EFFECTS OF COGNITIVE TASK ANALYSIS-BASED INSTRUCTIONAL GUIDE ON STUDENTS’ ACHIEVEMENT IN ELECTRONICS WORK

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Abstract

This study determined the effects of cognitive task analysis-based instructional guides on technical college students’ achievement in electronics work. The study adopted a quasi-experimental design. The population of the study was 174 Technical college III (TC III) students of all the technical colleges offering Electronics Work in North central, Nigeria. The entire population of 174 students was used for the study from which 90 TC III students comprising of 79 male and 11 female constituted treatment group assigned to cognitive task analysis-based instruction, and 84 TC III students comprising 65 male and 19 female constituted control group assigned to conventional method. Two research questions and three null hypotheses, tested at 0.05 level of significance, guided the study. The instrument used for data collection was Electronics Work Troubleshooting Cognitive Achievement Test (EWTCAT). The instrument was subjected to validation by three experts in vocational and technical education. The trial test for determining the coefficient of stability of the EWTCAT was carried out using test re-test reliability technique. Pearson Product Moment Correlation coefficient was used to determine the reliability of the EWTCAT and it was found to be 0.83. While, the internal consistency of the EWTCAT was checked by Kuder-Richardson 20 (KR20) and was found to be 0.72. Mean was used to answer the research questions; while ANCOVA was employed to test the hypotheses. The study found out that cognitive task analysis-based instructional guide is more effective in improving students’ cognitive achievement in electronics work than the conventional method. There was an effect of gender on students’ cognitive achievement in electronics work favouring boys. Furthermore, the study found out that there are no significant interaction effects of treatment and gender on technical college students’ cognitive achievement in electronics work. It was therefore, recommended among others that Electronics teachers should adopt the use of cognitive task analysis-based instructional guide in teaching electronics.

Keywords: Cognitive Task Analysis, Electronics Works, Instructional Guide, and Students’ Achievement
I. Introduction

Cognitive task analysis (CTA) is a method of eliciting knowledge from experts that can inform more comprehensive instructional support materials for students. The goal of CTA is to elicit the conscious and non-conscious (automated) knowledge from experts in order to expose all the critical action and decision-making steps necessary to perform a task or solve a problem [1]. CTA by implication is a technique carried out to yield information about the knowledge, thought process and goal structures that underlie observable task performance. It captures information about both overt observable behavior and covert cognitive functions behind it to form an integrated whole [2]. Cognitive task analysis, seeks to relate the behavioural concerns of a task analysis with the internal knowledge concerns of cognitive science. Thus, a cognitive task analysis not only elicits the explicit knowledge of an expert, but it also examines the way the expert tries to accomplish the specific task through his perceptual and information processing abilities. [3] defines CTA as the general term used to describe a set of methods and techniques that specify the cognitive structures and process associated with task performance. The focal point is the underlying cognitive processes, rather than observable behaviours. For instance, monitoring of electronics signals on an oscilloscope is a cognitive activity that is necessary in the performance of electronics troubleshooting task.

The purpose of CTA is to model the actions and especially the knowledge and thinking that learners engage in when performing some tasks. In order to achieve this, CTA provides a systematic approach to capturing expert’s knowledge of a specific task from multiple experts that informs instructional design by revealing the knowledge and skills that must be taught to achieve performance goal [1]. CTA therefore is a systematic process of studying the cognitive processes and structures that support work performance because it identifies all the major steps, task and decisions experts employ in task performance, hence the analysis determines the knowledge, skills and strategies needed for effective task performance. By capturing the decision points and other cognitive processes, in addition to the action steps experts used in problem solving, instruction can be developed that have the potential of replicating expert performance [4].

CTA is concerned with what the learner must know or be able to do in order to complete a task [5]. Task analysis according to [6] is performed for several purposes including designing instruction in education. Task analysis performed for the purpose of designing instruction is concerned with articulating what the learner is required to do in terms of actions and/or cognitive processes to achieve identified objectives. Furthermore, [7] stated that task analysis is an approach that uses a variety of strategies to capture a description of the decisions and knowledge that experts use to perform complex tasks. Complex tasks are defined as those where performance requires the integrated use of both declarative (conceptual) and procedural (strategic) knowledge to perform tasks that often extend over many hours or days. Therefore, when the mental models used by experts can be elicited and represented by CTA, there is good evidence that it can be captured in an instructional guide and taught to students in order to improve academic performance.

An instructional guide is defined as step-by-step information for carrying out instruction which contains brief explanations and graphic or pictorial illustrations as needed [8]. Task analysis-based instructional guide is therefore, step-by-step information on the procedure for carrying out practical tasks which is developed by breaking down complex or large tasks into smaller ones for easy learning. Instructional guide provide a systematic step-by-step instructions that take learners from start to finish of a learning activity. [9] stated that an instructional guide provides a planned and logical organization of practical content and the instructional process designed to meet a given educational goal. The author further noted that instructional guide requires the selection and use of tools, equipment and materials. Appropriate checks and standards are also included so that the users know when a step is performed properly. Instructional guide provides a platform for instruction that engages all students in rigorous and dynamic learning which is necessary for knowledge acquisition. Task analysis-based instructional guide has the potentials to promote learning which may result in better mastery of knowledge in electronics. Therefore, it may be used to improve student academic achievement.

Achievement according to [10] refers to a measure of the student’s academic standing in relation to those of other students of his age. It is the learning outcomes of students which include knowledge and skills in a course of study such as electronic works. Furthermore, Student academic achievement according to [11] is the attainment of articulated objectives by students, measured through a variety of identified instruments, which result in excellence and the ability to thrive in the rapidly changing world. The Forum on Education and technology notes that improved student achievement include improved scores on standardized tests, increased application and production of knowledge for the real world and increased ability for students to manage learning. This implies that academic achievement is a measure of what a student knows or can do after training.
Students’ achievements need to be improved in order to prepare them to succeed in the rapidly changing world. This may be achieved through the use of instructional guide for instruction. In this regard, [12] stated that the use of instructional guide for pedagogical purposes may help students develop better understanding of a subject which may lead to improved performance in cognitive achievements.

Cognitive achievement refers to students’ performance in conceptual or factual knowledge in an area of study. According to [13], students’ cognitive achievement is measure of the students’ standing in theoretical knowledge in relation to that of other students of the same group. The authors further noted that a student cognitive knowledge in a subject is very crucial for his general progress in that area. Other researchers have also shown that cognitive knowledge accumulated by students in an area of study strongly affects their skills performance capability in such area [14]. In essence, students’ cognitive achievement and the acquisition of practical skills are highly related. There is, therefore, the need to get students to learn not just to pass theoretical examinations but to be able to apply their theoretical knowledge in carrying out practical skills to solve technological problems in practically oriented courses such as electronics work.

Cognitive achievement in technical education, especially electronics work has also been linked to gender because a lot of researches have been carried out on gender issues in science and technology education in which many differences have been documented between achievements of males and females. Many researchers [15] [16] feel that gender differences are one of the factors that affect academic performance. It is often argued that girls’ performance is poorer than that of boys in Affective, Cognitive and Psychomotor skills achievement [17] [18]. On the other hand some experts have reported that there is no significant difference between the performance of male and female students in Affective, Cognitive and psychomotor skills achievement [19] [20] [21] [22] and [23]. Furthermore, others argued that sex difference seems not to play any role on academic achievement. For instance, [24] stated that females are special and gifted like their male counterparts. Therefore, if females are exposed to similar learning conditions and challenges as males, they will compete equally as well. In the same vein, [25] maintained that the influence of sex related task, the contextual nature of the tasks, and the perceived difficulty of these tasks revealed that males scored higher than females on male’s related tasks and females score higher on female’s related tasks. He found out that there is no significant difference on a relatively common task among the sexes. These conflicting views necessitate the present study with a view to lending support to the actual situation in Nigeria. Task analysis-based instructional guide may offer tools for reducing gender differences in instructional setting.

Electronics work is a programme offered at the technical college level to give relevant training to electronic students [26]. Trainees are expected to among others, acquire knowledge and skills to enable them understand the principles and operation of electronic devices and also be able to troubleshoot or trace faults and repair electronics appliances. Troubleshooting in electronics according to [27] is the act of detecting, locating and rectifying faults in electronics systems. Over the years, electronics as a subject is being taught with the use of conventional methods such as lecture and demonstration. These conventional methods seems to place students in a passive role in the learning process which disallowed them from discovering their potentials. For students to be effective in Electronics troubleshooting there is the need for a sound cognitive or factual knowledge of the subject area and hence the need for it to be taught with effective instructional approaches such as task analysis. [28] suggested that task analysis should be used when a task is complex, when it is difficult to learn and when tasks are not pre-sequenced. Electronics work trade requires that the trainees be effective in applying knowledge acquired during teaching-learning process in solving new and unfamiliar problems on their own. In addition, one of the objectives of the training provided at the technical colleges as contained in the National Policy on Education is to empower the individual for self-employment [29]. However, more than two decades after adoption of the laudable initiative, majority of Technical college graduates are unemployed due to lack of required cognitive knowledge to be applied in solving problems when the need arise in electronics. The need for diversified instructional approach for teaching in electronics work therefore becomes imperative due to the present advancement in electronics technology which makes the conventional teaching methods (demonstration and lecture methods) inadequate. [30] reiterates that for successful teaching to occur, a variety of pedagogical approaches that focuses on providing activities for learners to perform either in group or individually that helps to create deeper, swifter and more effective learning should be applied in order to enhance their performance.

The use of task analysis-based instructional guide in the classroom is purported to increase students performance because it create experiences that involves and support
students’ participation in the learning process. The importance of CTA is based on compelling evidence that experts are not fully aware of about 70% of their own decisions and mental analysis of tasks [31] [32] and so are unable to explain them fully even when they intend to support the design of training, assessment, job aids, or work. CTA methods attempt to overcome this problem by specifying observational and interview strategies that permit designers/analyst to capture more accurate and complete description of how experts succeed at complex tasks. Research evidence [33] [34] strongly suggests huge potential benefits for instructors and learners when CTA-based instruction is used in training. For instance cognitive tasks in electronics troubleshooting include: monitoring of signals on oscilloscope, situation assessment in the operation of faulty electronics equipment and decision making after assessing situations. This follows that if cognitive task analysis-based instruction is used in teaching, it could improve students’ academic performance. Hence the need to use task analysis-based instructional guide for improving students’ cognitive achievement in electronics work.

A. Theoretical Framework

Current theories of learning emphasize the importance of actively engaging students in the learning process. Hence, the theoretical framework for this study was built around constructivism.

**Constructivism:** Constructivism emerged in the late 1970s by cognitive psychologists: Vygotsky (social constructivism) and Piaget (cognitive constructivism) [35]. The theory states that learners actively construct their own knowledge and meaning from their experiences [36] [37]. Constructivism is founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own rules and mental models, which we use to make sense of our experiences. Learning, therefore, is simply the process of adjusting our mental models to accommodate new experiences. According to [38], constructivist learning theory is based on the fact that all knowledge is constructed from a base of prior knowledge. Children are not a blank slate and knowledge cannot be imparted without the child making sense of it according to his or her current conceptions. Therefore children learn best when they are allowed to construct a personal understanding based on experiencing things and reflecting on those experiences. According to [39], constructivism acknowledges the learner’s active roles in the personal creation of knowledge, the importance of experience (both individual and social) in this knowledge creation process, and the realization that the knowledge created will vary in the degree of validity as an accurate representation of reality. Similarly, [40] proposed four essential epistemological tenets of constructivism: (1) Knowledge is not passively accumulated, but rather, is the result of active cognizing by individual. (2) Cognition is an adaptive process that functions to make an individual’s behavior more viable given a particular environment. (3) Cognition organizes and make sense of one’s experience, and (4) Knowing has root both in biological/neurological construction, and in social, cultural and language based interaction

These four fundamental tenets provide the foundation for basic principles of the teaching, learning and knowing process as described by constructivism. Furthermore, [38] noted that constructivism is a link between theory and practice, as such, there are some factors that are considered essential in constructivist pedagogy. It should however be noted that this principles are not solely constructivist in nature, the assemblage of these principles informs the basis for their inclusion: (1) Learning should take place in authentic and real world environments. (2) Learning should involve social negotiation and mediation. (3) Content and skills should be made relevant to the learners. (4) Content and skills should be understood within the frame work of the learner’s prior knowledge. (5) Student should to assessed formatively, serving to inform future learning experiences. (6) Student should be encourage to become self-regulatory, self-mediated, and self-aware. (7) Teachers serve primarily as guides and facilitators of learning, not instructors. (8) Teachers should provide for and encourage multiple perspectives and representation of content.

Based on these principles, it’s obvious that constructivism is a theory that suggests that learners construct knowledge out of their experiences which is associated with pedagogical approaches that promote learning by doing or active learning. Constructivist teaching focuses on independent learning, creativity, critical thinking and problem-solving. Constructivist teaching is based on the fact that skills and knowledge acquisition are not by passive receiving of information and role learning but involve active participation of the learners through knowledge construction, hands-on and mind-on activities [41]. The constructivist principles when applied in technical and vocational education dictate that teachers should expose students to an array of learning experiences for student to develop their abilities through the activities inherent in their experiences. The use of task analysis-based instructional guide can create learning experiences that imbibes the constructivist principles.

The review of literature on constructivism shows that it promotes a more open-ended learning experience where the learners are actively involved in the entire learning process. Constructivism shares some similarities with other theories
such as cognitivism. An example of their compatibility is the fact that they share the analogy of comparing or relating the process of the mind to the learning process [42]. Despite these similarities between cognitive and constructivism, the objective side of cognitivism supported the use of models to be used in the systems approach of instructional design. Constructivism is not compatible with the present systems approach to instructional design, as such, [38] points out that the difference between constructivist and objective instructional design is that objectivist design has a predetermined outcome and intervenes in the learning process to map a pre-determined concept of reality into the learner’s mind, while constructivism maintains that because learning outcomes are not always predictable, instruction should foster, not control, learning. Based on the fact that technical and vocational education is skills oriented, application of the principles of this theory in the teaching and learning of this type of education is important.

II. Purpose of the Study

The general purpose of the study is to determine the effects of cognitive task analysis-based instructional guide on student’s cognitive achievement in electronics work. Specifically, the study determined the effect of:

1. Cognitive task analysis-based instruction on students’ cognitive achievement in electronics work
2. Gender on cognitive achievement of students taught electronics work with cognitive task analysis-based instructional guide

III. Research Questions

The following research questions are formulated to guide the study:

1. What is the effect of cognitive task analysis-based instruction on students’ cognitive achievement in electronics work?
2. What is the effect of gender on the cognitive achievement of students taught electronics work with cognitive task analysis-based instructional guide?

IV. Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

HO₁: There is no significant difference in the cognitive achievement mean scores of students taught electronics work with cognitive task analysis-based instructional guide and those taught with conventional method.

HO₂: Gender will have no significant effect on the cognitive achievement mean scores of student taught electronics work with cognitive task analysis instructional guide and the conventional method

HO₃: There is no significant interaction effect of treatment given to students and their gender with respect to their cognitive achievement mean scores in electronics work

V. Methodology

The study adopted a quasi-experimental design. Specifically, the Pre-test Post-test non-equivalent control group design was used. The study was conducted in four technical colleges offering Electronics work in North-Central States of Nigeria. These include Federal Science and Technical College Shiroro-Kuta in Niger state, Federal Science Technical College Orozo, FCT Abuja, Government Technical College Assakio, Nassarawa state, Government Technical College Markudi, Benue State. The Population for the study consisted of all the 174 technical college III (TC III) student of all the four technical colleges offering Electronics work in North Central States of Nigeria. The entire population of 174 students was used for the study from which 90 TC III students which comprised 79 male and 11 female constituted treatment groups assigned to cognitive task analysis-based instructional guide, and 84 TC III students which comprised of 65 male and 19 female constituted the control groups assigned to conventional method. The instrument that was used for data collection is: Electronics Work Troubleshooting Cognitive Achievement Test (EWTCAT). The instrument was validated by three experts in Vocational Education. The trial test for determining the coefficient of stability of the EWTCAT was carried out using test re-test reliability technique. Pearson Product Moment Correlation coefficient was used to determine the reliability of the EWTCAT and it was found to be 0.83. While, the internal consistency of the EWTCAT was checked by Kuder-Richardson 20 (KR20) and was found to be 0.72. Data were collected by subjecting the treatment and control groups to Pre and Post-tests, in which the EWTCAT was used to collect data on students’ scores on cognitive achievement in Electronics work. Data collected were analyzed using Mean and ANCOVA. Mean was used to answer the research questions while ANCOVA was used to test the hypotheses at 0.05 level of significance.
VI. Experimental Procedures

The study was conducted during the normal school lesson period after the permission to conduct the study has been obtained from school principals. Electronics work instructors teaching in the same schools who have at least a minimum of five years teaching experience were used for teaching both the treatment and control groups. The instructors received two-week training on how to use or administer the instruments as well as how to use the instructional guide before commencement of lessons. Out of the four schools involved in the study, two were randomly assigned to treatment group; while the other two were assigned to control group. The treatment group was taught with cognitive task analysis-based instructional guide while the control group was taught with the conventional method (Lecture method). The treatment was made up of eight lessons carried in eight weeks. Each group met once a week for a period of 45 minutes. Electronics troubleshooting conceptual knowledge were presented to both treatment and control group within eight weeks.

The two groups were however, subjected to a pre-test (EWTCAT) before the treatment which was conducted by the teachers teaching these groups. The answer scripts were marked using the marking scheme to obtain students’ scores on achievement and before the treatment. After eight weeks of treatment, post-test (EWTCAT) was administered in order to obtain students’ scores in cognitive achievement in electronics work.

A. Research Question 1

What is the effect of cognitive task analysis on students’ cognitive achievement in electronics work?

<table>
<thead>
<tr>
<th>GROUP</th>
<th>N</th>
<th>PRETEST SCORE</th>
<th>POSTTEST SCORE</th>
<th>MEAN GAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>90</td>
<td>25.42</td>
<td>51.45</td>
<td>26.03</td>
</tr>
<tr>
<td>Control</td>
<td>84</td>
<td>25.13</td>
<td>45.69</td>
<td>20.56</td>
</tr>
</tbody>
</table>

Data presented in Table 2 showed that the treatment group taught electronics work with cognitive task analysis had a mean score of 25.42 in the pretest and 51.45 in the posttest, making a pretest, posttest mean gain in the treatment group taught with cognitive task analysis to be 26.03. Meanwhile, the control group taught electronics work with the conventional method had a pretest mean score of 25.13 and a posttest mean score of 45.69 which resulted into pretest, posttest mean gain of 20.56. With these results, both cognitive task analysis and conventional method are effective in improving students’ cognitive achievement in electronics work but the effect of cognitive task analysis on students’ cognitive achievement in electronics work is greater than that of the conventional method.

B. Research Question 2

What is the effect of gender on the cognitive achievement of students taught electronics work with task analysis instructional techniques?

<table>
<thead>
<tr>
<th>COGNITIVE TASK ANALYSIS</th>
<th>CONVENTIONAL METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>N</td>
</tr>
<tr>
<td>Male</td>
<td>79</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
</tr>
</tbody>
</table>

Key

PT1 - Pretest,
PT2 - Posttest,
MG - Main Gain

Data presented in Table 2 showed that male students taught electronics work with cognitive task analysis had a mean score of 25.01 in the pretest and a mean score of 54.18 in the posttest making a pretest, posttest mean gain for the male students taught with cognitive task analysis to be 29.17, while female students taught electronics work with cognitive task analysis had a mean score of 24.79 in the pretest and a posttest mean score of 48.54 with pretest, posttest mean gain of 24.75. Also male students taught with conventional method had a mean score 24.33 in the pretest and a mean score of 29.63 in the posttest, making a pretest, posttest mean gain in the male students taught with traditional task analysis to be 5.30. Meanwhile, female students taught electronics work with conventional method had a mean score of 23.21 in the pretest and a posttest mean score of 27.44 with pretest, posttest mean gain of 4.23. With these results, it is shown that male and female students taught electronics work with cognitive task analysis had a higher mean gain score than male and female students taught with the conventional method in the cognitive achievement test. The result further shows that male students in both cognitive task analysis and conventional method groups had higher mean gain scores than female students in the same groups in the cognitive achievement test. Hence there is an effect attributed to gender on the cognitive achievement of students taught electronics.
work with cognitive task analysis instructional guide and the conventional method.

C. Hypotheses

H₀₁: There is no significant difference in the cognitive achievement mean scores of students taught electronics work with cognitive task analysis-based instructional guide and those taught with the conventional method.

H₀₂: Gender will have no significant effect on the cognitive achievement mean scores of students taught electronics work with cognitive task analysis instructional technique.

H₀₃: There is no significant interaction effect of treatments given to students and their gender with respect to their cognitive achievement mean scores in electronics work.

The data presented in Table 3 shows F-calculated values for three effects: treatment, gender and interaction effect of treatments and gender on students’ cognitive achievement in electronics work. The F-calculated value for treatment is 31.997 with a significance of F at .000 which is less than .05. This result shows that there a significant difference between the effect of treatment on students cognitive achievement in electronics work. The null hypothesis is therefore rejected at .05 level of significance. Hence, there is significant difference in the cognitive achievement mean scores of students taught electronics work with cognitive task analysis-based instructional guide and those taught with the conventional method. The F-calculated value for gender is 15.429 with a significance of F at .000 which is less than .05. The null hypothesis is therefore rejected at .05 level of significance. This result shows that there is significant effect of gender (male and female) on students’ cognitive achievement in electronics work. The interaction effect of treatment and gender has F-calculated value of 85.532 with significance of F at .344 which is higher than .05. Therefore, the null hypothesis of no significant interaction effect of treatments given to students taught with task analysis instructional guide and their gender with respect to their mean scores on the cognitive achievement test is accepted.

VII. Findings of the Study

Based on the data collected and analyzed, the following findings emerged from the study:

1. Cognitive task analysis-based instructional guide and conventional method were effective in improving students’ cognitive achievement in electronics work but cognitive task analysis-based instructional guide was more effective than the conventional method.

2. There was an effect of gender on the cognitive achievement of students in electronics work in favour of male students.

3. There was a significant difference in the cognitive achievement mean score of students taught electronics work with cognitive task analysis-based instructional guide and those taught with conventional method.

4. There was a significant effect of gender on students’ cognitive achievement in electronics work in favour of boys.

5. There was no significant interaction effect of treatments given to students and their gender with respect to their cognitive achievement mean score in electronics work.
VIII. Discussion

The data presented in Table 1 provided answer to research question one. Findings revealed that cognitive task analysis-based instructional guide and conventional method are effective in enhancing students’ cognitive achievement in electronics work. The effect of cognitive task analysis-based instructional guide on students’ cognitive achievement in electronics work is higher than the effect of conventional method. Analysis of covariance was employed to test the first hypothesis, Table 3. At the calculated F-value (31.997), significance of F (.000) and confidence level of .05, there was a significant difference between the effect of treatment on students’ cognitive achievement in electronics work. With this result, there was statistically significant difference between the effect of cognitive task analysis-based instructional guide and the conventional method implying that cognitive task analysis-based instructional guide is more effective than the conventional method in improving students’ cognitive achievement in electronics work. This finding might be due to the fact that cognitive task analysis-based instructional guide has the potential of increasing intellectual potency by enhancing the learner’s ability to organize and classify information. Information imbedded through cognitive task analysis becomes firmly embedded in the cognitive structure of the learner thereby facilitating retrieval. This finding is in line with the finding of [43] and [44] who in their separate studies found out that cognitive task analysis-based instruction has significant positive effect on students’ cognitive achievement. [4] pointed out that cognitive task analysis is effective in eliciting, analyzing and representing expert knowledge in a more accurate and complete manner than the conventional method which is capable of influencing learner’s success. Furthermore, cognitive task analysis provides a comprehensive description of the conceptual knowledge associated with a given job which is absent in the conventional method. In the same vein, [8] and [9] believes that instruction organized in a systematic and orderly manner such as the cognitive task analysis-based instructional guide can make learners to respond well to learning activities.

Similarly, Analysis of covariance was used to test the third hypothesis, Table 3. At the calculated F-value (85.532), significance of F (.344) and confidence level of .05, there was no significant interaction effect of treatments given to students taught with task analysis-based instructional guides and their gender with respect to their mean scores on Cognitive Achievement Test. This result indicates that the effectiveness of cognitive task analysis-based instruction does not depend on the level of gender. Hence, cognitive task analysis-based instructional guide is effective in improving students’ cognitive achievement in electronics work regardless of gender.

Data presented on table 2 provided answer to research question two. Findings revealed that male students taught electronics work with cognitive task analysis-based instructional guides had higher mean scores than female students in the Electronics Work Cognitive Achievement Test. Analysis of covariance was employed to test the second hypothesis, Table 3, at the calculated F-value (15.429), significance of F (.000) and confidence level of .05 there was significant difference between the main effect of gender (male and female) on students’ cognitive achievement in electronics work. This finding confirmed that there was a statistically significant difference between the cognitive achievement of male and female students in electronics work in favour of males. Hence there was an effect attributable to gender on student cognitive achievement in electronics work. The result is consistent with findings of [19] that show significant difference in the mean performance between boys and girls in cognitive knowledge in favour of boys. This is in line with the opinion of [17] who stated that boys are generally better than girls in technical education and that may be one of the reasons why technical trades are considered as male-dominated occupation.

IX. Conclusions

The results of this study show that cognitive task analysis-based instructional guide is more effective than the conventional method in improving students’ cognitive achievement in electronics work. Furthermore, the study revealed that there was an effect of gender on students’ cognitive achievement but there was no interaction effect of treatment given to student and their gender in electronics work. This implies that cognitive task analysis-based instructional guide is a viable teaching method that can be employed in technical colleges because it is a learning guide that can give teachers the opportunity to provide students with meaningful activities that will make them active in the entire learning exercise and thus improve learning.

X. Recommendations

Based on the findings of this study, the following recommendations are made:

1. Teachers in technical colleges should adopt the use of cognitive task analysis-based instructional guide to improve instruction in relevant subjects such as electronics work.
2. Workshops, seminars and conferences should be organized by the Ministry of Science and Technical Education to enlighten and train electronics work teachers on...
how to carry out task analysis and its instructional application in the classroom.

References


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