

Investigations of Experiential Cooperative Concept Mapping Instructional Approach on Secondary School Girls' Achievement in Physics in Nyeri County, Kenya

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Abstract

This study investigated the effects of Experiential Cooperative Concept Mapping Instructional Approach (ECCA) on girls' achievement in Physics in secondary schools. The study employed Quasi- Experimental Research Design represented by Solomon Four Non-equivalent Control Group Design. Stratified sampling technique was used to select 8 Secondary Schools from girls' alone and co- educational schools strata drawn from Nyeri County. A total of 334 Form Two students were involved in the study. A validated Students Physics Achievement Test (PAT) with a reliability coefficient of 0.80 was administered. The experimental group I and III were exposed to ECCA while the conventional Method was used for the control group. Two groups were pre-tested prior to the implementation of the ECCA treatment. After five weeks, all four groups were post-tested using the Physics Achievement Test (PAT). Data was analyzed using ANOVA and ANCOVA at a significance level of alpha (α) equal to 0.05. The results of the study revealed significant effect on achievement of girls when ECCA was used. However there was a significant effect in achievement on school type in favour of girls' alone class performing better than girls in co-educational class when ECCA was used. The investigations concludes that ECCA is an effective learning strategy which physics teachers should be encouraged to use in their teaching/ learning process in order to address the current low girls performance. This may create an increased pool of scientific and technical female workers in the area where Physics is a requirement.

Key words- Experiential Cooperative Concept Mapping (ECCA), Conventional Methods (CM), Secondary School, Girls' Achievement, Physics, Nyeri County.

1. Introduction

Despite notable gains in African Education in recent years there is still notable gender disparity in Sub-Sahara African countries especially in science and mathematics. The performance of girls in Kenya's KCSE Physics examination has been poor and lower than that of boys. There is need to employ teaching methods that provide equal opportunity to participation for girls and boys, therefore address the poor performance for girls in Physics. Table 1 shows the overall performance by gender in KCSE Physics for a period of six years.

Table 1. Students' Performance in KCSE Physics Examination by Gender between the Years 2005 and 2011

Year	2005	2006	2007	2008	2009	2010
Female mean score %	32.85	39.07	39.04	36.10	33.46	29.93
Male mean score %	35.99	40.82	42.23	36.95	35.76	31.88

Source. Kenya National Examinations Council (2006, 2008, 2009, 2011).

Analysis of the results in Table 1 indicates that the performance of girls is poorer than that of boys. This brings about gender disparity in Physics performance implying that only few girls may end up taking careers that require Physics. There is therefore need to increase opportunities for girls taking Physics oriented careers. This can be done by applying teaching strategies that will improve the performance for girls. Teaching quality has a significant impact on academic access, retention and performance. Yet many often teachers conditioned by male-

dominated values, employ teaching methods that do not provide equal opportunity to participation of girls and boys. Neither do these methods take into account the individual needs of learners, especially girls.

ECCA is a composite instructional approach which combines experiential learning, cooperative learning and concept mapping. The amalgamation of ECCA is such that the elements of experiential learning are combined together with those of concept mapping and cooperative learning. The diversity of learning styles which characterize students' populations makes it necessary for teachers to constantly look for variety in the methods they use (Biggs, 2003). The full involvement of students in the learning process could be achieved through active rather than passive learning approaches. Active learning involves students directly in the learning process. This means that instead of simply receiving information verbally and visually students should actively participate in construction of meaning from learning experiences provided. Active learning includes everything from listening practices which help students to absorb what they hear to complex group exercises in which students' apply course material to real life situations and/ or to new problems. 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. Active learning also promotes the personal relevance and applicability of course material to students and often improves overall attitudes toward learning (Kalkanis, 2002; Kokatas, 2002; Minas, 2003 & Vlachos, 2004).

ECCA instructional approach can address diversity of learning styles, allow for critical thinking skills and engage students in active learning. This is made possible because of the elements of experiential learning, cooperative learning and those of concept mapping found in this teaching strategy. These elements when they complement each other may enhance the teaching of Physics. Experiential learning emphasizes systematic involvement of learners, as they reflect on the experience and apply them to real life situations. While cooperative learning encourages students of all performance levels to work together in small groups towards group goals and concept mapping helps learners fulfil high quality and meaningful learning outcomes as they visualize the structure of knowledge. This gives students an opportunity to express their understanding about various concepts and to show relationships with other similar concepts even as they go through the cycles of experiential learning in groups. The three learning approaches to instruction are treated in the study as teaching learning arrangements, which inherently integrate deep approach to learning constructivism. The students will learn best when they connect learning with real life experience thus making learning not only interesting but also relevant and satisfying. Further, the interactions among students on learning tasks will lead in itself to improved student achievement and motivation to learn. Students will not only learn through experience and reflection but will also learn from one another because in their discussions of the content, cognitive conflicts will arise and adequate reasoning will be exposed leading to high quality understanding of concepts. This will lead to conceptual change rather than in fusion of knowledge (Rogers & Freiberg, 1994; Slavin, 2007).

2. Statement of the Problem

Physics is a fundamental science and is also an important base for Science and Technology. Its learning enhances economic, industrial and technological development. However girls' achievement in the subject at KCSE has continued to decline and has been lower than that of the boys. Prominent among the factors which have been identified as contributing to the persistent poor level of achievement in Physics are the teaching methods adopted by Physics teachers. It would therefore, be necessary to search for effective strategies which may be suitable and efficient for improving the level of secondary school Physics achievement for girls to the satisfaction of the current Physics curriculum requirements. This would help in increasing the number of girls who take up careers that require Physics application. The use of instructional approaches such as ECCA to solve the problem of poor achievement among girls has not been determined. In addition, it is not clear how students' group composition would affect the achievement of girls in Physics especially when ECCA is used. The study was therefore intended to fill this gap of knowledge, by applying ECCA instructional approach in the teaching of Physics in Form Two in order to establish its effect on the achievement of girls in Physics.

3. Objectives of the Study

- i) To compare the achievement in Physics between girls taught using ECCA and those taught using Conventional Method (CM).
- ii) To compare the achievement in Physics of girls in co-educational class with that of girls in girls' alone class when ECCA is used.

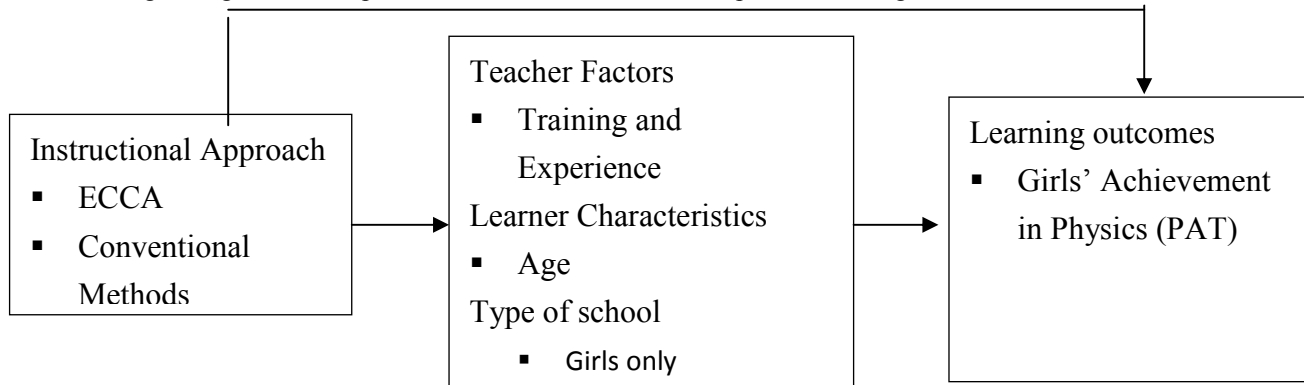
4. Hypotheses of the Study

Ho1: There is no statistically significant difference in achievement in Physics between girls exposed to ECCA and those that are not exposed to it.

Ho2: There is no statistically significant difference in achievement in Physics between girls in a co-educational class and those in girls' alone class when ECCA is used.

The conceptual framework that was used in this study was based on constructivist model of learning, and the systems approach theory of learning. Learning involves active cognitive processing of new information on

existing knowledge. The knowledge imparted to the learner must be constructed in such a way that it will be useful for long term recall and for applications in a variety of real life situations (Mestre, 1994). Systems approach to instruction involves setting goals and objectives, analyzing resources, devising a plan of action and continuous modification. ECCA allowed the learners to go through the four-stage learning cycle in order to effectively learn and apply concepts to real life situations. The learners were involved in the construction of knowledge. Diagrammatic representation of the framework is represented in Figure 1



Independent variables

Dependent variables

Extraneous variables

Figure 1. Conceptual framework for determining the effect of using ECCA instructional approach on girls' achievement in Physics.

In an ideal situation, the teaching method would affect the girls' achievement in Physics. The extraneous variables in this study were teacher characteristics, type of school and age of the girls. The teacher characteristics were controlled by involving trained teachers who have taught secondary school Physics for at least one year. The age of the students was controlled by involving Form Two students who had comparable age. The type of school was studied by determining their effects on girls' achievement in Physics in both girls alone and co-educational schools. The instructional approach used was then hypothesized to influence the girls' achievement in Physics.

5. Research Method

The research design used in this study was Quasi-experimental. The researchers used Solomon Four Non-equivalent Control Group Design. The design was appropriate because random assignment of the subject was not done, since secondary school classes once constituted exist as intact groups and they cannot be reconstituted for research purposes (Gall, Borg & Gall, 2003; Trochim, 2006). The research design may be represented as shown in Figure 2.

Group 1 0_1	X	0_2

Group 2 0_3	—	0_4

Group 3 —	X	0_5

Group 4 —	—	0_6

Figure 2. The research design used in the study.

Where 0_1 and 0_3 were pre-tests, 0_2 , 0_4 , 0_5 and 0_6 were post-tests. X represents the

Experimental treatment, where students were taught using Experiential Cooperative Concept Mapping Approach (ECCA).

The broken lines indicates that the experimental and control groups were not formed randomly.

- (i) Group 1 was the experimental group which received a pre-test, the treatment condition X and the post-test.
- (ii) Group 2 was the control group, which received a pre-test followed by the control condition and a post-test.
- iv) Group 3 was the experimental group which received the treatment X and a post-test but did not receive the pre-test.
- v) Group 4 was control group which received the post-test only.

Group 2 and 4 were the control groups and were taught using regular teaching methods while Group 1 and 3, the experimental groups were taught using ECCA.

The sampling unit was the secondary schools and not individual students since schools operate as intact groups. The sampling technique that was used in the study was Stratified sampling procedure (Sanders & Pinhey, 1979; Trochim, 2006). The various types of schools were considered as groups (strata) and then the independent samples were selected from within each of the stratum using simple random sampling. This enabled the researchers to have two strata, girls' alone and co-educational with total of eight secondary schools selected through stratified random sampling. The four schools in each category were randomly assigned to each of the four groups in the study. Each school provided one Form Two class for the research work.

The instrument used for the study was Physics achievement test (PAT). PAT had 40 structured short answer questions on magnetic effect of electric current and had a total of 50 marks. The items tested knowledge, comprehension and application of learnt material. The questions were scored dichotomously, where a score of one was given to the correct answer and zero to the wrong answer. The test was then pilot tested using two secondary schools with similar characteristics as the sampled schools in the study but in a different county. The reliability coefficient was calculated using Kuder-Richardson method was 0.80 (Gronlund, 1990).

Data was analyzed using One-way ANOVA and ANCOVA. ANCOVA was used to statistically cater for initial differences among the groups (Ary, Jacobs, & Razavieh, 1979). All tests of significance were performed at a significant level of alpha equal to 0.05.

6. Results and Discussions

Solomon Four Non-equivalent Control Group Design was used in this study. This enabled the researcher to have two groups sit for pre-tests. Groups 1 and 2 sat for pre-tests PAT. This helped the researcher to assess the entry behavior of the students (Gall et al., 2003). Analysis of independent sample t-test for PAT was done for the two groups and the results are shown in Table 2.

Table 2. Independent Samples t-test of the Pre-test Mean Scores on PAT
 Group 1, N= 83 Group 2, N= 86

Variable	Group	Mean	SD	df	t-value	P- value
PAT	1	6.51	0.50	119	0.47	0.1(ns)
	2	6.55	0.51			

SD = standard deviation, df=119, t-critical =1.96, ns = not significant, $P \leq 0.05$

An examination of Table 2 shows that the mean scores of Groups 1 and 2 on PAT are not statistically significantly different since $t(119) = 0.47$, $P > 0.05$. This means that the groups used in the study exhibited comparable characteristics. The groups were therefore regarded suitable for the study.

7. Effect of ECCA on Girls' Achievement

Analysis of variance for the four groups was carried out to establish whether the difference was statistically significant. The results of this analysis are shown in Table 3.

Table 3. ANOVA of the post-test Scores on the PAT for Girls in Experimental and Control Groups.

	Sum of squares	df	Mean Square	F	P- Value
Between Groups	13406.77	3	4468.93	133.68	0.00
Within Groups	5448.96	163	33.43		
Total	18855.74	166			

df = (3;163), F-critical = 2.68, $P \leq 0.05$

An examination of Table 3 indicates that there is a statistically significant difference between the groups, $F(3,163) = 133.68, P < 0.05$. A Post Hoc LSD test was carried out to establish where the differences were. The results of the Post-Hoc LSD test indicate that there is a statistically significant difference with alpha level of 0.05 between Groups 1 and 2, Groups 1 and 4, Groups 2 and 3 and Groups 3 and 4. The difference between the mean scores of Groups 1 and 3, and 2 and 4 is not statistically significant different. Since the study involves non-equivalent control groups design, it was therefore necessary to carry out analysis of covariance with Kenya Certificate of Primary Education (KCPE) scores as covariate. A multiple comparisons on ANCOVA were carried out and the results are shown in Table 4.

Table 4. ANCOVA of the Post-test Mean Scores on the PAT for Girls

	Sum of squares	df	Mean Square	F	P- Value
Group	8352.22	3	2784.07	91.38	0.00
KCPE	495.96	1	495.96	16.28	0.00
Error	4966.30	1.63	30.47		

$df=(3;1.63), F\text{-critical} = 2.70, P \leq 0.05$

The results in Table 4 indicate that there was a statistically significant difference between groups. $F(3, 1.63) = 91.38, P < 0.05$. This means that the girls who were exposed to ECCA had a better achievement scores in Physics than those in the control groups. The results for the girls in the experimental groups and those in the control groups reveal that ECCA benefited the girls more than CM. This indicates that ECCA is superior in achievement in Physics than CM. Therefore Hypothesis H_{01} is rejected. The findings of this study indicate that ECCA instructional approach assists girls to perform better in Physics achievement test. The findings concur with those of Ngesa (2002), Kolawole (2008), and Ling and Boo (2007). In each of these findings there is increased students performance when experiential, cooperative and concept mapping instructional approaches are used.

The findings of this study indicate that ECCA instructional approach resulted in higher achievement than the CM. The reason for the increase in achievement could be caused by the girls' involvement in explaining and receiving explanation in which the concepts can be easily represented in maps, understood and applied to real life situations. ECCA gives more space and opportunities for girls to discuss, solve problems, reflect on the concept, provide ideas and help each other. The girls reflect on the activities critically by sharing reactions and observations and then generalize by applying the ideas to real life situations. The results were in line with previous studies reported by other researchers on cooperative learning, concept mapping and experiential learning, such as Tarim and Akdeniz (2008), Zakaria, Chin and Daud (2010) and Healey and Jenkins (2002). The CM instructional approaches are teacher based, therefore less opportunity is given to girls for discussions, working with peers, constructing the concept maps and applying the experiences to real life situations.

The girls in this study demonstrated by their improved performance that ECCA helped them to understand the learning process. It facilitated the girls to learn effectively and organize their knowledge in a meaningful way. Through this instructional approach they were able to represent ideas and solve problems by connecting different concepts through construction of maps. This was very effective because they worked in cooperative groups. They were able to apply their knowledge in other areas outside their original context, as they explained and applied their own learning to real life situation. This kind of active learning which involves the students enhances improved classroom performance and fosters development of critical thinking skills. It promotes the personal relevance and applicability of course material to students and improves overall attitudes towards learning. The findings concurs with those of Vlachos, (2004) and Piliouras and Kokotas (2002)

It can be noted that ECCA, through cooperative learning provided a better learning environment that helps the girls learn through participation. When girls are placed in competitive academic situations, learning may be viewed as a commodity to be competed for, and they can be entrained to view other students as opponents because a students' success is measured against the performance of their peers. In contrast, cooperative learning situations they experience learning as a collaborative process. Others become resources and partners in learning,

and the success of each girl is, in part dependent on the involvement of their peers. This resulted in higher achievement when ECCA was used. Research studies done on cooperative learning by Johnson, Johnson and Stanne, (2000) who conducted a meta-analysis on the impact of cooperative learning on students' achievement concurs with these findings since they found out that students in cooperative learning situations scored, on average almost two thirds of standard deviation higher than their peers in competitive and individualistic situations.

Furthermore cooperative learning has been associated with improved attitude towards subject learnt, increased interest in schooling, expanded student faculty interactions, improved classroom behavior and climate, and the development of life-long learning skills. The elements of cooperative learning in ECCA helped to improve achievement in Physics. The findings concur with those of Tanel and Erol, (2008) and also of Berger and Hazne (2005).

ECCA helped the girls to understand, integrate, and clarify Physics concepts hence improved performance. In ECCA concept mapping were done in the cooperative groups even as the students went through the stages of experiential learning. This helped the girls to counter anxiety and encouraged them to reflect in their own thinking as they drew concept maps and apply the knowledge to real life situations. The exercise resulted to a genuine effort to negotiate the meaning of the Physics concepts, resulting to improved achievement. Interaction of the girls with each other when doing group activities, sharing reactions and observations, systematically examining their experiences by drawing the concepts maps and evaluating different views, provided a better understanding atmosphere as proved by the outcome of this study. Learnt information is not immediately forgotten indicating the effectiveness of ECCA as an effective instructional approach. These research findings concur with the findings of Nuhoglu and Yalcin (2006), Chang Chiou (2008) and Asan (2007) who found an increased students' achievement when learning cycle model was used in Physics laboratory and adopting concept mapping strategy significantly improved students' learning. The findings are also in agreement with those of Gahr (2003) in his study on cooperative chemistry concept mapping in the organic chemistry laboratory, that of Ngesa (2002) who found improved performance in secondary school agriculture and also Lai and Kiger (2009) who found out that experiential learning approach helped students learn integration of computer technology into teaching and learning settings.

ECCA offers potential for a learning atmosphere of shared partnership, a common purpose and joint management as portrayed by the cooperative groups. Concept Mapping helps students to reflect on their own knowledge, concentrate themselves in the process of group work. This gives the teacher information about students' knowledge. This is in agreement with the findings of (Canas, Reiska, Alberg & Novak, 2008). While experiential learning addresses the diversity of learning styles as the students are actively engaged in their own learning. The experiences are also structured to require that the learner takes initiative, makes decisions and is accountable for the results in their groups. This is in agreement with the findings of Arnold, Warner and Osborne (2006). In the learning sessions passiveness in control groups turns the girls into passive listeners and after a short time they begin to lose concentration from the course, and resort to rote learning. While in the experimental groups, students spend greater efforts participating in group discussions with an involvement in personal experiences. They use a systematic approach to problem solving and focus on understanding the meaning of ideas and presentation of these ideas in concept maps. This in the long run helps the girls understand the Physics subject matter making it real and hence perform well.

ECCA provides a classroom environment in a way that is beneficial for academic achievement and thus provide a satisfying atmosphere. As Glasser (1986) points out that there is no sense in telling learners how valuable classes are and how much they need them unless the classes are structured so that they are more satisfying to students. In competitive learning situations students compete to achieve their individual goals. This tends to create a negative interdependence in the class where students perceive they can obtain good grades when others do worse. In such an environment there is little motivation to work together while competition encourages some students to work hard to do better and other students are labeled as being failures in the class. There are also a number of students who give up because they do not believe that they have a chance to do well in the competition.

8. A Comparison of Girls' Achievement between Co-educational and Girls' alone Classes

Hypothesis Ho₂, sought to establish whether there was statistical significant difference in achievement in Physics between girls in a co-educational class and those in girls alone class when ECCA was used. This was done by analyzing the PAT post-test mean scores obtained by the girls in the experimental groups. There were 84 girls in girls alone class and 36 girls in co-educational class. The analysis of covariance for PAT, post-test mean scores for girls in both types of schools was carried out. The results obtained from this analysis are shown in Table 5.

Table 5. ANCOVA of the PAT Post-test Mean Scores of Girls in Experimental Groups Based on School Type

	Sum of squares	df	Mean Square	F	P- Value
KCPE	14.31	1	14.31	0.53	0.47
School Type	310.02	1	310.02	11.38	0.001
Error	3188.82	117	27.26		

df=(1;117), F-critical =3.94, P<0.05

The results of Table 5 shows that there was a statistically significant difference between the PAT mean scores for girls in co-educational schools and those of girls in girls only classes. The difference was significant at alpha level of 0.05, $F(1,117) = 11.30$, $P < 0.05$. The achievement of girls in girls' alone class is higher than those of girls in co-educational class. This means therefore that Hypothesis Ho2 is rejected. This implies that ECCA instructional approach benefited, girls in girls' alone class more than the girls in co-educational class. This made it necessary to carry out an analysis on the PAT post-test mean scores for the girls in the control groups in relation to the school type. There were 84 girls in girls alone class and 42 girls in co-educational school. Table 6 shows the results of the mean scores for PAT of girls in the control groups.

Table 6. PAT Mean Scores For Girls in the Control Groups

School Type	N	Mean	Std Error
Girls	84	13.63	6.64
Co-educational	42	7.40	3.25

The results of Table 6 indicate that the mean score for PAT post-test for the girls in Co-educational schools were lower than that of girls alone school. The results indicate that girls in a girls exposed to ECCA had a higher achievement than those in the control groups. However the performance of girls in co-educational school exposed to ECCA had a lower performance. The worst achievement was shown by girls in the co-educational school who were in the control group.

Table 7. The ANCOVA of the Post-test Mean Scores of Girls in the Control Groups

	Sum of squares	df	Mean Square	F	P- Value
KCPE	329.15	1	329.15	10.75	0.001
School Type	7.98	1	7.98	0.26	0.611
Error	3764.53	123	30.61		

df=(1;123), F-critical = 3.92, P<0.05

Table 7 indicates that the mean score of girls in girls' alone schools and that of girls in co-educational schools is not significant, $F(1,123) = 0.26, P > 0.05$. When the results for girls in the control schools are compared with those of girls in the experimental schools, they show that the ECCA method was beneficial to girls in the girls' alone class and those in co-educational class but more to girls alone class. Perhaps the presence of boys in co-educational class was intimidating the girls even when a learner centered approach such as ECCA was used. The results agree with those of Murphy and Whitelegg (2006) who argue that girls tend to do well in Physics when barrier of belonging are reduced. Although the findings tend to disagree with those of Wachanga (2002), who found that there was no significant difference in Chemistry achievement tests between girls in girls' only school and girls in co-educational schools, when cooperative learning was used.

It can therefore be argued that ECCA instructional approach has varying effects depending on the class composition. Smithers and Robinson (1995) in their research on achievement in relation to school type found out that students in single sex schools did achieve highly as compared to their counterparts in co-educational schools. They also found out that girls from co-educational school performed at the same level as girls from single sex schools. They associated the high achievement of students in single sex schools in comparison with co-educational to the nature of the schools. Their results seems to differ with the findings of this study since the results of this study shows the opposite, that is girls in girls' alone performed better than their counterpart co-educational when ECCA was used. The findings of this study concur with those of Patrick, Kpangban and Chibueze (2007) who found out that single-sex schools performed better than co-educational schools for both boys and girls. The higher achievement may be associated with the conducive learning environment and opportunity for self-esteem created by single-sex educational programme.

National Association for Single Sex Public Education (2010) report indicated that girls in single sex school performed better in science and mathematics. These findings also concur with that of Hamilton (1985); Warrington, Younger and Williams (2000), and Francis (2000) who noted in their studies that girls in single sex schools attain the highest achievements, followed by boys at single sex schools, then the boys and finally the girls in co-educational schools. According to Stables (1990) and Lee and Lockheed (1998), single sex schools allows student to broaden their horizon to allow them to feel free to explore and their own strengths and interests, not constrained by gender stereotypes. ECCA enhances girls confidence and enables them to perform well in physics.

Conclusions

The major findings of the study were;

- (i) ECCA instructional approach is a superior approach in improving the performance in Physics than the regular teaching method.
- (ii) Girls in girls' only schools performed better than girls in co-educational schools when ECCA was used.

Based on the findings of the study, the following conclusions were made.

- (i) ECCA instructional approach produced a significant impact on academic achievement in secondary schools Physics. This means that it facilitates girls' learning of Physics better than regular teaching methods.
- (ii) When ECCA method was used, the type of school significantly affects girls achievement with girls' in girls alone schools attained higher achievement in co-educational schools when taught through ECCA, their achievement was affected equally.
- (iii) The findings of the study provide evidence that ECCA instructional approach improves achievement for girls in Physics in Secondary Schools. This instructional approach is therefore likely to assist in improving the performance of girls which has been low as compared to that of boys at KCSE Physics examination. The improved performance would lead to a better representation in scientific occupation, even as Kenya looks forward into achieving vision 2030.
- (iv) Although the results of the study indicate that girls in girls only schools perform better than those in co-educational schools when ECCA instructional approach is used, girls in co-educational schools perform better than those in the same type of school who were taught using regular teaching methods. This implies that ECCA instructional approach is suitable for students in the three categories of schools.

The superiority of ECCA instructional approach over the regular teaching method could be attributed to the fact that it is an integration of three teaching approaches. Therefore, its strength is in the elements of cooperative learning that make students develop more positive attitude toward self and learning in general. Group learning activities can help individual students teach other students and also help them to learn that they are responsible for one another. On concept mapping students are engaged in knowledge construction and they find new ways to link concepts while in experiential learning, students learn through experience as the conceptualize what they learn applying it to real life situations. ECCA instructional approach enhances students reasoning ability and improves critical thinking. This implies that this teaching approach may go a long way to achieve the secondary school objectives of Physics.

Recommendations

ECCA offers a critical link between the classroom and the real world. Active involvement with group activities, real life situations improves girls' understanding of abstract theories, therefore increases their achievement in Physics. Teachers should incorporate ECCA Instructional approaches into their classroom activities and encourage students to participate. A study may need to be done in order to give insight on why girls in girls' alone schools perform better than those in co-educational schools when ECCA instructional approach is used.

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