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THE STATUS OF INDIVIDUAL LEARNING VERSUS COOPERATIVE LEARNING IN ENHANCING SCIENCE CONCEPT SKILLS AND CRITICAL THINKING SKILLS AMONG SENIOR SECONDARY SCHOOL SCIENCE STUDENTS

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ABSTRACT

The task of teaching students science concepts meaningfully is sometimes rather complicated, and is too often not fulfilled. As science continues to influence our world more and more, it is important that we learn to make science sensible and accessible to more people. This formed the basis for the investigation on the status of individual learning versus cooperative learning in enhancing Science Concept Skills and Critical Thinking Skills among Senior Secondary School Science Students. A total of 48 subjects participated in this study, which were Senior Secondary School Two (SSS II) Students from Six Secondary Schools in Ado Local Government Area of Ekiti State. The treatment comprised of two part, both Chalk and Talk and Activity oriented Teaching were administered simultaneously to two groups to prevent the effect of any extraneous variables. There are Cooperative Learning group and Individual Learning group. The same contextual grading was given to both groups which comprised of both Science Concept Items and Critical Thinking Items. The statistical analysis on the pre and post test scores of both groups using T-test analysis showed that students who participated in Cooperative Learning performed significantly better on the Critical Thinking Test than students who studied Individually. And also, that both groups did equally well on the Science Concept Test.

INTRODUCTION

Cooperation is working together to accomplish shared goals. Within cooperative activities individuals seek outcomes that are beneficial to themselves and beneficial to all other group members. This type of learning is the instructional use of small groups so that students work together to maximise their own and each other's learning. The idea is simple, class members are organised into small group receiving instruction from the teacher. They then work through the assignment until all group members successfully understand and complete it. Cooperative efforts results in participants striving for mutual benefit so that all group members gain from each other's efforts. Moreover, cooperative learning is also relatively easy to implement and is inexpensive if compared to other teaching method such as experiment. Over the past decade, it is claimed that cooperative learning has emerged as the leading new approach to classroom instruction slaving (1991). Cooperative learning is recommended as a very useful teaching strategy for all subjects area at different levels of education. Research have documented, Backson (1992) that the proper use of cooperative learning will improve academic achievement, behaviour, attendance, self confidence, motivation, interests and team work capacity among students. The reason for its advocacy is that, it is documented that students completing cooperative group tasks tend to achieve higher achievement test score, have higher self esteem, and positive social attitude. (Johnson, Johnson and Holubec, 1993).

Also ,Stahl's (1994) highlighted some essential elements of cooperative learning to include, clear set of specific students' learning objectives, clear and complete set of instructions; heterogeneous groups, equal opportunity for success, access to must learn information; opportunities to complete required information-processing tasks; sufficient time to learn in cooperative learning situations, and there is a positive interdependence among students goal attainments. Students perceive that they can reach their learning goals if and only if the other students in the learning group also reach their goals. (Johnson and Johnson 1995). It is emphasized that teaching and learning science in schools should enable the students to understand scientific concepts and their inter dependability, develop rational thinking in solving their daily life problems, develop scientific process skills to achieve scientific concepts as well as to develop students' scientific judgement. Ministry of Education, Nigeria (1998). These goals suggested that teachers should employ appropriate teaching approaches and strategies. Likely, the teachers should consider and use cooperative learning as part of their teaching strategy. In a research conducted by Springer et al (1999) on effect of small –group learning in science, Technology, Engineering and Mathematics (STEM), it was concluded that the meta-analysis demonstrated that various forms of small group learning are effective in promoting greater academic achievement. (Kagan spencer 2001) also submitted that cooperative learning is a successful teaching strategy in which small teams, each with student of different levels of ability, use variety of learning activities to improve their understanding of a subject.

The advances in science, technology, engineering and mathematics (STEM) has increased emphasis on team work within the science classroom at all levels of education. Students need to be able to think creatively, solve problems, and make decisions as a team. Therefore, the development and enhancement of Critical Thinking Skills through Cooperative learning is one of the primary goals of science education. The present research was designed to study the status of Individual learning versus Cooperative learning in enhancing Science Concept Skill (SCS) and Critical Thinking Skills (CTS) among Junior Secondary School Science Students.

Purpose of Study

The study examined the status of individual learning versus cooperative learning in enhancing Science Concept Test and Critical Thinking Skills among Senior Secondary School Science Students and the subject matter was series are parallel dc circuit.

Research Questions

The research questions examined in the study were:

1. Will there be a significant difference in achievement on Science Concept Test between Students Learning Individually and Students Learning Cooperatively.
2. Will there be a significant difference in achievement on Critical Thinking Skills between Students learning Individually and Students Learning Cooperatively.

Definition of Terms

Cooperative Learning is a successful teaching strategy in which small terms, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject.

Individual Learning is an instruction method in which students work individually at their own level and rate toward an academic science concept items that certain to factual knowledge and comprehension of the concept. Critical thinking items: Items that involve analysis, synthesis, are evaluation of the concepts.

Methodology

The independent variable in this study was method of instruction, a variable with two categories individual learning and cooperative learning. The dependent variable was the post test score. The post test was made up of science concept test items and critical thinking items.

Population and Sample

The population for this study consisted of 48 subjects selected from Six Senior Secondary Schools in Ado Local Government Area of Ekiti State. There were two sections, with each section comprising of 24 students each.

Treatment

The treatment comprised of two parts that is, Chalk and Talk method of Teaching and Activity Oriented method of Teaching. Initially, the researcher taught both groups simultaneously to prevent the effect of any extraneous variables such as time of the day, day of the week, lightning of room, and others. The lecture was 50 minutes in duration. It was based on series direct current circuits and parallel direct current circuits. Next, one section was randomly assigned to the '' Individual learning group" while the other section was assigned to the ''Cooperative learning group". The two sections worked in separated classrooms while the same numeric scale was given to both treatment groups. It was comprised of both Science Concept Items and Critical Thinking Items. The full ranges of cognitive operations were called into play, in that single scale. It began with factual questions asking for the units of electrical quantities. Next, the questions involved simple applications of ohm's law and watt's law or power formula. The factual questions and the simple application questions were analogous to the Science Concept Items on the post test. The questions that followed required analysis of the information, synthesis of concepts, and evaluation of the solution. These questions were analogous to the Critical Thinking Items on the post test. When designing the Critical Thinking Items it was ensured that they would require extensive thinking. Both sections had the same treatment time.

Individual Learning

In Individual Learning, the academic task was first explained to the students. The students then worked on the conceptual grading scale by themselves at their own level and rate. They were given 30miuntes to work on it. At the end of 30 minutes, the students were given a sheet with answer to the questions on the conceptual grading scale. In case of problems, the solution sheet showed how the problem was solved. The students were given 15miuntes to compare their own answers with those on the solution sheet and understand how the problems were to be solved. The participants were then given a post test that comprised of both science concept items and critical thinking items.

Cooperative Learning

When implementing Cooperative Learning, the first step was to clearly specify the academic task. Next, the Cooperative Learning structure was explained to the students. An instruction sheet that pointed out the key elements of the cooperative learning process was distributed. As part of the instructions, students were encouraged to discuss ''why'' they thought as they did regarding solutions to the problems. They were also instructed to listen carefully to comment on each member of the group and be willing to reconsider their own judgements and opinions. As experience reveals, group decision making can easily be dominated by the loudest voice or by the student who talks the longest. Hence, it was insisted that every group member must be given an opportunity to contribute his or her ideas. After that the group will arrive at a solution.

Group Selection and Size

Groups can be formed using self-selection, random assignment, or criterion-based selection. This study used self-selection, where students chose their own group members. There were 24 students in the cooperative learning treatment group. Thus, there were six groups of four students each.

Grading Procedure

According to slavin (1989), for effective cooperative learning, there must be ''group goals'' and individual accountability. When the group's task is to ensure that every group member has learned something, it is in the interest of every group member to spend time explaining concepts to group mates. Research has consistently found that students who gain most from cooperative work are those who give and receive elaborated explanations (Webb, 1985). Therefore, this study incorporated both ''group goals'' and ''individual accountability''. The post test grade was made up of two parts. Fifty percent of the test grade was based on how a particular group performed on the test. The test points of all group members was pooled together and fifty percent of each student's individual grade was based on the average score. The remaining fifty percent of each students grade was individual. This was explained to the students before they started working cooperatively. After the task was explained, group members came together and started working on the contextual grading scale. They were given 30 minutes to discuss the solutions within the group and come to a consensus. At the end of 30 minutes, the solution sheet was distributed. The participants discussed their answer within the respective groups for 15 minutes. Finally, the students were tested over the material they had studied.

Instruments

The instruments used in this study were developed by the researcher. The pre test and post test were designed to measure student understanding of series and parallel dc circuits and hence belonged to the cognitive domain: Bloom taxonomy (1956) was used as a guide to develop a blue print for the pre test and post test. On analyzing the pilot study data, the cronbach reliability coefficients for the pre test and post test were found to be 0.91 and 0.87 respectively. The post test was a paper and pencil test consisting of 15 Science Concept Test and Critical Thinking Items. The items that belonged to the ''Knowledge'' ''Comprehension'', and ''Application'' classifications of Bloom's. Taxonomy were categorized as ''Science Concept Items. These items pertained to units and symbols of Electrical Quantities, Total Resistance in Series and Parallel, and simple applications of

Ohm's Law. The items that belonged to ''Synthesis'', ''Analysis'' and ''Evaluation'' classification of Bloom's taxonomy were categorized as ''Critical Thinking'' items. These items required students to clarify information, combine the component parts into a coherent whole, and then judge the solution against the laws of Electric circuits. The pre test consisted of 12 items, two items belonging to each classification of Bloom's taxonomy.

Research Design

A none equivalent control group design was used in this study. The level of significance (alpha) was set at 0.05. A pre test was administered to all subjects prior to the treatment. The pre test was helpful in assessing students' prior knowledge of dc circuit and also in testing initial equivalence among groups. A post test was administered to measure treatment effects. The total treatment lasted for 95 minutes. In order to avoid the problem of the students becoming ''test-wise'', the pre test and post test were not parallel forms of the same test **Findings**

Research Question I

Will there be a significant difference in achievement on a test comprised of science concept items between students learning individually and students learning cooperatively.
The mean of the post-test scores for the participants in the group that studied cooperatively (13.56) was slightly higher than the group that studied individually (11.89). A T-test on the data did not show a significant difference between the two groups. The result is given in Table 1. An analysis of covariance procedure yielded a f-value that was not statistically significant ($f=1.91$, $p>0.05$).

Research Question II

Will there be a significant difference in achievement on a test comprised of ''Critical Thinking Items between students learning individually and student learning Cooperatively?
The mean of the post-test scores for the participants in the group that studied cooperatively (12.21) was higher than the group that studied individually (8.63). A T-test on the data showed that this difference was significant at the 0.01 alpha levels. This result is presented in Table I. An analysis of covariance yielded a f-value that was significant at the same alpha level ($f=3.69$, $p<0.001$).

Table I Results of t-Test

Item classification	Method of teaching	n	Mean	sd	t	P
	Individual	24	11.89	2.62		
					1.73	.09
Science Concept	Cooperative	24	13.56	2.01		
	Individual	24	8.63			
Critical thinking					3.53	.000
	Cooperative	24	12.21	2.52		

Discussion of Findings

After conducting a statistical analysis on the test scores, it was found that students who participated in Cooperative Learning had performed significantly better on the Critical

Thinking Test than students who studied individually. It was also found that both groups did equally well on the Science Concept Test. Thus, the result is in agreement with the learning theories proposed by proponent of Cooperative Learning. Slaving (1991) recommended Cooperative Learning as a useful is teaching strategy for all subjects' area at different levels of Education. He documented that proper use of Cooperative Learning will improve academic achievement, behaviour and motivation, which also increase interests and team work capacity among students. Also in good term with Balckon, (1992) who ascertained that that students completing cooperative group tasks tend to achieve higher academic test scores, have higher self esteem, possesses greater numbers of positive social skills, and achieve greater comprehension of the content they are studying which is also as presented by Johnson, Johnson and Holubec, (1993).And In line with the research conducted by Springer, Stanne and Donovon (1991) on effect of small-group learning on Students in Science, Technology, Engineering and Mathematics (STEM), it was concluded that the meta-analysis demonstrated that various forms of small-group learning are effective in promoting greater academic achievement, more favourable attitudes toward learning, and increased persistence in Science, Technology Engineering and Mathematics programs.

Implications for Instruction

From this research study, it can be concluded that Cooperative learning fosters the development of Critical Thinking through discussion, clarification of ideas and evaluation of other ideas. However, both methods of instructions were found to be equally effective in gaining factual knowledge. Therefore, if the purpose of instruction is to enhance Critical Thinking and Problem Solving skills, then Cooperative Learning is more beneficial. Therefore, for Cooperative learning to be effective, the instructor must view teaching as a process of developing and enhancing students' ability to learn. The instructors role is not to transmit information, but to serve as a facilitators for learning. This involves creating and managing meaningful learning experiences and stimulating students' thinking through real and word problems. Future research studies need to investigate the effect of different variables in the Cooperative learning process. Group composition, group selection and size, structure of Cooperative Learning, amount of features intervention in the group learning process, differences in preference for Cooperative learning associated with gender and ethnicity and differences in preference and possibly effectiveness due to different learning style. Also, a psycho-analysis of the group discussions will reveal useful information.

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