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Research Paper

Comparative Effects of Self-Concept and Self-Belief Teaching Techniques in Electrical Installation and Maintenance Work Students' Psychomotor Achievement in Technical Colleges, In Nigeria

IGRUBIA, victor
Technical Education Department Isaac Jasper Boro College of Education Sagbama, Bayelsa State

SHETIMA, Abdullahi
Faculty of Vocational and Technical Education Department Industrial Technical Education University of Nigeria, Nsukka

PAUL,Thomas Muge
c/o st. Micheal's Catholic Church P.O Box 1038 Anguldi, Zawan Jos Plateau.

ABSTRACT
This study is a comparative effect of Self-Concept and Self-Believe Teaching Techniques in Electrical Installation and Maintenance Work Students' psychomotor in Technical Colleges. The study adopted the quasi-experimental research design, pre-test protest, the study was carried out in Nigeria which is located in Nigeria and this study used two Government Technical Colleges (Tombia and Kuma). The population for the study is 247 NTC II students with a sample of 99 students which comprises of 72 boys and 27 girls. An intact class was used, the researcher developed three instruments based on the literature reviewed and whose used for this study. Electrical Installation and Maintenance Work Psychomotor Test (EIMWPT) with 20 items three null hypotheses guided this study. Three experts from the department of industrial Technical Education, University of Nigeria, Nsukka validated the instruments used for the study. The pilot test with GTC Port Harcourt and administered to 58 NTC II students and the reliability was determined using Pearson Product Moment Correlation Coefficient. The researcher used two research assistants for data collection of data. The data collected were analyzed using ANCOVA was used to test the null hypothesis at 0.05 levels of significance. self-believe teaching technique was effective in improving the students' psychomotor achievement for male students. while self-concept teaching technique in favour of female students. no significant difference in both but significant difference between the mean score of male and female students and interactive effect in students that were taught Electrical Installation and Maintenance Work using Self-believe and Self-concept teaching techniques. Recommendations: Technical College teachers should adopt the use of Self-concept and Self-believe Teaching Techniques in the teaching of Electrical Installation and Maintenance Work. National Board for Technical Education (NBTE) should consider review of curriculum for electrical installation and maintenance work programme with a view to incorporating the Self-concept and Self-believe Teaching Techniques into the teaching of Electrical Installation and Maintenance Work.

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I. INTRODUCTION

The biosphere today is being driven by knowledge, and many modern technologies are transforming into more knowledge-based technology. New information's are being generated every day while the old are being polished, reviewed and reinterpreted in the context of new believe and concepts realities. According to Myers (2009) concept involves interpreting ideas, relationships, connections, or having a sense of something. In concept learning, students are actively involved in processing information and ideas. Atherley (2011) specified that concept teaching technique is a strategy adopted by teachers in which students interact with other students, explain and discuss each other's problems, which may lead to greater self-understanding of concepts. Concept

learning encompasses learning how to discriminate and categorize things (with critical attributes). Therefore, Concept learning directed at an individual is referred to as self-concept.

Self-Concept is the total picture a person has of himself or herself. It is composite of the traits, values, thoughts and feelings that one has of oneself (Baumeister, 2006). It represents sum of an individual's beliefs and attributes. It also reflects how an individual evaluates oneself in domains such as scholastic ability, behavior, conduct, close friendship and social acceptance in which one considers success important. Self-concept teaching technique refers to teachers using measurements, manipulators or constructive activities or patterns, to discover relationships (Bong & Skaalvik, 2003). The relationships that are discovered are based on observations, experience, inferences and conclusions. According to Bong and Skaalvik (2003) self-concept teaching technique has five phases. In phase one the teacher explains the purposes of the lesson, describes why concepts are important, and gets students ready to learn. Phase two consists of presentation of examples and non- examples of the concept. The teacher gives examples and non-examples and the students strive to discover the concept and its attributes through inductive reasoning. In the third phase, after the concept has been discovered, the teacher gives more examples and non- examples, and then asks students to provide examples and non-examples. The purpose of this tactic is to test students understanding of the concept and its attributes. The fourth phase encourages student - student interactions on understanding of concept and its attributes. A self-concept teaching technique lesson is concluded with the fifth phase, with the teacher asking students to analyze their thinking patterns, techniques, and decisions in order to develop more effective thinking skills and to help students integrate the new concepts into existing knowledge. The learning environment (classroom) for self-concept teaching technique has a moderate degree of structure in that the teacher controls the first three and the fifth phases of the lesson. The fourth phase is more open to students as students gain more experience with the concept learning, they can assume increased responsibility for their learning as the lesson proceeds. When a student retains what was learnt, his or her self-believe is affected.

Self-believe is developed from inside. It is human's power base of energy that they were born with. Self-believe intimately depend upon the value that an individual place on something and on that individual's attitude towards that value (Roebken 2007). The assumption is that the belief that people create, develop and hold to be true about themselves is a vital force in their success or failure in all endeavors. Self-believe teaching technique is the act of breaking behavior and skills into component tasks and mastering each sub-component. According to Roebken (2007) self-believe teaching technique is an approach used by teachers to ensure that students master concepts taught through fixed pattern of learning procedures. Roebken stated that, self-believe teaching technique has its root in behaviorism. Bandura (1997) says that behavioral theorists emphasize breaking behavior and skills into component tasks and mastering each sub-component. Self-believe teaching technique emphasizes the importance of modelling desired behavior and using feedback and reinforcement to guide students toward desired goals. Ingledew, Wray, Markland and Hardy (2005) stated that self-believe teaching technique studies the relationship between teaching behavior and student achievement in classrooms. Bong and Skaalvik (2003) pointed out that a self-believe teaching technique lesson proceeds through four phases. Teachers begin the lesson with an orientation phase, which includes clarification of the goals of the lesson, explanation of the importance of the lesson, connects the lesson to previous lessons and students' prior knowledge, and motivates students. This establishes the students' mental set and prepares them for the lesson. This initial phase is followed by phase two, presentation or demonstration. The teacher demonstrates the skill or presents new information. If a skill is being taught, each step must be identified and demonstrated accurately. If new information is being taught, the information must be well organized and logically presented. Teachers give multiple examples, provide accurate demonstrations, restate the information often, and use visual models or illustrations. The third phase is guided practice. The teacher structures the initial practice by demonstrating to the students through step-by-step and giving feedback on correct and incorrect responses. When students comprehend, the teacher moves to guided practice in which students work independently while the teacher monitors students work and gives individual feedback. According to Bong and Skaalvik (2003), guided practice is most effective in short increments repeated over time. At the end of guided practice, phase four tests for understanding and provides feedback, formally or informally assessment. The most common tactic in this phase of the lesson is the teacher questioning, assessing independent work and giving quiz. Feedback is given as soon as possible after the practice and is specific and focused on behavior which improves students' technical skills

Technical skills are acquired through repetition and manipulation skills of particular tasks, which are accompanied by evaluation and feedback to assess the progress and provide additional skill in work. Psychomotor according to Salihu (2014) is a degree of skill demonstrated by an operator in the completion of a task. Psychomotor task in a college subject is represented by the practical skills used to carry out a task and obtained scores or marks in a performance test. Okoro (2006) explained that performance test involves the use of tools and equipment in a direct assessment of the amount of practical skills possessed by students. Psychomotor achievement is controlled by several factors among which are the instructional method, techniques, learner, instructional delivery and the subject matter (Atherson, 2003). While Owodunni (2009) stated that considerable mastery is required in teaching electrical subject coupled with rapid electrical

technological changes in the world. However, he also observed that students' cognitive and psychomotor achievement may also be influenced by gender of the student.

Gender refers to sex difference which is the status of being male or female (Raymond 2013) also states that gender factor has assumed prominence in engineering, science, vocational and technical education subjects in Nigeria educational system, gender is important as it tends to influence the pattern of school enrolment and academic performance of students. Raymond opined that the general societal belief that engineering related tasks belong to the male students which could be responsible for the high ratio of male to female in electrical trades in Technical Colleges in Nigeria. Owodunni (2010) positions that gender roles affect familiarity with academic content, career aspirations, attitude toward subjects, teacher expectations and preferred approaches which also affect academic performance. The author also explains that disparity exists between male and female students' performance in engineering, science, vocational and technical subjects. This study will therefore, ascertain if students' psychomotor in studying electrical installation and maintenance work will be influenced by gender after being exposed to self-concept and self-believe teaching techniques. Instructional technique rooted in self-concept or self-believe teaching techniques may seem to provide a learning environment that gives students deeper engagement in the learning process which may influence students' retention of learning.

Electrical Installation and Maintenance Work comprises Electrical Drawing, Basic Electricity and Electronics, Introduction to Domestic Electrical Appliances, Domestic Installation, Industrial Installation, Cable Jointing and Winding of Electrical Machines (NBTE, 2001). Electrical Installation according to Gupta (2005) is a process of fixing in a building, various kinds of electrical apparatus, connecting wires and control gears in position ready for use. Gupta (2013) registered the following as types of electrical installation: bare conductor wiring, rubber sheathed wiring, polyvinyl chloride (PVC) wiring used in sheathed wiring of earthed concentric installation, mineral insulted installations, and electrical machine installation. Electrical installation and maintenance work is one of the vocational trade studied in Technical Colleges in Nigeria.

Technical colleges are institutions where students are trained to acquire relevant knowledge and skills in different occupations for employment in the real world. According to the Federal Government of Nigeria (FGN 2004), technical colleges form part of technical and vocational education designed to produce craftsmen at the secondary school level and master craftsmen at the advanced craft level. The goals of the functional colleges are to provide trained workers in the applied sciences, technology, and business, especially in the advanced craft and technician levels. Technical college students are expected to put learning into practice using newer techniques of applying devices, materials, tools, equipment, machinery, and other resources to enable electricians to solve practical problems (Salihu, 2014). The techniques include the manipulation of materials or objects in the form of work tasks, such as lighting a lamp, tightening or unscrewing a socket outlet as part of the complex process of dismantling and re-assembling a burned distribution chamber in an electrical installation. Hence, complementary techniques of preparing may well motivate students to learn better.

The challenge of preparing Technical College students for the 21st century electrical workplace, therefore, necessitates a shift in the instructional delivery system used in the teaching of electrical installation and maintenance work in Technical Colleges. The traditional instructional methods especially lecture and demonstration teaching methods though used for so many years in the teaching of electrical installation and maintenance work seem today inadequate for equipping students with skills such as creative skills, higher order thinking skills and problem-solving skills needed by the students to thrive as craftsmen in the 21st century electrical workplace. This is because the teaching methods are executed by teacher centered activities; hence most students are not always given enough opportunity to participate actively in the teaching/learning process. These teaching methods emphasize knowledge transmission from the teacher to passive students and encourage rote memorization of facts and concepts (Boyle, Duffy & Dunleavy, 2011). Therefore, self-concept and self-believe teaching techniques may overcome the challenges of preparing technical teachers due to the phase skills adopted in the strategies. It is against this background that this study determined the comparative effect of self-concept and self-believe teaching techniques in Electrical Installation and Maintenance Work student's psychomotor in Technical Colleges in Nigeria.

Statement of the Problem

The skills needed in installation works are becoming increasingly complex. This is as a result of the rapid rate of technological development in the world of work. The electrical industrial work place practices have improved technologically especially in the 21st century where employers in the electrical industries are seeking for employees with workplace skills such as higher order thinking skills, creativity and problem-solving skills. The conventional teaching methods adopted by most electrical installation and maintenance work teachers in Technical Colleges seem not to be adequate for equipping the electrical installation craftsmen with the workplace skills such as adaptability, creativity, flexibility, high order thinking and problem solving. These teaching and learning methods are teacher-centered, hence, do not give students enough opportunities to think for themselves and actively participate in the learning process.

The short coming of these methods of teaching could partly be responsible for the poor performance of electrical installation and maintenance work students in examinations conducted in Government Technical Colleges in Nigeria which shows that in 2014/2015, 2015/2016 and 2016/2017 sessions, the average results have not been encouraging. In the year 2014/2015, out of 204 students that sat for terminal examinations in Government Technical Colleges in Nigeria only 61 students representing 30 per cent made a pass grade of credit to merit while 143 students representing 70 per cent failed. Also, in the year 2015/2016, out of 179 students that sat for the same examination only 49 students (27%) made a pass grade of credit to merit, while 130 students (73%) failed, and in the year 2016/2017, out of 164 students that sat for the examination only 59 students (36%) made a pass grade of credit to merit, while 105 students (64%) failed students. (Exams and Record, Ministry Education, Nigera).

This continuous poor academic achievement of most Electrical Installation and Maintenance Work students in Technical Colleges is worrisome and in no doubt reduces students' interest, leads to poor knowledge retention in electrical installation and maintenance work and has other adverse effect on the entire objectives of the course. These failures could be traced to the current adopted teaching method. Hence, it is necessary to adopt instructional approaches that would be more effective in improving students' interest, achievement and retention in electrical installation and maintenance work. This study is, therefore, designed to determine the effects of self-concept and self-believe teaching techniques in electrical installation and maintenance work students' interest, achievement and retention in Technical Colleges in Nigeria.

Research Questions

The following research questions are posed to guide the study:

1. What is the comparative effect of self-concept and self-believe teaching techniques on students' psychomotor achievement in electrical installation and maintenance work?
2. What is the influence of gender (male and female) on students' Psychomotor achievement in electrical installation and maintenance work?

Hypotheses

H_{07}: There is no significant difference between the mean effect of self-concept and self believe teaching technique on students' psychomotor achievement in electrical installation and maintenance work.

H_{08}: There is no significant difference between the mean effect of gender on electrical installation and maintenance work psychomotor achievement of students (male and female) when taught using self-concept and self believe teaching technique.

H_{09}: There is no significant interaction effect of treatment and gender on students' psychomotor achievement taught using self-concept and self believe teaching technique in electrical installation and maintenance work.

II. METHODOLOGY

The study was comparative effect of Self-Concept and Self-Believe Teaching Techniques in Electrical Installation and Maintenance Work Students' psychomotor in Technical Colleges. The study adopted the quasi-experimental research design, pre-test protest, the study was carried out in Nigeria and this study used two Government Technical Colleges (Tombia and Kumo). The population for the study is 247 NTC II students with a sample of 99 students which comprises of 72 boys and 27 girls. An intact class was used, the researcher developed three instruments based on the literature reviewed and whose used for this study. Electrical Installation and Maintenance Work Psychomotor Test (EIMWPT) with 20 items three null hypotheses guided this study. Three experts from the department of industrial Technical Education, University of Nigeria, Nsukka validated the instruments used for the study. The pilot test with GTC Port Harcourt and administered to 58 NTC II students and the reliability was determined using Pearson Product Moment Correlation Coefficient. The researcher used two research assistants for data collection of data. The data collected were analyzed using ANCOVA was used to test the null hypothesis at 0.05 levels of significance.

III. RESULTS

Research Question 1

What is the comparative effect of Self-concept and Self-belief teaching techniques on students' psychomotor achievement in electrical installation and maintenance work?

Table 1: Means and Standard Deviation Pre-Test and Post-Test Scores of Self-Concept and Self-Believe Teaching Techniques in the Psychomotor Achievement Test in Electrical Installation and Maintenance Work

		Pretest		Posttest		Mean Gain
Treatment group	**N**	**X_1**	**SD_1**	**X_2**	**SD_2**	
Self-Believe	48	93.06	4.41	10.71	2.65	82.35

Self-Concept	51	83.63	4.67	22.94	2.97	60.69 21.66

The data presented in table 1 show that Self-believe teaching technique had a pre-test mean score of 10.71 and standard deviation of 2.65 and a post-test mean score of 93.06 and standard deviation of 4.41 making a pre-test post-test mean gain of 82.35. Self-concept teaching technique had a pre-test mean score of 22.94 and standard deviation of 2.97and post-test mean score of 83.63 and standard deviation 4.67 and mean gain of 60.69. With these results both Self-believe and Self-concept teaching techniques are effective in improving students' psychomotor achievement in Electrical Installation and Maintenance Work but the effect of self-believe teaching technique in improving the students' psychomotor achievement Electrical Installation and Maintenance Work is higher than that of self-concept teaching technique. There is a mean gain difference of 21.66 in favour of self-believe teaching technique.

Research Question 2

What is the influence of gender on students' psychomotor achievement in electrical installation and maintenance work?

Table 2: Mean and Standard Deviation of Pre-Test and Post-Test Scores on Male and Female Students Psychomotor Achievement in Electrical Installation Maintenance Work

			Posttest		Pretest		Mean Gain
Treatment group	**N**	**Gender**	**X_1**	**SD_1**	**X_2**	**SD_2**	
Self-Believe	36	Male	93.06	3.79	10.56	2.86	82.50
	12	Female	93.08	6.11	11.17	1.90	81.91 0.59
Self-Concept	37	Male	83.86	4.85	23.51	2.67	60.35
	14	Female	83.00	4.26	21.43	3.27	61.57 1.22

The data presented in table 2 show that, male students taught Electrical Installation and Maintenance using self-believe teaching technique had a pre-test mean score of 10.56 and standard deviation of 2.86 and post-test mean score of 93.06 and standard deviation of 3.79 making a pre-test post-test gain of 82.50. Female students taught Electrical Installation and Maintenance using self believe teaching technique had a pre-test mean score of 11.17 and standard deviation of 1.90 and post-test mean score of 93.08 and standard deviation 6.11 making a pre-test- post-test mean gain of 81.91. Also, male students taught Electrical Installation and Maintenance Work using self-concept teaching technique had a pre-test mean score of 23.51 and standard deviation of 2.67 and post-test mean score of 83.86 and standard deviation of 4.85 making a pre-test post-test mean gain of 60.35. At the same time, female students taught Electrical Installation and Maintenance Work using self-concept teaching technique had a pre-test mean score of 21.43 and standard deviation of 3.27 and post-test mean score of 83.00 and standard deviation of 4.26 making a mean gain of 61.57.

With these results, male students taught Electrical Installation and Maintenance Work using self-believe teaching technique had slightly higher post-test mean scores than female students in the psychomotor achievement test with mean gain difference of 0.59. But female students taught Electrical Installation and Maintenance Work using self-believe teaching technique had a higher post-test mean gain than male student in psychomotor achievement test with mean gain difference of 1.22. Therefore, there is an effect attributed to gender on students' psychomotor achievement in Electrical Installation and Maintenance Work with self-believe teaching technique in favour of male students while self-concept teaching technique in favour of female students.

Table 3

Summary of analysis of Covariance (ANCOVA) or test significance on the Effect of either Self-concept and Self-believe Teaching Techniques on students' psychomotor achievement in Electrical Installation and Maintenance Work

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2307.915[a]	2	1153.957	58.365	.000
Intercept	17854.476	1	17854.476	903.050	.000
Psychomotor	106.689	1	106.689	5.396	.022
Group	833.851	1	833.851	42.175	.000
Error	1898.045	96	19.771		
Total	774386.000	99			
Corrected Total	4205.960	98			

a. R Squared = .549 (Adjusted R Squared = .539)

The data presented in Table 3 show the F calculated value for the group is 42.175 at 833.851 with significant value of 0.001 which is below 0.05. The null hypothesis (HO_7) is rejected at 0.05 level of significance. This implies that there is no significant difference between the psychomotor achievement mean scores of students that were taught Electrical Installation and Maintenance Work using Self-believe and Self-concept teaching techniques.

H_{02} There is no significant difference between the mean effects of gender on Electrical Installation and Maintenance Work psychomotor achievement of students (male and female) when taught using Self-believe and Self-concept Teaching Techniques.

Table 4
Summary of analysis of Covariance (ANCOVA) for Test Significance on the Effect of Self-concept and Self-believe Teaching Techniques on students' (male and female) psychomotor achievement in Electrical Installation and Maintenance Work

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2308.355[a]	4	577.089	28.587	.000
Intercept	16958.845	1	16958.845	840.076	.000
Psychomotor	99.525	1	99.525	4.930	.029
Group	814.319	1	814.319	40.338	.000
Gender	.397	1	.397	.020	.889
group * gender	.053	1	.053	.003	.959
Error	1897.605	94	20.187		
Total	774386.000	99			
Corrected Total	4205.960	98			

a. R Squared = .549 (Adjusted R Squared = .530)

The data presented in Table 4 show the F calculated value for the group is 0.02 at 0.397 with significant value of 0.889 which is above 0.05. The null hypothesis (HO_7) is accepted at 0.05 level of significance. This implies that there is no significant difference between the mean score of male and female students that were taught Electrical Installation and Maintenance Work using Self-believe and Self-concept teaching techniques.

H_{03} there is no significant interaction effect of treatment and gender on students' psychomotor achievement taught using Self-believe and Self-concept Teaching Techniques on students' interest in studying Electrical Installation and Maintenance Work.

Summary of analysis of Covariance (ANCOVA) for Test Significance on the Interactive Effect of Self-concept and Self-believe Teaching Techniques on students' (male and female) psychomotor achievement in Electrical Installation and Maintenance Work

Table 5

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2308.355[a]	4	577.089	28.587	.000
Intercept	16958.845	1	16958.845	840.076	.000
Psychomotor	99.525	1	99.525	4.930	.029
Group	814.319	1	814.319	40.338	.000
Gender	.397	1	.397	.020	.889
group * gender	.053	1	.053	.003	.959
Error	1897.605	94	20.187		
Total	774386.000	99			
Corrected Total	4205.960	98			

a. R Squared = .549 (Adjusted R Squared = .530)

The data presented in table 5 show the F calculated value for the group and gender is 0.03 at 0.053 with significant value of 0.959 which is above 0.05. The null hypothesis (HO_8) is accepted at 0.05 level of significance. This implies that there is no significant interactive effect between the mean score of male and female students that were taught Electrical Installation and Maintenance Work using Self-believe and Self-concept teaching techniques.

Findings

1. self-believe teaching technique was more effective in improving the students' psychomotor achievement in Electrical Installation and Maintenance Work

2. There was an effect attributed to gender on students' psychomotor achievement in Electrical Installation and Maintenance Work with self-believe teaching technique in favour of male students while self-concept teaching technique in favour of female students.
3. there was no significant difference between the psychomotor achievement mean scores of students that were taught Electrical Installation and Maintenance Work using Self-believe and Self-concept teaching techniques
4. There was significant difference between the mean score of male and female students that were taught Electrical Installation and Maintenance Work using Self-believe and Self-concept teaching techniques.
5. There was significant interactive effect between the mean score of male and female students that were taught Electrical Installation and Maintenance Work using Self-believe and Self-concept teaching techniques.

Implications

The findings of this study have implications for government and administrators of Technical Colleges, Technical teachers and National Board for Technical Education (NBTE). This study found out that Self-Concept Teaching Technique and Self-Believe Teaching Technique were positivity effective on cognitive achievement, psychomotor achievement and retention of learning in Electrical Installation and Maintenance Work. This finding implies that teachers have to adopt these techniques by incorporating it into the teaching and learning of Electrical Installation and Maintenance Work. The implication to the curriculum planners of technical programmes (such as NBTE) is that, they will develop appropriate Electrical Installation and Maintenance Work curriculum that will make provision for the teachers to adopt Self-Concept and Self-Believe teaching techniques used in the study.

IV. CONCLUSIONS

The Self-Concept and Self-Believe Teaching Techniques greatly affected the students learning of Electrical Installation and Maintenance Work. This was reflected in the students' cognitive, psychomotor achievements scores and retention of learning. In other words, students learnt Electrical Installation and Maintenance Work, psychomotor skills better because they were allowed to participate actively in the classroom teaching and learning by interacting with teacher, learning environment and their colleagues, work and learn together in groups. Also, students retained their learning for a longer time when they were allowed to think on possible solutions to a problem while engaging in practical activities with real objects, tools and machines collaboratively. It is hoped therefore, that if the self-concept teaching technique and self-believe teaching technique is taken into consideration in the teaching of any trade subject in the Technical Colleges, craftsmen trained will graduate from the Technical Colleges with knowledge, psychomotor skills, strong problem-solving skills, creative thinking, collaborative work and independent decision making skills will make them adaptable to the present and envisaged changes in the Electrical Industries occasioned by technological advancement. Consequently, the craftsmen will be able to improve on their learning and pass NABTEB examinations with better grades, contribute their quota to industrial development of the nation, and become employers of labour instead of hoping solely on paid employment.

V. RECOMMENDATION

1. Technical College teachers should adopt the use of Self-concept and Self-believe Teaching Techniques in the teaching of Electrical Installation and Maintenance Work.
2. National Board for Technical Education (NBTE) should consider review of curriculum for electrical installation and maintenance work programme with a view to incorporating the Self-concept and Self-believe Teaching Techniques into the teaching of Electrical Installation and Maintenance Work.

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