1.56	0.90	Disagreed
26.	Intelligently formulated electrical installation scenarios that provoke students critical thinking are facilitated	2.55	0.98	2.00	0.47	Disagreed
27.	Exploration method is used as a means of instruction in appliances repairs	2.75	0.69	1.65	0.90	Disagreed
28.	Students are helped to generate their own content-related problems and be guided through the investigation that	2.76	0.79	1.70	0.96	Disagreed

	fallows in electronic troubleshooting					
29.	Teachers use demonstration method for instruction in electrical and electronic trade	2.98	0.97	1.00	0.91	Disagreed
30.	Teachers employ the use of animations to illustrate abstract ideas such movement of current in a conductor	2.67	0.98	2.32	0.94	Disagreed
31.	Teachers mentor, advise and facilitate project tasks accomplishment for students in electrical practical classes	2.71	0.90	2.63	0.98	Disagreed
32.	Practical tasks in electronics troubleshooting are analyzed in substantially more detailed form based on their cognitive components	2.77	0.85	2.25	0.90	Disagreed
33.	Teachers provide a systemic process for identifying the cognitive elements and activities needed for task performances	2.00	0.48	1.96	0.95	Disagreed
34.	Task performances in radio and television repair work are broken into series of overt observable behaviours that support the performances	2.64	0.97	2.31	0.90	Disagreed

Key: $\bar{X}_{YT}$ = Mean Scores of Young EET Teachers, SD_{YT} = Standard Deviation of Young EET Teachers, $\bar{X}_{OT}$ = Mean Scores of Old EET Teachers, SD_{OT} = Standard Deviation of Old EET Teachers,

Data presented in Table 1 shows that the respondents disagreed/did not adopt all the items on innovative teaching methods adopted by EET teachers in Niger and Katsina states.

Research Question 2

What are the factors affecting the adoption of innovative teaching methods by Electrical and Electronic Trade teachers in Niger and Katsina states?

Table 2: Mean Responses of EET Teachers on Factors Affecting the Adoption of Innovative Teaching Methods

SN	Items	$\bar{X}_{YT}$	SD_{YT}	$\bar{X}_{OT}$	SD_{OT}	Remark
35.	The school environment is not conducive for the adoption of new teaching methods relevant to electrical and electronic trade	4.48	1.98	4.50	1.65	Agreed
36.	Experimenting new teaching methods is difficult due to large class size of electrical and electronic trade	2.65	1.92	2.78	1.66	Agreed
37.	Teachers' lack of sufficient skills required to experiment new teaching methods relevant to electrical and electronic trade	4.29	1.90	4.27	1.68	Agreed
38.	Unawareness of innovative teaching methods applicable to electrical and electronic trade	4.99	1.80	4.95	1.71	Agreed
39.	Workshops and conferences in which teaching methods are discussed are not forthcoming	4.89	1.44	4.98	1.69	Agreed
40.	Training on pedagogies related to the teaching of electrical and electronic trade is not encouraged by higher authority	4.32	0.99	4.48	1.76	Agreed
41.	Electrical and electronic trade teachers do not interact with their colleagues in the same profession from different institutions of learning	4.36	1.76	4.58	1.61	Agreed
42.	Lack of access to internet to browse on innovative teaching methods relevant to electrical and electronic trade	4.37	1.98	4.38	1.66	Agreed
43.	Reluctance towards the adoption of new innovative teaching methods suitable for the effective teaching of electrical and electronic trade	4.40	1.90	4.58	1.65	Agreed
44.	Innovative teaching methods relevant to electrical and electronic trade instruction are too difficult to adopt	4.99	1.93	4.88	1.69	Agreed
45.	Lack of sharing of new ideas with colleagues from the same institution	4.68	1.95	4.49	1.87	Agreed
46.	The school does not allow new methods of teaching to be trial tested	4.56	1.91	4.38	1.90	Agreed
47.	There is no enough time in the school calendar to enable new methods of	4.81	1.96	4.78	1.71	Agreed

	teaching to be tested					
48.	Innovative teaching methods relevant to electrical and electronic trade are not perceived as advantageous	2.38	1.92	2.52	1.91	Agreed
49.	Most electrical and electronic innovative teaching methods are not compatible with the school system	4.25	1.93	4.36	1.36	Agreed
50.	Most innovative teaching methods related to electrical and electronic trade are complicated and difficult to understand and apply	4.48	1.95	4.39	1.69	Agreed
51.	The workload in electrical and electronic trade is too high for innovative teaching methods to be employed	4.59	1.95	4.55	1.67	Agreed
52.	Most innovative teaching methods are against the electrical and electronic trade teachers' belief, values and opinions	4.45	1.90	4.57	1.61	Agreed

Key: $\bar{X}_{YT}$ = Mean Scores of Young EET Teachers, SD_{YT} = Standard Deviation of Young EET Teachers, $\bar{X}_{OT}$ = Mean Scores of Old EET Teachers, SD_{OT} = Standard Deviation of Old EET Teachers

The result emerging from table 2 reveals that the respondents agreed with all the items concerning factors affecting the adoption of innovative teaching methods by EET teachers in Niger and Katsina. These include: difficulty in experimenting new teaching methods by the teachers, teachers' lack of awareness of innovative teaching methods, lack of internet to browse on innovative teaching methods among others.

Hypothesis 1

There is no significant difference between the mean rating of old and young EET teachers on innovative teaching methods adopted by Electrical and Electronic Trade teachers in Niger and Katsina states

Table 3: Z-test Analysis on the Innovative Teaching Methods Adopted by EET Teachers

Subjects	$\bar{X}$	SD	N	df	Z-cal	Z-critical	Decision
YT	2.84	0.98	59.00				
				122.00	7.46	1.65	**Rejected**
OT	1.67	0.76	65.00				

Level of significance = 0.05

Key: OT= Old Teachers, YT = Young Teachers, $\bar{X}$ = Mean SD = Standard Deviation and df = Degree of Freedom.

Result shown in Table 3 reveals that with Z-cal value of 7.46 which is greater than Z-critical value of 1.65 (from Z-table) at 0.05 level of significance and 122.00

degree of freedom, the null-hypothesis is rejected. Hence, there is significant difference between the Mean ratings of old and young EET teachers on innovative teaching methods adopted. Furthermore, Young Teachers (YT) Mean score of 2.84 is greater than that of Old Teachers (OT) Mean score of 1.67. However, both Mean scores are less than 2. 99 (the value of Mean at which responses are agreed upon). This means that even though both teachers did not adopt innovative teaching methods, the young EET teachers are more likely to adopt them than their older colleagues.

Hypothesis 2

There is no significant difference between the mean rating of old and young EET teachers on factors affecting the adoption of innovative teaching methods by Electrical and Electronic Trade teachers in Niger and Katsina states.

Table 4: Z-test Analysis on Factors Affection the Adoption of Innovative Teaching Methods by EET Teachers

Subjects	$\bar{X}$	SD	N	df	Z-cal	Z-critical	Decision
YT	4.48	1.92	59.00	122.00	0.06	1.65	**Accepted**
OT	4.50	1.67	65.00				

Level of significance = 0.05
Key: OT= Old Teachers, YT = Young Teachers, $\bar{X}$ = Mean SD = Standard Deviation and df = Degree of Freedom.

Result emerging from Table 4 reveals that with Z-cal value of 0.06 which is less than the Z-critical value of 1.65 (from Z-table) at 0.05 significance level and 122.00 degree of freedom, the null hypothesis was accepted. This means that significant difference did not exist between the mean responses of old and young EET teachers on the factors that hindered them from adopting innovative teaching methods.

Discussion

The findings of this study presented in Table 1 revealed that the respondents disagreed/did not adopt all the items on innovative teaching methods in Niger and Katsina states. This implies that innovative teaching methods that are more effective in the teaching of EET as observed by pedagogues such as Raymond and Ogbuanya (2014); Atsumbe, Raymond and Ajunwa (2015); Doris and Rosa (2014) and others were not adopted by the EET teachers in Niger and Katsina states' technical colleges. These include: Problem-based teaching; self-directed learning, debate and questioning; cooperative learning; cognitive and traditional task analysis-based instructional guides; animation teaching method; project-based teaching method, discussion and demonstration among others. This finding contradicts the assertion of Neo and Neo (2001) who projected that many institutions around the globe are moving towards the use of innovative teaching methods such as problem-based learning so as to promote creative and critical thinking skills in graduates who can solve problems analytically. Findings from z-test analysis on hypothesis 1 at 0.05 level of significance as shown in

Table 3 also revealed that there is significant difference between the mean ratings of old and young EET teachers on the innovative teaching methods they adopted. More so, the young teachers had a mean score of 2.84 which is greater than that of their older colleagues which is 1.67. However, both mean scores are less than 2.99 (the value of mean at which responses are agreed upon or accepted). This means that even though both teachers did not adopt innovative teaching methods, the young EET teachers are more likely to adopt innovative teaching methods than their older contemporaries. This finding is in disagreement with that of Lau and Sim (2008) who stated that older teachers are more likely to incorporate innovations such as the use of computer in their teaching than younger teachers in the same profession. The possible explanation to this finding may be the perceived tendency of younger individuals being more interested in the use of computer and other innovative ideas than their older colleagues in developing countries like Nigeria.

Finding presented in Table 2 revealed the factors affecting the adoption of innovative teaching methods by EET teachers in Niger and Katsina states. These include: The school environment is not conducive for the adoption of new teaching methods relevant to electrical and electronic trade; perceived difficulty of adopting innovative teaching methods; teachers' lack of sufficient skills required to experiment new teaching methods relevant to electrical and electronic trade; and EET teachers' unawareness of innovative teaching methods applicable to electrical and electronic trade among others. This finding is in consonance with that of Britnell (2010) who discovered that lack of formal training such as skills in research methods to experiment new ideas is one of the factors affecting adoption of innovation. In the same vein, the finding of this study tallies with the opinion of Yvonne (2009) who pointed out that lack of awareness of innovation is one of the factors that hinder its adoption in a social system. Furthermore, as shown in Table 4, findings further revealed from z-test analysis on hypothesis 2 at 0.05 level of significance that there is no significant difference between the mean ratings of old and young EET teachers on factors affecting the adoption of innovative teaching methods in Niger and Katsina states. This means that both categories of teachers agree with the stated factors as those that hinder or prevent them from adopting innovative teaching methods.

Generally, the findings in this study are in harmony with Rogers (2003) theory of diffusion of innovation. The theory states that diffusion of innovation is the process by which it is communicated through certain channels over time among the members of a social system. The four main elements in the diffusion of innovation are the innovation itself; the communication channels; the time; and the social system. Therefore, simply put in line with the present findings, innovative teaching methods such as animation teaching method, demonstration, project-based teaching method among others would have been adopted by EET teachers if not for the stated factors that hinder this diffusion. For instance, the high mean scores of 4.99 and 4.95 for item 38 as well as 4.99 and 4.88 for item 44 as shown in Table 3 means that there is lack of awareness and perceived difficulty to adopt innovative teaching methods among EET teachers. These factors are similar to the observability and complexity factors of innovation as suggested by Rogers among other elements. Therefore, it is correct to assert that Rogers's Diffusion of

Innovation Theory can be adopted as a framework for the transmission of innovative teaching methods in the context of Niger and Katsina states Technical Colleges.

Conclusion and Recommendations

The dynamic demand for different types of electrical and electronic skills in the global labour market depends largely on the applied technology by Electrical and Electronic Trade (EET) graduates. Consequently, researchers in technical education have experimented innovative teaching methods relevant to the effective teaching of (EET) in technical colleges. The present study investigated the innovative teaching methods adopted by EET teachers in Niger and Katsina states. Findings revealed that teachers did not adopt these innovative teaching methods due to some restraining factors. Based on these findings, it can be concluded that there is a gap between the discovery of innovative teaching methods in EET and the adoption of such by EET teachers. It is therefore recommended based on these findings that:

1. EET teachers should be encouraged to undergo further studies and training on pedagogies to acquire skills needed for innovative teaching methods;
2. Workshops and seminars should be organised to promote interaction and create awareness among teachers on innovative teaching methods;
3. The school environment should be made conducive for the experimentation and adoption of innovative teaching methods;
4. Computer and internet facility should be provides in Niger and Katsina states technical colleges to promote the practice of innovative teaching methods;
5. Incentives should be used to motivate Old and young EET teachers towards the adoption of innovative teaching methods with priority given to old teachers who were more reluctant to adopt innovative teaching methods as discovered in this study.

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