

Effects of Cooperative Instructional Strategy on Secondary Students' Academic Achievement and Motivation in Physics in Nyamira County, Kenya.

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Abstract: Physics knowledge plays a fundamental role in Science and Technology. Its application has increased productivity and improved economic and industrial development in many countries of the world. This study sought to investigate the effects of Cooperative Instructional Strategy (CIS) on secondary school learners' achievement and motivation in Physics. The study used a Quasi-experimental research design, the Solomon Four Group Design. The study sample comprised of 148 Form two physics students in four secondary schools. Random sampling technique was used to select the four schools. The four schools were randomly assigned into two experimental and two control groups E1 & E2, C1 & C2 respectively. The experimental groups were taught using the Cooperative instructional strategy (CIS), while the control groups were taught through regular teaching methods. Groups E1 and C1 were pre-tested prior to the implementation of the CIS treatment. Five educational research experts and three experienced physics teachers validated the research tools. Cronbach's Alpha Coefficient was used to estimate their reliability and yielded a reliability coefficient of 0.86 for the Physics Academic Test and 0.82 for the Student Motivation Questionnaire. ANOVA, t-test and ANCOVA were used to analyse the data generated with the aid of the Statistical Package for Social Sciences (SPSS) version 22.0. Hypotheses were tested and accepted or rejected at 0.05 level of significance. The findings indicate that there was no statistically significant gender difference in achievement after the intervention. CIS enhances the learning of school physics, minimizes the gender disparities. The findings from this study provide a basis for improvement of in-service and pre-service physics teacher training programmes, Curriculum developers and Educational administrators.

Keywords: Cooperative instructional strategy, secondary student's achievement, physics performance

1. INTRODUCTION

Cooperative Instructional Strategy (CIS) is an approach that engages learners in active learning where they work and learn together in small groups to accomplish shared goals (Panitz, 1996). Cooperative instructional strategy (CIS) is viewed positively by educators because of its emphasis on learner involvement during the teaching - learning process and also it is likely to engage most senses and is most suited for the preparation of individuals with desirable work characteristics (MOE, 2003). Science is an integrated subject encompassing three subjects in Kenyan secondary school curriculum, that is; Physics, Biology and Chemistry. The inclusion of these science subjects is to help Kenya as a country to achieve its national objective of self-reliance and economic development (Barchok, 2006). The subjects are also supposed to equip citizens with knowledge, skills and scientific attitudes necessary to help them solve problems in their day to day living. Kenya's Ministry of Education has been advocating for the need to improve the teaching and learning of science. Its main objective is to create a foundation of a technologically oriented workforce in line with national development (GOK, 2008). The current development policy of the Government of Kenya (GOK) is to transform the country into a middle-income economy providing a high quality life to all its citizens by the year 2030 (GOK, 2007).

The ultimate goal of teaching science subjects in secondary school is to develop members of society that are sufficiently literate and that possess relevant skills needed for technological innovations as well as meet the manpower requirements for the development of a country. Currently, science is perceived as something having universal value, and perhaps more importantly, an essential component of the core curriculum for all (Osborn & Wittrock, 2003). Trends of development in Kenya show that careers in Physics have contributed to socio-economic and technological

transformation especially in this era of information, communication and technology (Munishi et al.,2006). These innovations require the fundamental principles of Physics education taught in Secondary Schools. These principles are taught in major topics such as Magnetism, electricity, mechanics and electronics among others. Physics is an important subject in the secondary school curriculum because it helps the learners to apply the principles, acquired knowledge and skills to construct appropriate scientific devices from available resources. According to the Kenya National Examinations Council (KNEC), physics is clustered with biology and chemistry. Majority of the students opt for a combination of chemistry and biology due to subject clustering system which does not favour physics. This account for the current low students' achievement, motivation and enrolment in the subject. Performance in physics has been low and many students shun the subject as indicated in Table 1.

Table1. Performance in KCSE Physics Examination and Performance and percentage Candidature for the science subjects from 2011 to 2014

Year	% mean score in physics	% Candidature in physics	% Candidature in chemistry	%Candidature in biology
2011	31.33	29.69	98.34	88.76
2012	35.13	30.15	97.87	88.67
2013	36.64	30.61	98.48	89.34
2014	39.87	31.33	97.92	89.79

Source: Kenya National Examination Council (KNEC, 2015)

Table 1 show that performance in physics has been poor and the subject is unpopular amongst secondary school students compared to chemistry and biology. Several studies have investigated the causes of the appalling state of physics performance and low student enrolment. These causes were identified as low students' motivation to learn physics, poor teaching approaches used by physics teachers, poor content mastery by the physics teachers, teachers' use of language in classrooms, perceived difficulty of the subject, inadequate instructional materials and inadequate supervision from the Ministry of Education Science and Technology.

A critical challenge encountered by teachers remains how to improve students' performance nationally especially in physics as its pass rates at Kenya Certificate of Secondary Education level is the lowest compared to that of biology and chemistry (Njoku, 2007). Since Physics is one of the important subjects in the fields of natural sciences, the country will not be able to produce sufficient number of scientists to meet the demand of the country's socio-economic development (Wachanga, 2005). Sciences and particularly physics is viewed as an instrument that can aid technological advancement and development of any society. Despite the importance of Physics for mankind, there has been a general decline in its' academic performance of secondary school students at KCSE level. Considering the importance attached to physics in industrialization and technology, the performance is below the expectations that Kenya would require to achieve vision 2030 (KNEC, 2013).

Table2. K.C.S.E Physics Performance

Year	2011	2012	2013	2014
Percentage mean score	31.33	35.13	36.64	39.87

Source: Kenya National Examinations Council: 2011-2014.

The results in Table 3 show that the students' performance in Physics in Kenya has been low. Several studies have investigated the causes of the appalling state of Physics performance and low student enrolment. These causes were identified as low students' motivation to learn Physics, poor teaching approaches used by Physics teachers, poor content mastery by the Physics teachers, perceived difficult of the subject, and inadequate instructional materials (SMASSE, 2004; Etkina, 2005; Kiboss, 2002).

1.1. Objectives of the Study

The following objectives guided the study:

- i. To determine the effects of cooperative instructional strategy on students' academic achievement in secondary school physics.
- ii. To determine the effects of cooperative instructional strategy on students' academic achievement in secondary school physics with regard to the gender of the students.

iii. To determine the effects of cooperative instructional strategy on students' motivation in secondary school physics.

1.2. Hypotheses of the Study

To achieve the above objectives, the following hypotheses were tested:

H₀1: There is no statistically significant difference between the achievement scores of students who are exposed to cooperative instructional strategy and those who are not exposed to it.

H₀2: There is no statistically significant difference in students' academic achievement between boys and girls who are exposed to cooperative instructional strategy.

H₀3: There is no statistically significant difference in students' motivation between those who are exposed to cooperative instructional strategy and those who are not exposed to it.

1.3. The Role of Science in Society

The influence of science on people's lives is growing. While recent benefits to humanity are unparalleled in the history of the human species, in some instances the impact has been harmful or the long-term effects give causes for serious concerns (Schmit, 2008). The growing technology demand from emerging economies, world recognition of the interconnectedness of the planet's biophysical systems and improved communications, especially via internet, all these forces are boosting cross-border scientific cooperation and information exchange between individual researchers, institutions and governments (Schmit, 2008).

1.4. The Role of Science Education

Science teaching and knowledge should not only be interpreted in terms of the effects on people's lives for example in technology, war and automation; it should also be considered in terms of its effects on people's ways of reasoning (Okere, 1996). Research findings in Science Education show that active learning has many positive outcomes. It can enhance motivation, increase inquisitiveness, facilitate retention of material, improve classroom performance, and foster development of critical thinking skills.

1.5. Physics Education in Kenya

Physics education refers to the methods currently used to teach physics and to an area of pedagogical research that seeks to improve those methods. Historically, physics has been taught at the high school level primarily by the lecture method together with laboratory practical/experiments aimed at verifying concepts taught in the lectures. These concepts are better understood where lectures are accompanied with demonstrations, hands-on experiments, and questions that require students to ponder what will happen in an experiment and why. Physics education therefore enables the learner to acquire problem-solving and decision-making skills that provides ways of thinking and inquiry which help them to respond to widespread and radical changes in industry, health, climatic changes, information technology and economic development

2. CONCEPTUAL FRAMEWORK

The conceptual framework of this study was based on the systems theory developed by Ayot & Patel (1987) and Gerlach & Ely (1980) that portrayed the teaching-learning process as dynamic with inputs and outputs with the assumption that teaching methods that involved students cooperation led to worthwhile learning (Hanrahan, 1998). The study involved guided discovery in which teachers played the key roles of planning and facilitating learning. It also indicates that teaching approach (conventional or Cooperative instruction) influences students' academic achievement and motivation among secondary learners in physics.

The dependent variables in this study were learners' achievement and motivation in Physics. In an ideal situation, the teaching influences learners' achievement and motivation. However, various intervening variables may affect the expected outcome. The student's teacher characteristics were controlled by involving trained teachers who have taught secondary school Physics for at least three years. The age of the students was controlled by involving Form Two students who had comparable age. Gender was studied by determining its effects on students' achievement in Physics.

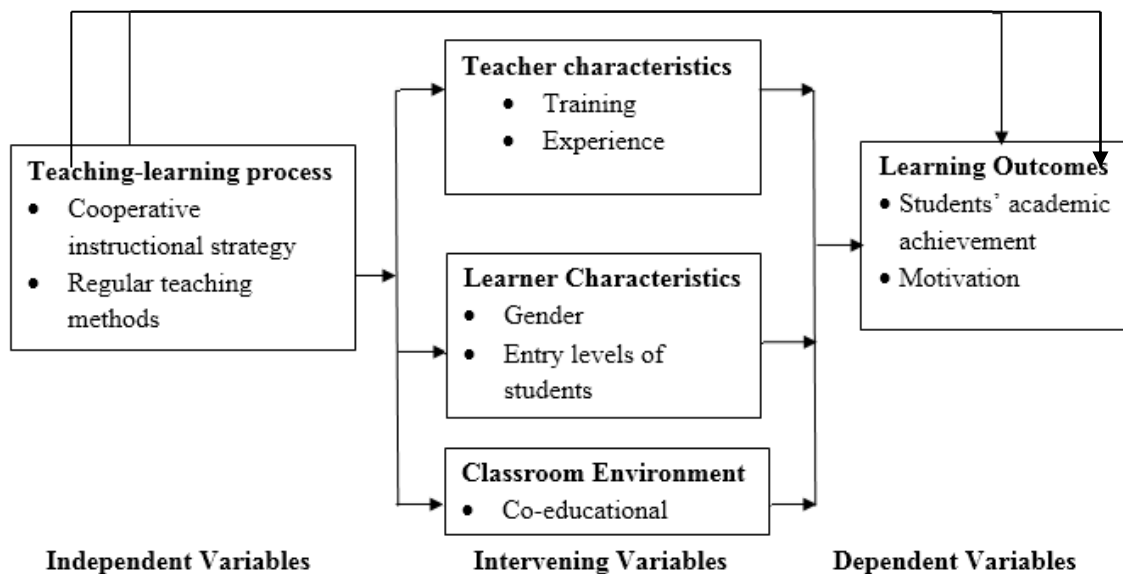


Figure1. Effect of Cooperative Instructional Strategy on Student's Achievement and Motivation in Physics. (source: author)

3. RESEARCH METHOD

The research study was Quasi-experimental involving Solomon Four Non-Equivalent Control Group Research design. This is because there was non-random assignment of students to the groups. An experimental design is a strong design for a researcher to test hypotheses to reach valid conclusions between independent and dependent variables (Best & Kahn 2003). Quasi-experimental researches are widely used in the evaluation of teaching interventions because it is not practical to justify assigning students to experimental and control groups by random assignment (Randolph, 2008). Quasi-experimental research offers the benefit of comparison between groups because of the naturally occurring treatment groups (Cohen, Manion & Morrison, 2007) and to compare the effect of a treatment and can control all major treats to internal validity.

The experimental group was exposed to the treatment and the control group received no treatment. The performance of the two groups was then compared after data collection to determine whether there was any treatment effect. Solomon Four Non-Equivalent Control Group Design was involved since it controls the major threats to internal validity except those due to interaction, and history, maturity and instrumentation (Sekaran, 2006). The Solomon Four Non-Equivalent Group Control Design involves setting up two experimental groups and two control groups for the study. The effect of treatment is then calculated in a number of different ways to the extent that the researcher comes up with almost the same results in each of calculations. The quasi-experimental study uses pre-tests to establish group equivalence. The Solomon Four Non-Equivalent control Group Design is represented in figure 2

GROUP I	O ₁	X	O ₂
GROUP II	O ₃	—	O ₄
GROUP III	—	X	O ₅
GROUP IV	—	—	O ₆

Figure2. Solomon Four Non-equivalent Group Control Design.

Source: Sekaran (2006. p.161)

Key: O₁ and O₃ are pre-tests; O₂, O₄, O₅ and O₆ are post-tests; X is the treatment which in this study was the Cooperative instructional strategy.

4. DISCUSSION AND CONCLUSION

This study investigate the effects of cooperative instructional strategy on secondary school learners' physics achievement and motivation in selected topic in Borabu sub-county of Kenya. The findings from this study shows that students who were taught through cooperative instructional strategy, achieved statistically significantly higher achievement scores in PAT compared to those who were taught through the regular teaching method. This implies that cooperative instructional strategy was more effective in enhancing student achievement scores and motivation in physics than the regular teaching methods. On the basis it is evident from the study findings that the observed differences in the pre-test scores among the experimental groups were not statistically significant. However, the difference in the post-test mean scores of the four groups was found to be statistically significant in favour of the experimental groups.

5. RECOMMENDATIONS

Based on the above discussion, the study provides important recommendations which the use of cooperative instruction strategy improved the academic achievement of students in the secondary physics. Therefore, Physics teachers should be encouraged to use CIS as alternative strategy that they can fall back on in order to improve the teaching and learning of secondary physics. School administrators should create necessary time during school for cooperative learning and ensure that it is done effectively. Physics teachers need to undergo further training to update their skills in teaching effectively, during which importance of cooperative learning should be emphasized. Cooperative instruction strategy is an effective and gender-friendly instructional strategy that should be used to maximize learning among students irrespective of their gender. It is also recommended that cooperative learning strategy should be adopted as a method of teaching for both male and female students. There is need to conduct more studies in other subjects and further confirm the effectiveness of this approach in the Kenyan context. In addition more studies should be conducted at different education levels such as the primary school level, secondary school level and university level to gather more evidence on the effectiveness of the approach.

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