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Effects of Experiential Cooperative Concept Mapping Instructional Approach on Secondary School Students' Motivation in Physics in Nyeri County, Kenya

Wambugu Patriciah W.[1], Changeiywo Johnson M.[1] & Ndiritu Francis G.[2]
1. Department of Curriculum, Instruction & Educational Management
2. Department of Physics Egerton University. P. O. Box 536-20115, Egerton, Kenya
Corresponding author E-Mail: patriwa2010@gmail.com

Abstract
This study aimed at finding out the effects of Experiential Cooperative Concept Mapping ECCM on students' motivation to learn Physics. Solomon Four Non-equivalent Control Group Design under the quasi- experimental research was used. A stratified random sample of 12 Secondary Schools was drawn from Nyeri County. Four boys' alone, four girls' alone and four co-educational schools were randomly assigned to four groups with a total of 513 Form Two students. Students in all the groups were taught the same Physics content of Magnetic Effect of Electric Current. The experimental groups were taught using ECCM approach while the control groups were taught through Regular Teaching Methods (RTM). Two groups were pre-tested prior to the implementation of treatment. After five weeks, all four groups were post-tested using the Student Motivation Questionnaire (SMQ). The instrument was validated and pilot tested before use. The reliability coefficient for SMQ was 0.81. The instrument was scored and data analyzed using t-test, one-way ANOVA and ANCOVA at a significance level of alpha equal to 0.05. The results of the study revealed that there was a statistically significant difference between the motivation to learn of students who were taught through ECCM and those taught through RTM. The researchers recommend the used of ECCM in addressing motivation of students towards learning physics.
Keywords: Experiential Cooperative Concept Mapping (ECCM), Regular Teaching Methods (RTM), Secondary School students, Physics, Motivation, Nyeri County.

INTRODUCTION

The study of Physics in Secondary Schools is necessary in building up knowledge, basic skills, attitudes and competencies necessary for human resource needs in socio-economic development. Students should therefore be motivated to enroll in Physics and pursue courses that require Physics in university and tertiary colleges. Physics is an important subject in the secondary school curriculum because it helps the learners apply the principles, acquired knowledge and skills to construct appropriate scientific devices from available resources (Feinstein, 2011; Kiboss, 2011). In addition it prepares learners for scientific and technological vocations, which play a major role in technological, socio-economic and industrial development in many countries of the world (Mirko, Dusanka & Mirjana, 2012; Waititu et al., 2001). Physics is a key discipline in producing qualified engineers, scientists, teachers and researchers among others. It should therefore be in a position to attract many students to pursue it. In many countries, there has been a decline in interest to study Physics and lack of enthusiasm to take it as a course in higher levels in schools. This reduces the number of students wishing to continue with Physics in higher levels ((Reid, 2003; Semela, 2010; Soong, 2010). Although learner centered instructional approaches have been encouraged in teaching secondary school Physics there has been low student enrolment in Physics at Kenya Certificate of Secondary Education (KCSE) compared to the other sciences (KNEC, 2012; Wambugu, 2011; Wambugu, Changeiywo & Ndiritu(2013)**.2 No. 3 August 2013Vol. 2 No. 3 August 2013**

A number of reasons have been identified by previous researchers as contributing to this lack of interest. Smithers (2006) noted that the study of Physics in schools and Universities is spiraling into decline as teenagers believe it is too difficult. There is a perception among students that the subject is difficult to grasp conceptually. Williams, Stanistreet, Spall, Boyes and Dickson (2003), observed that the major reason for students finding Physics uninteresting are that it is seen as difficult and irrelevant. Another reason identified is that the teaching method used may not be interesting resulting in more students dropping Physics in upper secondary (Gunasingham, 2009; Wambugu, 2011). The concern is how to motivate students and make Physics popular among Secondary School students, thus reducing this decline in interest. Findings of researchers who focus on teaching various topics in Physics indicate that regular teaching methods hardly improve the teaching of principle concepts in Physics (Crouch & Mazur, 2001; Tanel & Erol, 2008,). The foundation for increased interest in Physics takes its root from the first two years of the secondary school cycle. The Physics curriculum at this level emphasizes the development of lower level cognitive domain that is knowledge, comprehension and application before that of the other higher levels of analysis, synthesis and evaluation. This enables the students understand Physics concepts at their early introduction to the subject. The teaching method employed by a teacher has been shown to reflect on students' understanding of the subject. It is also important for teachers to understand and interpret the objectives of Physics. Lack of attention to these aspects of the Physics curriculum by the respective Physics teachers, could lead to students' perception of Physics as a difficult, irrelevant and boring subject, hence losing interest. It is therefore necessary to use methods which utilize instructional activities that students are involved in doing and thinking of the applications of what they are carrying out. Instructional strategies need to be participatory where all the domains of the student are engaged in learning (Muindi, 2008). Adesoji and Ibraheem (2009) were of the opinion that the teaching method adopted by the teacher in order to promote learning is of topmost importance, hence they concluded that there is need to introduce, adopt and adapt the latest instructional techniques that are capable of sustaining the interest of the learners.

The level of cognitive engagement and motivation of students is affected by the teacher controlling almost all activities, assigning a passive role to the students (Hanrahan, 1998). One of the most important psychological concepts in education is motivation. Research has shown that motivation is related to various outcomes such as curiosity, persistence, learning and performance (Guay, Ratelle & Chanal, 2008). Motivation plays an important role in determining how much the students will participate and also the level of achievement. Self determination theory proposes three categories of motivation; amotivation, extrinsic motivation (which is itself made up of four different types of regulations; external, introjected, identified and integrated) and intrinsic motivation. Each type of motivation varies with regard to the amount of autonomy associated with it and thus lies along a continuum ranging from low (amotivation) to high (intrinsic motivation) self determination (Deci & Ryan, 2008).

Both intrinsic and extrinsic motivation which could lead to deep involvement in learning may be constrained by a preponderance of teacher oriented method of instruction. This is because teachers play a significant role in inspiring and motivating students to learn. They are also responsible for creating opportunities that support learner's motivation (Jang, 2008). A teaching approach that a teacher adopts may motivate students to learn. And consequently improve on their interest, perception of relevance of the subject matter and satisfaction during instruction. If students are motivated to learn Physics, not only are they likely to do well in the subject but they may also opt to take it as an examination subject in KCSE. In addition, they are likely to pursue it later in higher education, and so end up in careers that require physics. There is need for classroom practices that would arouse students' interests and attention, raise their ability to belief they can accomplish tasks and raise their expectancies of academic work. Classroom tasks can be structured so that students' are forced to compete with one another, work individually or cooperate with one another to obtain rewards that teachers make available for successfully completing these tasks. On the other hand, individualist and competitive classroom practices, encourages students to work alone, without caring about others and students trying to outdo others. These perceptions may cause some students to avoid challenging subjects or tasks or to give up in the face of difficulty or reward themselves only if they win a competition and believe that their own successes are due to ability; whereas success of others are due to luck (Dembo, 1994; Dweck, 1986; Hohn, 1995; Spaulding,1992).

ECCM is a composite instructional approach which combines experiential learning, cooperative learning and concept mapping. The amalgamation of ECCM 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. 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 experienced in ECCM promotes the personal relevance and applicability of course material to students and often improves overall attitudes toward learning (Kalkanis, 2002; Minas, 2003 & Vlachos, 2004).

In this study experiential learning is amalgamated with cooperative learning and concept mapping. The integration of the elements of these three instructional approaches would provide a teaching strategy which supports contextualization of concepts, discussed in interactive groups and therefore provide an appropriate environment for meaningful learning (Keraro, 2008). This may improve students' motivation to learn Physics. The use of ECCM may make students active participants in knowledge construction facilitate learning of scientific knowledge and assist the students to extend the knowledge by applying it in their everyday life. In this instructional approach, students participate in the learning process by being provided with opportunities to engage in appropriate concrete experiences as they work in groups. They then draw concept maps and relate the acquired knowledge in their existing knowledge as they apply it to real life situations. The strategy enhances the development of need achievement, self confidence, and self-direction as they present the group concepts maps, through self-determination. The strategy also emphasizes group activity, investigation, social interaction and application of concepts into the real life situations thus making learning interesting (Deci & Ryan, 2008, Wambugu, 2011).

A cooperative learning atmosphere, accompanied with prior experiences and application of knowledge to real life situation motivates students out of a sense of obligation, autonomy and Self-Efficacy (Bandura, 1997; Bandura & Eccles, 2002; Wambugu, 2011, Weinberg, Basile, & Albright, 2011). ECCM allows students to know what they are to do, how to proceed through the cycles of learning and how to determine when they have achieved goals. It gives the students an opportunity for the satisfaction of deficiency needs, as they work together in groups, towards self actualization. It also allows for learning experiences that give feelings of success and encourages an orientation towards achievement, and strong sense of Self-Efficacy.

Statement of the Problem

Physics is a fundamental science subject and is also an important base for Science and technology. The learning of Physics also enhances economic, industrial and technological development. Despite all this, students' enrolment in the subject at KCSE has continued to remain low over the years. Prominent among the factors which have been identified as contributing to the lack of motivation and hence the persistent low enrolment in Physics, are the instructional strategies adopted by Physics teachers. It would therefore, be necessary to search for effective strategies which may be suitable and efficient for improving motivation to learn Physics to the satisfaction of the current Physics curriculum, requirements. The use of instructional approach such as ECCM could help to solve the problem of motivation to learn the subject but has not been determined in Nyeri County. The study was therefore intended to fill this gap of knowledge, by applying ECCM instructional approach in the teaching of Magnetic Effect of Electric Current in Form Two and establish its effect on students' motivation to learn.

Objectives of the Study

The objective of the study was;

i) To compare students' motivation to learn Physics between those taught using ECCM and those taught using Regular Teaching Method (RTM)

Hypothesis of the Study

The null hypothesis was tested at significance level of alpha (α) equal to 0.05.

Ho1: There is no statistically significant difference in motivation to learn physics between students exposed to ECCM and those that are not exposed to it.

Conceptual Framework

A conceptual framework that was used in this study was based on constructivist model of learning, and the systems approach theory of learning. The knowledge of the learner needs to be probed by exposing them to an instructional approach that will not only allow discussions as in cooperative learning groups but will give them an opportunity to consciously and explicitly tie the new knowledge to relevant concepts or propositions they already possess (Novak, Gowin, & Johansen, 1983). This study was based on the assumption that an instructional approach that involves students' cooperation and activity, using concept mapping and applying the new knowledge to real life situations may lead to worthwhile learning than a transmission approach (Hanrahan, 1998). Systems approach to instruction involves setting goals and objectives, analyzing resources, devising a plan of action and continuous modification. ECCM allowed the learners to go through the four-stage learning cycle in order to effectively learn and apply concepts to real life situations. This was done through doing, reflecting, thinking and planning. Assessment of the content covered was done to ascertain how much the learners learnt.

Diagrammatic representation of the framework is shown in Figure 1.

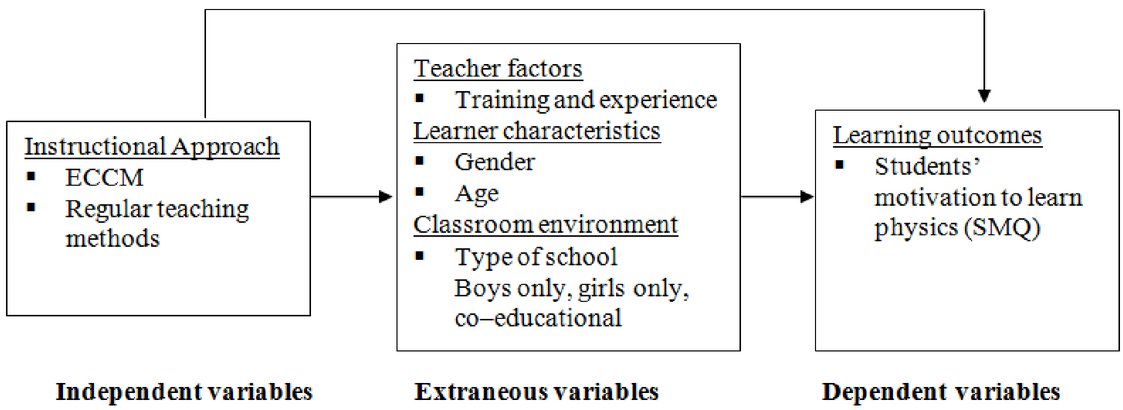

Figure1: Conceptual framework for determining the effect of using ECCM instructional approach on students' motivation to learn Physics.

Figure 1 illustrates the conceptual framework that relates the various factors considered to have an effect on students' motivation to learn Physics. The extraneous variables in this study were teacher characteristics, type of school, age and gender of the students. 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 and gender of the students were studied by determining their effects on students' motivation to learn Physics. The instructional approach used then influenced the students' motivation to learn Physics.

METHODOLOGY

Research Design

The research design used in this study was quasi-experimental. The researcher used Solomon Four Non-equivalent Control Group Design. This design is particularly strong in quasi-experimental procedure because it ensures the administration of pre-test to two groups and post-test to all the four groups (Gall, Borg & Gall, 2003; Lammers & Badia, 2005; Wachanga & Mwangi, 2004). 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 (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 (ECCM).

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 method while Group 1 and 3, the experimental groups were taught using ECCM.

Sampling Procedure and Sample Size

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 (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 three strata, namely boys 'alone, girls' alone and co-educational. There were eight boys' only, nine girls' only, and thirty co-educational schools that were selected. Four schools from each category were randomly selected. The four schools in each category were randomly assigned to the experimental and control schools such that each group in the experiment had three schools; one boys' only, one girls' only and one co-educational school. A summary of the school type and number of students is shown in Table 2.

Table 2 Summary of School Type and Number of Students Involved in the Study.

School	Female	Male	Total
Boys' only	-	176	176
Girls' only	168	-	168
Co-educational	79	90	169
Total	247	266	513

A total of 513 form two students were assigned to the four groups as follows.

Group 1 (Experimental group)	N= 125
Group 2 (Control group)	N= 130
Group 3 (Experimental Group)	N= 129
Group 4 (Control group)	N= 129
Total	N= 513

All the form two students were exposed to the same content of magnetic effect of electric current.

Instrumentation

The instrument used was composed of a Students Motivation Questionnaire (SMQ). The instrument was developed and validated before the commencement of the study. SMQ was constructed using Keller's ARCS motivation theory (Hohn, 1995). The researchers developed the SMQ and were guided by the ones used by Kiboss (1997), Wachanga (2002) and Buntting, Coll and Campbell (2006). SMQ contained 60 five point Likert-scale items on favourable and unfavourable statements of the students' motivation towards ECCM versus Regular Teaching Methods. SMQ was pilot tested in schools where the respondents had similar characteristics with those in the actual respondents in the study but were not involved in the research study. Cronbach's coefficient alpha method was used to estimate the reliability of the questionnaire. The alpha value was 0.81.

Construction of Instructional Materials and their Use

The instructional materials used in the study were based on the Kenya Institute of Education syllabus (KIE, 2002). The Physics topic of Magnetic Effect of Electric Current was chosen for the study and is normally covered in form two. The topic has been reported to be difficult and it is a foundational topic that combines the effects of magnetism and electricity. The instructional materials included training manual on ECCM for teachers and a teachers' guide to implementing ECCM on magnetic effect of electric current. The manuals were used throughout the treatment period.

The teachers in the experimental groups were trained by the researchers on skills of ECCM for one week. All the physics teachers in the experimental groups were trained on the use of ECCM instructional approach even if they were not teaching form two classes because of ethical reasons. After the training the students were taught using ECCM on a different topic other than Magnetic Effect of electric Current, to enable them master the skills. The treatment started and the experimental groups were taught using ECCM while the control groups were taught using RTM on the topic of Magnetic effect of Electric current. The lessons for the experimental groups were planned such that the learning process involved the four cycles of experiential learning and students held discussions in their various groups. Also the students discussed and drew concept maps that were later presented on the chalk board for further discussions. The control groups were taught through the regular teaching methods for the same period. Also all Form Two students in the schools involved in the study were taught using a similar method.

Data Collection and Analysis

Pre-tests were administered to groups 1 and group 2 before the treatment condition. After five weeks of treatment condition, post-test was administered to all groups. The researchers then scored SMQ and generated quantitative data which was analyzed. Data was analyzed using t-test, One-way ANOVA and ANCOVA. The Least Significant Difference (LSD) Post Hoc test was done to establish where the difference in mean scores existed. ANCOVA was used to cater statistically for initial differences among the groups. ANCOVA is a superior method that is used to compensate for lack of equivalence (Ary, Jacobs, & Razavieh, 1979). All tests of significance were performed at a significant level of alpha equal to 0.05.

RESULTS AND DISCUSSION

The Solomon four-group design used in this study enabled the researchers to have two groups sit for pre-tests as recommended by (Gall, Borg, & Gall, 2003). This enabled the researchers to assess the effects of the pretest relative to no pre-test and assess if there was an interaction between the pre-test and the treatment conditions. The results of the t-test are shown in Table 3.

Table 3Independent Samples t-test of the Pre-test Score on SMQ

Scores on SMQ Group 1, N= 125 Group 2, N= 130

Variable	Group	Mean	sd	df	t-value	P- value
SMQ	1	197.49	15.16	253	0.038	0.97(ns)
	2	197.40	20.83		0.038	

sd =Standard; df = 253; t-critical = 1.96; $P < 0.05$

The results of Table 3 reveal that the mean scores of groups 1 and 2 on SMQ are not statistically significantly different since $t(253) = 0.038$, $P > 0.05$. This means that groups used in the study for SMQ exhibited comparable characteristics. The groups were therefore suitable for the research study.

Effects of ECCM on Students Motivation to Learn Physics.

The Hypothesis H_O1 of the study sought to examine the effect of ECCM on students' Motivation to learn Physics. This Hypothesis indicated that there was no statistically significant difference between students exposed to ECCM and those that were not. The post-test SMQ scores were analyzed. Table 4 shows the results of the mean scores for the four groups on the SMQ post-test.

Table 4 Mean Scores for Post-test on SMQ

Group	N	Mean	sd
1	125	225.18	14.83
2	130	194.96	22.21
3	129	224.43	15.47
4	129	195.71	24.45

sd= Standard Deviation

To establish whether the differences between the groups were statistically significant. Analysis of variance was done and the results are shown in Table 5.

Table 5
Analysis of Variance (ANOVA) of the Post-test SMQ Scores.

	Sum of squares	df	Mean Square	F	P- Value
Between Groups	111934.52	3	37131.51	95.4	0.00
Within Groups	198105.51	509	389.21		
Total	309500.04	512			

df=(3,509; F-critical = 2.70; P<0.05

The results show that there was a statistically significant difference within the four groups. A Post-Hoc multiple comparisons were done to establish where the differences were. The results indicated that the pairs of SMQ mean scores for Groups 1 and 2, Groups 1 and 4 and Groups 2 and 3 with an alpha level of 0.05 were statistically significant different. However, there was no statistically significant difference at alpha level of 0.05, in the mean scores of Groups 1 and 3, and 2 and 4. Since the study involved quasi-experimental design, it was necessary to carry out analysis of covariance. The analysis was carried out by performing the analysis of covariance on the SMQ post-test with KCPE scores as the covariate. The results of the adjusted means scores for SMQ are shown in Table 6.

Table 6 Adjusted SMQ Post-test Mean Scores in the ANCOVA

Group	N	Mean	Std. Error
1	125	224.29	1.77
2	130	196.02	1.75
3	129	223.62	1.74
4	129	196.31	1.73

The data in Table 6 shows that the mean score for the experimental group is higher than the control group for post test SMQ means scores after adjustments. With the adjusted means the researchers did the analysis of covariance of the post test. Results of this analysis are shown in Table 7.

Table 7Analysis of Covariance of the Post-test Scores on the SMQ

	Sum of squares	df	Mean Square	F	P- Value
Group	90459.29	3	30153.1	78.84	0.00
KCPE	3827.23	1	3827.23	10.00	0
Error	194278.28	508	382.44		

df=(3,508); F-critical = 2.72; P<0..05

The results indicate that there was a statistically significant difference between the groups F (3,508) = 78.84, P< 0.05. To establish where the differences were a Post Hoc pair wise comparison was carried out. The results indicated that the results of ANCOVA were statistically significant different at alpha level of 0.05 between Groups 1 and 2 , between Groups 1 and 4 , Groups 2 and 3 and Groups 3 and 4. However, there are no statistically significant difference at alpha level of 0.05 between Groups 1 and 3, and Groups 2 and 4. These results agreed with those of ANOVA and they therefore indicate that the experimental groups had higher motivation to learn than the control groups. This means therefore that ECCM instructional approach had an effect on students' motivation to learn Physics. The results of the analysis of variance and those of analysis of covariance for SMQ post-test mean scores indicate that ECCM had an effect on students' motivation to learn Physics. Therefore, Hypothesis H_O1 is rejected. This means that ECCM instructional approach motivated students to learn Physics as compared to RTM.

DISCUSSION

Effects of ECCM on Students Motivation to Learn Physics

The results of this study indicate that ECCA instructional approach increases motivation towards learning Physics. This probably is because when students work in groups, as they draw the concept maps and apply the experiences to real life situation, they feel that they can depend on others for help and also the concept learnt have meaning to their daily lives. This increases their confidence in performing tasks and solving problems in Physics. ECCM actively involves students in the learning process. These findings are consistent with the findings of previous researchers such as Ifamuyiwa and Akinsola (2008), Anderson 2006; Keraro, Wachanga and Orora (2007); Wachanga, 2002); Kelly and Kolb (2002) and Berger and Hanze (2007). ECCM instructional approach provides a balanced approach to instruction that serves as a motivating force for many students to engage in the learning process. This resulted in higher students' motivation than the regular teaching method. The regular methods of teaching assume that the teacher is the person in authority in the class whose job is to impart knowledge and skills to the learners. Students tend to see their role as relatively passive recipients of the knowledge, expecting the teacher to be in charge of their learning. Students learn but the cooperation between them is limited by competition for grades.

In Contrast, ECCM, provides intrinsic Motivation and self directed learning. Learners see themselves as increasingly competent and self determined and assume responsibility for their own learning. This is provided by the elements of each of the instructional approach contained in ECCM. Experiential learning offers students opportunities to learn in real life application and the four stages that are involved in the learning process- concrete experience which provides learning by intuition with emphasis on personal experiences. The activities that support this activity include group discussion which cooperative learning caters for. Reflective observations, where learning is done by perception, focus on understanding ideas, concepts and situations by careful observations. This is also achieved through construction of concept maps which are done in cooperative groups and increases students satisfaction and motivation to learn.

Abstract conceptualization is where learning requires rigorous thinking using a systematic approach to structure and frame of phenomena. Concept mapping allows accomplishment of this stage, since it emphasizes on linking concepts and ideas with words in the maps. The fourth stage, active experimentation is where learning is attained through action; this involves learning through the transfer of learning and application to the real world. This consequently led to increased motivation when ECCM was used as compared to use of regular teaching methods. These results concur with those of Clinton and Kohlmayer (2005) in their study on the effects of group quizzes on performance and motivation to learn. They also agree with those of (Gahr, 2003) who found out that the students in a cooperative chemistry concept mapping class were motivated to learn and hence performed well. ECCM employ variety of motivational techniques to make instruction more relevant and students more responsible. This kind of instruction strategy encourages students to see their ability in performing the task to completion, hence increasing their self-efficacy which leads to increased motivation to learn. Also students work in groups, can role model each other, whereby a student is able to observe others doing an activity and therefore gets encouraged to do equally well. The role played by the teacher is that of a facilitator, hence the teacher has minimal control over the working of groups. This encourages autonomous group work and increases self determination. According to Deci and Ryan (1985), the level of intrinsic motivation increases when students act by self determination. Forsyth and McMillan (1994) emphasizes intrinsic motivation as a key element in teaching and learning, noting that successful intrinsic motivation develops attitude, establishes inclusion, engenders competence and enhances meaning within diverse students. ECCM is an instructional approach that can enhance intrinsic motivation, as proved by the results of this study.

The primary benefit of cooperative learning in ECCM is that it enhances students' self esteem and satisfaction with the learning experience by actively involving students in designing and completing class procedures and course content (Johnson & Johnson, 1998). On the other hand, experiential learning motivates students to learn in that it stresses the full involvement of students in the learning process. This is achieved through active learning as opposed to passive learning as it is reflected in findings of (Mckeachie, 2001). Findings of research studies in Physics education also point out that active learning has many positive outcomes such as enhancing motivation, improving classroom performance and development of critical thinking (Kalkanis, 2002). The results of this study concur with the findings of these researchers, since ECCM enabled the students not only to be actively involved but also encouraged groups working together throughout the learning process.

Concept mapping as an instructional strategy, combined with cooperative learning motivates students to learn. This is because concept mapping as a learning strategy stimulates learners' commitment and involvement in negotiation of ideas, which is very important to learn meaningfully (Cansas, Novak & Gomzalez, 2004). Therefore if each of these instructional approaches in ECCM has the potential of motivating students to learn, then when integrated in an organized way, they may help the students to perceive the relevance of Physics to

their lives and be highly motivated to learn as this study found out. This concurs with the finding of Kolb and Kolb (2005); Kayes, Kayes and Kolb (2005); Fuifong and Hong Kwen (2007) and also those of Berger and Hanze (2007)). Their findings indicate that students through experiential learning, cooperative learning and concept mapping are more engaged in the learning process, achieve a better understanding of Physics concepts and their motivation to learn increases. Therefore, it can be concluded that ECCM provides many advantages to teachers and learners, in relation to the teaching and learning of Secondary School Physics, since it incorporates all the elements of the three strategies. The ECCM instructional approach also resulted in better student-student, student-teacher interactions; helped students to understand, integrate and clarify Physics concepts and also enabled students have a critical link between classroom and the real world. This improves students' motivation as was shown by the results of SMQ in this study. This study has also shown that this instructional approach resulted in an improvement in the four conditions which exist in a motivated learner. These are Attention, Relevance, Confidence and Satisfaction (Hohn, 1995). Students' attention improved as they drew concept maps in cooperative groups and in their discussions on the application of learnt concepts to real life situations. The goals of each group were set with the involvement of the students in advance. This made the members feel that the course content was valuable to them. Through the application to real life situations, the learners appreciated the fact that the skills and knowledge acquired will have future usefulness. Encouragement from fellow group members increased the students' confidence. This was also enhanced by the feedback which came from the presentation of the concept maps and applications of learnt knowledge by various groups.
Satisfaction of the students was as a result of the achievement of goals and the students feeling that the skills and knowledge was useful and less patronizing from the teacher. The higher motivation acquired by students who were taught through ECCM instructional approach strengthens the case for the implementation of this method in Secondary School Physics teaching. Motivated students will want to continue with the task even when it is difficult. An important note of the instructional strategy used in this study is that of intrinsic motivation and self-directed learning. The learners in their respective groups and as they go through the learning cycle, are able to see themselves as competent and capable as they assume the responsibility for their learning.

CONCLUSIONS
Based on the findings it can be concluded that;

(i) Students who learnt Physics under ECCM instructional approach have higher motivation to learn than the students who learnt through regular teaching methods.

IMPLICATIONS
The findings of the study provide evidence that ECCM instructional approach improves motivation to learn Physics in Secondary Schools. The increased motivation to learn physics would lead to a better representation in scientific occupation, even as Kenya looks forward into achieving vision 2030. The superiority of ECCM 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. 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. ECCM instructional approach by its nature, promotes self efficacy and self determination, which in turn fosters intrinsic motivation to perform tasks in Physics. This type of instructional approach moves beyond rote memorization and goes to the level of understanding, linking and integration of concepts. Therefore, the Ministry of Education in its effort to make teaching more effective should encourage Physics teachers to use this method.

RECOMMENDATIONS
Pedagogical competence of Physics teachers stands as a major challenge. The teachers need skills to concretize theoretical and practical notion of Physics in a manner that links acquired, knowledge, skills and attitude to students' everyday life situations. Based on the findings of the study therefore the following recommendations have been made;

(i) Teacher education programmes should be focused towards preparing Physics teachers to acquire appropriate skills in instructional strategies such as ECCM instructional approach which could promote effective teaching-learning process. ECCM instructional approach should be included in the methods courses in training of Physics teachers in university and Teacher training Colleges. The teacher preparation course must emphasize the importance of using all components of ECCM instructional approval for positive student learning.

(ii) Textbooks' writers should shift emphasis from teacher activities to students' activities as well as incorporating principles of ECCM instructional approach in new Physics text books to be produced.

AREAS FOR FURTHER RESEARCH

The findings of the study indicate that ECCM instructional approach is effective in improving Physics instruction and therefore motivating students. However, there are areas that warrant further investigation. These include the following;

(i) How ECCM instructional approach would lead to a significant increase in the choices related careers by students especially girls.

(ii) How to improve psycho-motor objectives through ECCM. This would improve on the acquisition of science processing skills.

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