MATHEMATICS TEACHERS' ATTITUDE, STRATEGIES AND CHALLENGES IN THE IMPLEMENTATION OF ACTIVITY, STUDENTS' EXPERIMENT AND IMPROVISATION INNOVATION IN SECONDARY SCHOOLS IN BUNGOMA CENTRAL SUB-COUNTY, KENYA

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DEDICATION

This thesis is dedicated to my wife Joyce Tabu, my three sons Jeremiah, Nehemiah, James and my two daughters Edith and Olivia for their love, patience, support and encouragement.

ABSTRACT

The Activity, Students' Experiments and Improvisation (ASEI) teaching innovation was started in Bungoma Central Sub-County in the year 2004, for mathematics performance enhancement. Despite the implementation of ASEI innovation in Bungoma Central Sub-County since 2004, the Sub-County has declining mean scores in Kenya Certificate of Secondary Education (KCSE) mathematics since 2008 as follows 2008 (3.403), 2009 (3.126), 2010 (3.044), 2011 (2.962) and the performance in some eight schools has been declining or erratic.KCSE is a standardized instrument for measuring performance at form four level and mean scores range from 1 to 12.The success of ASEI as a teaching innovation depends on the attitude of mathematics teachers, strategies used and challenges faced. What was unknown was the mathematics teachers' attitude, strategies used and challenges faced, the knowledge gap this study sought to fill. The purpose of this study therefore was to establish the attitude, strategies and challenges of mathematics teachers in the implementation of ASEI innovation in public secondary schools in Bungoma Central Sub-County. Objectives of this study were to; establish attitude of mathematics teachers towards implementation of ASEI innovation, establish the strategies that mathematics teachers use to implement ASEI innovation and establish the challenges that mathematics teachers face in the implementation of ASEI innovation. A conceptual framework was used in which attitude of mathematics teachers; strategies used and challenges faced interacted to determine successful implementation of ASEI innovation. This study used descriptive survey research design. The target population included 2 DQASOs, 15 Principals, 15 Deputy Principals, 15 HODs and 42 teachers. A sample comprising of 2 DQASOs, 14 Principals, 14 Deputy Principals, 14 HODs and 38 teachers were selected through saturated sampling technique. The interview schedules and questionnaires were presented to research experts to ascertain their content validity while a pilot study involving 4 teachers conducted to determine reliability of the research instruments. Data was collected using questionnaires and interview schedules. Quantitative data obtained from questionnaires was analyzed using descriptive statistics in the form of means, frequencies and percentages. Qualitative data was transcribed and analyzed and reported in emergent themes and subthemes. The study established that Mathematics teachers' had positive attitude towards implementation of the ASEI innovation with overall mean rate of 3.08 for schools with declining performance and negative attitude with an overall mean rate of 2.95 for schools with improved performance. The study also established that teachers used seven main strategies; team teaching, motivation, peer lesson study, group work, regular internal inspections and adequate use of resources. The study established that mathematics teachers experienced the challenges of limited time, negative attitude towards mathematics, low entry behavior, understaffing, inadequate resources, large class size, unsupportive administration and un-co-operative colleagues in the implementation of ASEI innovation. Qualitative data revealed proper record keeping and checking students' work as strategies while absenteeism and lack of incentives were challenges in the implementation of ASEI innovation. The findings of this study are significant to policy makers, school administrators and teachers in enhancing good performance in mathematics in Bungoma Central Sub-County.

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LIST OF ABBREVIATIONS AND ACRONYMS

K.C.S.E	Kenya Certificate Of Secondary Education
ASEI	Activity Student Experiment and Improvisation
COSMAT	Collaboration Supported Mathematics Teachers
DQASO	District Quality Assurance and Standards Officers
HOD	Head of Department
IN-SET	In-service Training
PDSI	Plan, Do, See and Improve
PRIMAS	Promoting Inquiry in Mathematics and Science
SESEMAT	Secondary Science and Mathematics Training
SMASSE	Strengthening Mathematics and Sciences in Secondary Education

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Teacher development under which in-service training is a key strategy is one of the approaches employed to upgrade teachers' skills and competencies all over the world and is in conformity with worldwide consensus that improving quality of education depends on improvement of classroom practices (Karega, 2008). Apart from improving teachers' knowledge and skills, in-service training helps teachers to develop new teaching strategies (Pervaton, Creed &Robinson, 2002). Somers and Sikorova (2002) evaluated in-service training of teachers in Czech Republic and found that it had impacted positively on the teachers' practice. Studies have found that students whose teachers have deeper content knowledge related to the mathematics that they teach outperform their peers (Hill, Rowan & Ball, 2005).Hartsell, Herron, Fang and Rathod (2009) investigated whether a four-week professional development workshop for mathematics teachers helped to improve their ability to integrate technology into instruction and teaching mathematics. Results of the study revealed that the professional workshop did improve teachers' technology skills in using graphing calculators and different software programmes as well as increasing their overall confidence in teaching different mathematics topics such as fractions, percentages and real numbers.

Current trends in in-service training advocate for learner- centered teaching approach which is believed to enhance effective learning. Researchers and policymakers around the

world have endorsed the use of learner –centered pedagogies (Darling-Hammond & Bransford, 2005; Hopkins, 2002). Effective professional development programs have been linked to teachers' shifts towards more student-centered beliefs and classroom practices (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009).Teachers' use of student-centered pedagogies has been found to significantly increase student achievement and students' conceptual understanding. Mathematics educators have advocated for the enactment of student-centered mathematics pedagogies in order to increase both student achievement and students' understanding of mathematics concepts (Higgins & Parsons, 2010; U.S. Department of Education, 2008).

Developed countries including Britain,Japan,Singapore and China have embraced learner –centered teaching and consequently better performance in mathematics has been realized (JICA, 2002).In Europe,PRIMAS (promoting inquiry in mathemtics and science) project was identified as the method of choice to increase students' interest and achievement in science .A study on the use of inquriry based learning (IBL) in PRIMAS countries showed significant differences in the actual routine use of IBL in the classroom. A certain basic level of IBL practices was found in every country and teachers were convinced that IBL had a great potential to motivate students (PRIMAS Project, 2011). In Africa, priorities for alleviating poor results in mathematics and sciences have been identified in various African countries like Zimbabwe and Namibia through learner-centered pedagogy (SMASSE, 2008).

The learner- centered teaching innovation that is ASEI (Activity, Student ,Experiments and Improvisation) has been recognized as an effective tool in enhancing the quality of teaching and learning science and mathematics in several African countries (SMASSE, 2008). Reports from various countries indicate enhanced teaching effectiveness and improved performance in mathematics and sciences since inception of ASEI innovation. A SMASSE report from Uganda, indicated that there has been improvement in mathematics and science performance and more students were opting for science combination at advanced level since 2008, after adoption of the ASEI innovation (SMASSE-WESCA, 2010).

A similar report from Rwanda ,indicated that mathematics and science teachers had positive attitude towards practice of ASEI innovation and consequently the number of students who chose mathematics and sciences as electives had increased since the year 2008 (SMASSE-WESCA, 2010).In Ghana , teachers appreciated the usefulness of ASEI innovation in the teaching of mathematics and science, consequently pupils' interest in mathematics had been enhanced based on their attendance in class and readiness to do projects (SMASSE-WESCA, 2010).A SMASSE baseline study in Nigeria in 2005,revealed that teachers had perceived difficulties in mathematics but after adoption of ASEI innovation, active participation of children during mathematics and science class lessons had been achieved between 2006 and 2009 (SMASSE-WESCA, 2010).In Niger ,the practice of ASEI innovation had enriched improvement of test scores in mathematics since 2006 as follows 2006 (11.93%), 2007 (19.62%), 2008 (30.60%), 2009(41.45%) and 2010 (31.35%) respectively. In Zambia, impact assessment report indicate that between

2008 and 2010,there was a marked improvement in general performance and quality of results for mathematics and science from the time ASEI was introduced (SMASSE-WESCA, 2010).

In Malawi, ASEI had generated considerable interest in mathematics and science and more students were enrolling in the subjects for examinations and there has been considerable improvement in students' performance in national examinations since the year 2008.However, the report, revealed that there were still challenges for mathematics and science teachers to apply the skills and knowledge acquired (SMASSE-WESCA, 2010).

In an effort to improve the performance in mathematics in national examination, the government of Tanzania introduced the COSMAT programme to train teachers in learner- centered pedagogy (Kitta, 2004). Teachers were encouraged to work in a collaborative ways and share ideas in study groups, co-planning of the lessons and team teaching. Uworwabayeho (2007) observed that learner-centered teaching had enhanced effective learning in Rwanda. His findings revealed that teachers were eager to change the culture of talk and chalk and give more opportunities for learners to think for themselves .He recommended that teachers within or between schools be encouraged to sit together and discuss their teaching in order to learn from each others' experience. Jebson (2012) investigated impact of cooperative learning on performance of students in mathematics in selected secondary schools in Nigeria and found that the experimental group which was taught using the cooperative approach performed better than the control

group which was taught using the conventional method. This implied that the cooperative teaching and learning approach had a significant effect on students' performance in secondary school mathematics.

The secondary science and mathematics (SESEMAT) in-service Progromme in Uganda whose focus is learner-centered teaching was recognized as an effective tool in enhancing the quality of teaching and learning science and mathematics. Research findings showed that SESEMAT programme had the greatest impact on improved teachers' and students attitude towards mathematics and sciences and improved performance in national examinations (Komakech & Osuu, 2014).

The ASEI teaching innovation in Kenya was in response to continuous poor performance in mathematics and science subjects (Ministry of Education, 2007). ASEI innovation has been implemented in the Kenyan education system for over fifteen years now. During this period, the innovation aimed at realizing the goal of enhancing the capability of the young Kenyans in mathematics and sciences. Monitoring and evaluation of ASEI innovation in Kenya in the pilot phase indicated a more positive attitude change in teachers and students towards mathematics in ASEI districts than in non- ASEI districts. The evaluation also revealed that achievement of students taught by teachers who had undergone ASEI training performed better than those taught by teachers who had not undergone ASEI training and lessons implemented by teachers who had attended the ASEI training were of high quality than those implemented by teachers who had not participated in the ASEI training (Njuguna & Sugiyama, 2004).Between the years 2005

and 2008, impact assessment report indicated that there was marked improvement in general performance and quality of results for mathematics and science from the time ASEI innovation was introduced in Kenya (SMASSE,2008).

In Kenya, by 1999 the mean score in KCSE mathematics was 24.46% and by 2006, the mean score had risen to 38.02% (Kibe & Ogwel, 2008) as a result of adoption of ASEI teaching innovation. Several studies on ASEI innovation in Kenya indicate considerable improvement in students' performance in national examinations since inception of the pedagogy. A study on the impact of ASEI innovation on teaching and learning mathematics in Tigania West district found that the performance in KCSE mathematics had become steady than before inception of the innovation (Liburu,2004). M'kiambi (2013) also established that adoption of ASEI innovation in Nkueni division, Meru County, had contributed to improved performance in mathematics. A similar study, in Bomet district established that ASEI innovation had influenced improved performance in KCSE mathematics (Anyango, 2006). Kahare (2011) also found that ASEI innovation had enhanced improved performance in physics in Lari district, Central Province.

While the enactment of student-centered pedagogies has been empirically linked to gains in student learning (Heck, Banilower, Weiss, & Rosenberg, 2008; Polly, 2008), prior studies have noted teachers' struggles implementing these types of instructional practices with a high level of fidelity (Boston & Smith, 2009, 2011; Poly & Hannafin, 2011). Handal and Herrington (2003) argued that mathematics teachers' pedagogical beliefs bring about complexity of bringing about educational change and this explains the failure

of some past reforms endeavours. In a study to investigate the effect of ASEI innovation on performance in mathematics in Kitui Central district, Kitui County, Mutambuki (2014) established that ASEI administrative structure affected the performance of mathematics in secondary schools and that the individual teachers'atttitude determined the implementation of ASEI, since there was a strong positive cor-relation (r= 0.82) between teachers' attitude about ASEI and the performance in mathematics.

Analysis of curriculum innovations identifies two different versions; the intended innovation which presents idealized innovative prescriptions and the realized versions, which is actually implemented in the curriculum (Sakui, 2004).A study by Le Van and Roger (2009) in Vietnam explored how teachers implement a curriculum innovation. The study highlighted the need to bridge the gap between the idealized world of innovation designers and the realistic world of teachers who are essential to the implementation of innovation. A study by Pomuti, Leczel, Lema and Swarts (2005) in Namibia revealed that though teachers were aware of the necessity to incorporate learner-centered principles in their teaching, they lacked the skills to do it.This agrees with Sikoyo (2010) in her study in Ugandan primary schools who concluded that although teachers understood and recognized the benefits of learner-centered pedagogic process, they were unable to implement it in a manner prescribed. Pham (2010) also concluded in Vietnam that implementation of learner-centered teaching needed changes in both school infrastructure and peoples perceptions. He recommended studies to be done to determine how to implement changes so that new approaches can be successfully implanted in the local context.Njiru (2012) studied how the ASEI approach to the teaching of biology was being

implemented in the classroom in Mbeere South district and found that the students were involved in practicals.Kahare (2011) found that physics teachers used activities such as question and answer sessions, group discussion and experiments in their practice of ASEI innovation. The study by (Anyango, 2006) in Bomet district established that mathematics teachers in their practice of ASEI; exchanged experiences, use locally improvised teaching materials in the teaching of mathematics.The above studies highlighted strategies used by teachers in the implementation of ASEI teaching innovation in biolgy,physics and mathematics whereas the current study sought to establish the ASEI implementation strategies in the context of declining performance in mathematics in Bungoma Central Sub-County, Kenya.

M'kiambi (2013) established that teachers had adopted ASEI innovation, despite inadequate teaching /learning resources in Nkueni division. Kahare (2011) noted that only a small percentage of teachers improvised, evaluated the lessons and used activity focused learning with experiments. Nekesa (2009) also concluded that ASEI innovation had influenced a slight improvement in KCSE chemistry in Uasin-Gishu district. Obonyo (2013) also found that although mathematics and science teachers in Nyamaiya division, Nyamira County had a high understanding of ASEI innovation, teachers had not adopted the ASEI pedagogy. There are challenges in the implementation of student –centered pedagogies including inadequate resources, large number of pupils, examination oriented curriculum which focus on memorization of facts (Alexander,2002).An evaluation of school improvement programme (SIP) in nursery and primary schools in Kampala revealed that utilization of learner-centered pedagogy was more sporadically

implemented because of inadequate materials and large classes (SirajBlatchford,Odada,&Omagor, 2002).Nevertheless ,in this setting, some teachers manage to reconcile these goals and at least for a period of time ,implemented learner – centered pedagogy in ways that enabled their students to acquire requisite knowledge and score well in examinations (Hopkins,2002).The results above suggest that teachers experience challenges in the implementation of ASEI,which the current study sought to establish in the context of declining performance in mathematics.

A study by Azuka, Durojaiye, Okwuoza and Jakayinfa (2013), examined the attitude of primary school mathematics teachers towards the use of activity-based learning (ABL) methods in teaching mathematics in Nigerian schools. The study involved 224 primary school teachers made up of 60 males and 164 females, who were sampled using purposive sampling. Four research questions guided the study. Simple frequency counts, percentages,t-test and analysis of variance were used to analyze the data. The study revealed that mathematics teachers were positively disposed to the use of activity- based learning in the sense that they understood it and preferred to use it in schools. The study showed that there was a significant difference in the mathematics teachers' attitude towards the use of activity –based learning among individual teachers. The teachers agreed that the method enhances students learning experiences. The study used, purposively sampling which could created room for subjective data and also the use of research questions was inadequate. The study would have yielded stronger conclusions if views of other stakeholders were factored in. However the study was quite elaborate in data analysis by employing many approaches. There was need for a similar study

involving secondary school teachers, incorporating the views of the Principals, their Deputies and Heads of department as important stakeholders who are the immediate supervisors of the teachers. The current study sought to fill this gap. The current study was not concerned with significant difference in attitude of teachers.

Barbara (2006) examined teaching strategies that mathematics employed after being trained in learner -centered pedagogies owing to poor success rates of learners in mathematics in the national examinations in Windhoek, Namibia. The sample for the study consisted two senior secondary schools and one junior school. The data collection comprised of class observations and interviews with teachers and learners of the schools involved. The process of triangulation was used in data analysis. The findings were that almost all teachers were using the same strategies, which were teacher- centered, with teachers relying heavily on textbooks. Activities to motivate self-discovery were almost non-existent. The findings from the above study cannot be used to represent all teachers in Windhoek since only teachers in three schools were sampled. The results are also not representative since the input of Principals, their deputies and Heads of department as supervisors were ignored. Learners may not have adequate analytical skills to respond to interview and questionnaires, this created room for biased data. The fact that teachers still employed teacher-centered strategies, meant that they faced challenges in the implementation of the new approaches. This created the need to study the challenges teachers encounter in the implementation of ASEI innovation in the context of declining performance in mathematics. The current study investigated the strategies teachers used to implement learner-centered teaching innovation and the challenges they faced in the

implementation process, incoprporating the input of Principals, their deputies and Heads of department as important stakeholders in the context of declining performance in mathematics in Bungoma Central Sub-County, Kenya. In this study saturated sampling is used.

Despite the successful implementation of ASEI innovation in Kenya and subsequent improved performance in KCSE mathematics, statistics from Bungoma Central Sub-County indicate that the sub-county had declining mean scores since 2008 and the performance in some schools has been declining or erratic as shown in the Table 1.1

Table 1.1: K.C.S.E Mean scores in mathematics in Bungoma Central Sub-County

SCHOOL	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
A	5.30	5.18	4.56	5.15	4.90	4.83	6.46	6.18	7.13	7.03
B	2.36	2.42	2.66	2.16	3.45	3.64	3.47	3.52	2.41	1.87
C	2.70	2.24	2.83	2.08	1.80	2.39	3.60	3.37	3.39	3.32
D	2.27	3.24	3.22	1.79	2.00	2.28	3.67	3.16	3.04	2.53
E	2.06	1.60	1.32	1.79	2.00	2.28	3.67	3.16	3.04	2.53
F	2.57	2.10	3.07	2.19	1.90	1.55	3.29	2.77	3.12	2.96
G	2.25	3.30	2.36	2.81	2.52	2.28	2.69	2.68	2.47	2.53
H	1.59	1.94	2.06	1.60	2.13	1.60	2.54	1.75	2.78	3.64
I	1.85	1.40	2.30	1.45	1.18	1.29	2.48	1.46	2.83	2.54
J	2.38	2.15	1.85	2.39	2.36	1.89	2.76	2.47	2.46	2.57
K	2.37	2.23	3.03	1.94	2.58	1.90	2.14	2.47	2.57	2.72
L	2.27	2.47	1.64	1.88	2.00	2.65	2.64	2.40	2.26	2.45
M	2.27	1.93	1.76	1.80	2.02	2.01	2.12	2.38	2.43	2.51
N	1.82	1.71	1.90	1.70	2.42	2.92	2.02	2.27	2.33	3.00
O	1.30	1.88	2.20	1.86	2.42	2.92	2.62	2.85	3.40	2.23
Overall mean Score	2.357	2.386	2.451	2.173	2.379	2.495	3.145	3.126	3.044	2.962

Source: Bungoma Central Sub-County Education Office (2011)

1.2 Statement of the Problem

Learner-centered teaching innovations have been used to enhance teaching effectiveness and performance in mathematics and sciences in many countries including; U.S, Japan, Singapore, China, Malawi, Namibia, Nigeria ,Tanzania, Uganda and Rwanda. Evaluation of impact of ASEI (Activity, Student, experiments and Improvisation) which is a learner- centered teaching innovation, on performance in KCSE mathematics in Kenya revealed that there has been positive performance trend since inception of ASEI innovation. Other evaluations by Liburu,Anyango and M'Kiambi revealed enhanced performance in KCSE mathematics and science as a result of adoption of ASEI innovation in Kenya .

However, despite the implementation of ASEI innovation in Bungoma Central Sub-County since 2004, statistics from the Sub -County Education Office indicate that the Sub-County had declining mean scores in KCSE mathematics since 2008 as follows 2008 (3.403), 2009 (3.126), 2010 (3.044), 2011 (2.962) and the performance in some schools has been declining. No study had been done to establish the attitude, strategies and challenges of mathematics teachers in the implementation of ASEI innovation in Public Secondary Schools in Bungoma Central Sub-County.

1.3 Purpose of the Study

The purpose of this study was to establish the attitude, strategies and challenges of mathematics teachers in the implementation of ASEI innovation in Public Secondary Schools in Bungoma Sub-County.

1.4 Objectives of the Study

This study was guided by the following specific objectives

i) To establish attitude of mathematics teachers towards implementation of ASEI innovation in Public Secondary Schools in Bungoma Central Sub-County.

ii) To establish the strategies that mathematics teachers use to implement ASEI innovation in Public Secondary Schools in Bungoma Central Sub-county.

iii) To establish the challenges that mathematics teachers face in the implementation of ASEI innovation in Public Secondary Schools in Bungoma Central Sub-county.

1.5 Research Questions

a) What is the attitude of mathematics teachers towards implementation of ASEI innovation in Public Secondary Schools in Bungoma Central Sub-County?

b) What strategies do mathematics teachers use to implement ASEI innovation in public secondary schools in Bungoma Central Sub-County?

c) What challenges do mathematics teachers face in the implementation of ASEI innovation in Public Secondary Schools in Bungoma Central Sub-County?

1.6 Significance of the Study

The study was to establish the attitude, strategies and challenges of mathematics teachers in the implementation of ASEI innovation .The findings of the study are useful in

a)Finding a remedy for declining KCSE mathematics performance in Bungoma Central Sub-County

b)Optimizing returns from the investment in ASEI innovation in Bungoma Central Sub-County.

c)Evaluating effectiveness of the ASEI innovation.

1.7 Assumptions of the Study

The K.C.S.E Mathematics mean scores are a reflection of impact of ASEI practice

1.8 Scope of the Study

This study was delimited to mathematics teaching and performance in K.C.S.E mathematics in public secondary schools in Bungoma Central Sub-County. The findings of this study were generalized to mathematics teaching and performance in mathematics in public secondary schools in Bungoma Central Sub-County, since the year 2008.

1.9 Conceptual Framework

The outcome of implementation of pedagogical innovations depends on what teachers think and do, with regards to those innovations (Fullan,2007). In particular ,what teachers think and do with regards to putting in practice the intended innovation is determined by the challenges teachers encounter during the implementation process as well as the meaning teachers ascribe to the innovation. Thus in the implementation of ASEI innovation in secondary schools, mathematics teachers possess some attitude toward ASEI innovation. At the same time these attitude will determine the kind of strategies to use in the ASEI implementation process. Teachers device teaching strategies to implement ASEI innovation which impact on student learning and achievement in examinations.In these attitudes and strategies in the implementation of ASEI, mathematics teachers experienced some challenges, which hampered effective implementation of ASEI innovation.

The attitude ,strategies and challenges faced by teacher were influenced by intervenening variables such as incentives,Principals'support and facilitators' attitude.The degree to which attitude affected implementation of ASEI depended on incentives given in terms of tokens ,

certificate of participation and promotions. If incentives are given, then teachers would have positive attitude towards implementation of ASEI and vice versa.Furthermore,the facilitators attitude would influence the degree to which attitude affected implementation of ASEI.Thus the attitude of facilitators determined if the teachers really benefitted from ASEI training.If the facilitators possessed positive attitude towards the ASEI innovation, this was passed onto the teachers and vice versa.Strategies employed by teachers were influenced by the Principal's support in terms of provision of requisite materials and general administrative support. The degree to which challenges affected implementation of ASEI depended on school type and Principal's support .These variables are diagrammatically represented in Figure 1

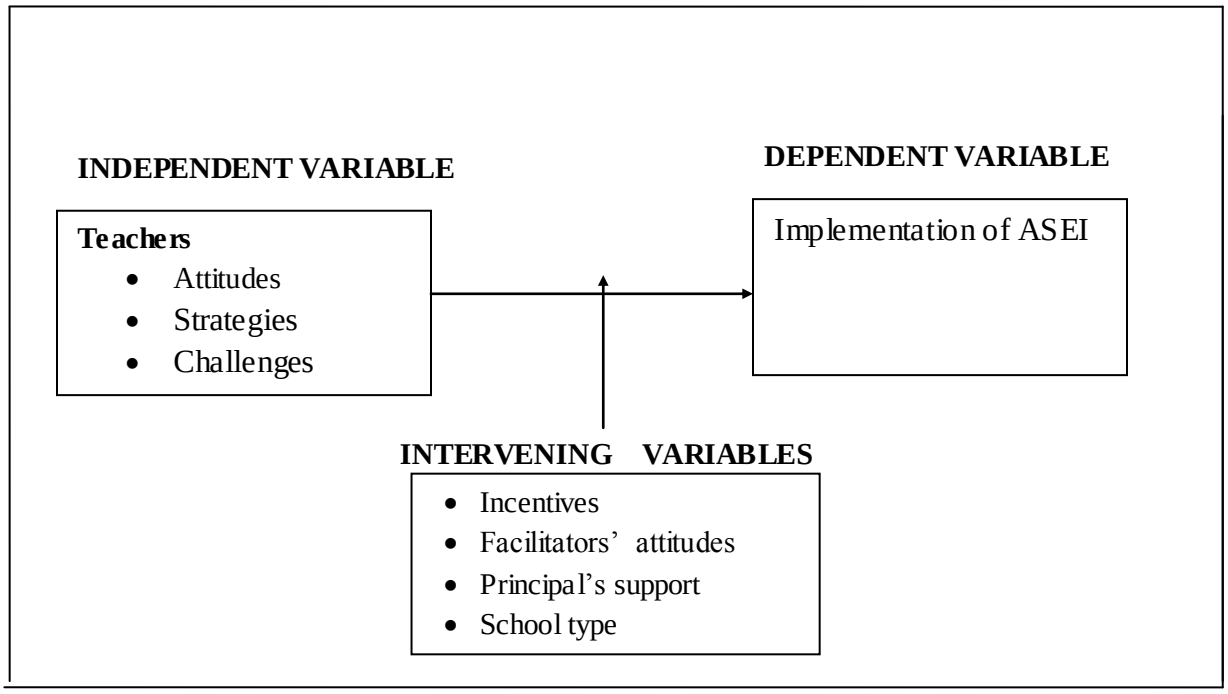

Figure 1: Diagrammatic representation of the Teacher Attitude, Strategies and Challenges in the implementation of ASEI Innovation

1.10 Study Limitations

One teacher (3%) did not complete the questionnaire in full as required. Since it was only two items ,it was assumed not to have affected the results significantly.

1.11 Definition of Operational Terms

ASEI innovation-Referred to learner- centered teaching pedagogy which involves improvisation of teaching rsources,demonstrations/experiments and student participation

Attitude- Referred to the beliefs or opinions of teachers towards implementation of ASEI teaching innovation.

Challenges- Referred to the difficulties faced by teachers in their efforts to practice ASEI teaching innovation.

Strategies- Referred to ways which facilitate mathematics teachers' practice of ASEI innovation.

CHAPTER TWO

LITERATURE REVIEW

2.1 Attitude of Teachers towards Implementation of ASEI Innovation in Mathematics

Yiğit (2008) in his study to evaluate the effectiveness of in-service training course on the use of instructional technology in Trabzon, Turkey found that the course had influenced positively the attitude of teachers towards the use of instructional technology. Qualitative data indicated that most teachers had positive attitude towards the use of instructional technology and believe that these technologies have the potential to enhance pupil learning as well as their teaching practices. In a similar study on teachers' attitude toward information and communication technology in Syria, based on the new technology initiative in Syrian education, Abdulkafi (2004) explored the attitude of high school teachers as a foreign language teacher (EFL) in Syria toward information and communication technology (ICT). His findings suggest that teachers have positive attitude towards ICT in education. The results point to the importance of teachers' vision of technology itself, their experience with it and cultural conditions that surround its introduction into schools in shaping their attitudes toward technology and its subsequent diffusion in their educational practices. Enayat,Madanloo and Mir Kazemi (2012) in their study to evaluate teachers'attitude towards implementation of technology in education in the city of Babol, Iran, also found that the teachers' attitude towards the use of technology in education was positive.

A study by Azuka, Durojaiye, Okwuoza and Jakayinfa (2013), examined at the attitude of primary school mathematics teachers towards the use of activity-based learning (ABL) methods in teaching mathematics in Nigerian schools. The study involved 224 primary school teachers made up of 60 males and 164 females, who were sampled using purposive sampling. Four research questions guided the study. Simple frequency counts, percentages,t-test and analysis of variance were used to analyze the data. The study revealed that mathematics teachers were positively disposed to the use of activity- based learning in the sense that they understood it and preferred to use it in schools. The study showed that there was a significant difference in the mathematics teachers' attitude towards the use of activity –based learning among individual teachers. The teachers agreed that the method enhances students learning experiences.

The results of the above study may be biased since it did not take into account the input of Head teachers, their deputies and heads of department who are the immediate supervisors of the teachers in question.Furthermore, the teachers were purposively sampled creating room for selecting teachers who have same attitude. The present study sought to determine the attitude of secondary school mathematics teachers towards implementation of ASEI teaching innovation in the context of declining performnce in Bungoma Central Sub-county, Kenya, by administering questionnaires to teachers and taking into account the views of Principals, their deputies and Heads of department who were sampled by saturated sampling.

Ndirangu and Nyagah (2013**)** carried out a study on teachers' concerns in the implementation of ASEI innovation in Kenya. This study aimed at establishing the level of implementation of the ASEI classroom practices innovation and the stages of concern of the implementers. The study established that majority, 70% of the teachers were implementing the ASEI innovation partially and 5% fully. The study revealed that most teachers had task concerns, which affected implementation. Makewa (2011) did a study on teachers' attitude towards ASEI teaching approach in mathematics and science in secondary education in Nandi Central district. The findings of this study showed that teachers tended to have a positive attitude towards the ASEI innovation and despite the challenges they faced, they worked hard to implement the innovation. Teachers with a more positive attitude tended to apply the ASEI pedagogy.Silungai (2011) studied teacher related factors influencing computer integration in mathematics teaching in Kakamega South district and found that most mathematics teachers had a positive attitude towards computers and were convinced of the positive role that computers could play in the teaching and learning of mathematics.

Irungu and Mugambi (2013) evaluated the extent to which the ASEI innovation had been effective since it was started in 1998 in Kenyan schools. The study targeted the mathematics and science teachers, learners, ASEI trainers, Principals, Sub-County Quality Assurance and standards Officers in Muranga south district. The study involved five schools selected through convenience method. Questionnaires and observation schedules were used. The study established that although there was some significant improvement in performance of sciences and mathematics, a lot need to be done to

improve the attitude of teachers towards ASEI innovation. The study revealed that, majority of teachers was coerced to practice ASEI pedagogy. The conclusions of the above study are defective in that findings from five schools which were selected conveniently cannot be used to generalize for a whole Sub-County. The above study was concerned with level and extent of implementation of ASEI innovation. The current study was concerned with the attitude of teachers towards the practice of ASEI in the context of declining performance in all public secondary schools in Bungoma Central Sub-County.

Sifuna and Kaime (2007) established that while teachers appreciated ASEI pedagogy it was not reflected in their classroom practices which were largely teacher dominated. Kahare (2011) in Lari District also observed that although ASEI innovation had positively impacted on the teaching of physics and subsequent improved performance, in mixed day schools, only a small percentage of teachers improvised, evaluated the lessons and used student-centered learning with experiments and improvisation. A similar study by Abongo (2013) in Rachuonyo South district revealed that although ASEI innovation had impacted positively on pedagogical skills and attitude of biology teachers, some aspects of student- centered teaching were weak and irregular in biology lessons. Osugo (2014) did a study to establish the implementation of ASEI innovation in biology in Taita-Taveta County in Kenya, and found that teachers used lecture method which did not promote ASEI principles. The results of the above studies suggest unwillingness on the part of teachers to fully implement the ASEI pedagogy. The current study sought to establish the attitude of mathematics teachers towards implementation of the ASEI teaching innovation in Bungoma Central Sub-County, Kenya.

Asembo (2013) established that mathematics teachers had a negative attitude towards ASEI innovation in Westland district, Nairobi County, which was traceable to the environment under which it was done and the benefits that they received from the innovation. The study however indicated a significant percentage of teachers (33.3%) of teachers felt that ASEI innovation had affected their teaching since it had enhanced their professional development. Inyenga (2002) also noted that some mathematics teachers do not appreciate the role of innovation in their individual continuous professional development and consequently slow down the attainment of the innovative pedagogy.

Whereas the studies by Sifuna and Kaime (2007), Kahare (2011),Asembo(2013), Abongo (2013),Irungu and Mugambi(2013),Ndirangu and Nyaga (2013), Azuka, et al (2013) and osugo (2014) examined the attitude of teachers towards implementation of learner-centered teaching in general, the present study sought to establish the attitude of secondary school mathematics teachers towards implementation of ASEI innovation in the context of declining performance in KCSE mathematics in Bungoma Central Sub-County, Kenya.

2.2 Strategies of Implementation of ASEI Innovation in Mathematics

Fairbanks, Gerald, Berverly, Yette, Barbara and Stein (2010), did a study to explore why some teachers are more adaptive than others. They found out that knowledge alone does not lead to the kind of thoughtful teaching everyone strives to maintain. According to the study, teachers with similar professional knowledge and qualifications were found to have differences in their teaching practices. They further suggested the need to move

beyond knowledge in teacher education with an aim to explore questions about preparing thoughtful teachers.

Research has established that learner-centered teaching innovations are highly effective but very difficult to practice (Trump Foundation, 2012). While learner-centered instruction is well advocated for in education, a traditional teacher-centered education may still be dominant (Massouleh &Jooneghani, 2012). Schweisfurth (2013) also observed that implementation of learner-centered pedagogy and changes in the classroom practice had proved to be problematic, particularly in developing nations. According to Mascolo (2009), student-centered teaching innovation should include collaborative learning, problem-based learning and a variety of other pedagogical methods. Pham (2010) in Vietnam concluded that implementation of learner-centered teaching needed changes in both school infrastructure and peoples' perceptions. He recommended studies to be done to determine how to implement changes so that new approaches can be successfully implanted in the local context.

Maklad (2008) observed that lesson study was an important strategy in the implementation of learner-centered teaching in Japan, while workshops and practical training were used mostly in Egypt. Japanese mathematics lesson include structured problem-solving approach which is designed to create interest in mathematics and stimulate creative mathematical activity in the classroom through students' collaborative work. The lesson usually starts with students working individually to solve a problem

using their own mathematical knowledge. After working individually, students bring various approaches and solutions to classroom discussions. The teacher then leads students in whole class discussions in order to compare individual approaches and solutions. This whole class activity provides students with opportunities to develop their mathematical abilities including conceptual and procedural understanding (Takahashi, 2006).

Barbara (2006) examined teaching strategies that mathematics employed after being trained in learner -centered pedagogies in Windhoek, Namibia. The sample for the study consisted two senior secondary schools and one junior school. The data collection comprised of class observations and interviews with teachers and learners of the schools involved. The process of triangulation was used in data analysis. The findings were that almost all teachers were using the same strategies, which were teacher- centered, with teachers relying heavily on textbooks. Activities to motivate self-discovery were almost non-existent. This study did not disclose the strategies employed by the teachers in enacting the new methods. Furthermore, the findings from the above study cannot be used to represent all teachers in Windhoek since only teachers in three schools were sampled. The results are also defective since the input of Principals, their deputies and Heads of department as supervisors were ignored. The current study sought to establish the strategies employed by mathematics in the context of declining performance by administering questionnaires to teachers and interviews to Principals, their deputies and heads of department.

Ingvarson and Mackenzie (2002) in their study in the state of Victoria, Australia, found

out that administrative support and follow-up assistance received, maximizes returns from the investment in pedagogical innovations. The study revealed that returns from innovations will be limited if follow- up both from within the school and external sources is not given. Ramatlapana (2009) in his study in Botswana also concluded that lack of regular follow-up activities led to lack of impact pedagogical innovations.Wang (2012) investigated, why many Chinese schools had no success despite implementing innovations. His findings were that the Principal and staff needed continuous revision and perfection of the innovation, while the Principal helped incompetent staff. Effective interventions were found to be key factors to guarantee the success of the innovation. The studies above did not reveal the exact strategies employed by teachers in the process of implementing learner-centered teaching innovations which the current study addressed in Bungoma Central Sub-County, Kenya.

The ASEI impact assessment survey conducted for 5 years from 2004 to 2008 in Kenya revealed that teachers' effectiveness had improved because of the Principals' encouragement. It was critical to support teachers in their efforts to upgrade their lesson practices. School Principals regularly sensitized teachers on in-set management and administration of classroom activities and giving immediate feedback to the teachers. Full time classroom teachers who train others were being considered and given incentives by the Principals (SMASSE Project, 2008).

Adula and Kassahun (2010) carried out a study to assess the implementation of student – centered teaching of mathematics and natural sciences in three selected schools in Jimna

and surrounding towns, in Ethiopia. The study used observation method to collect data. The observation findings were that teachers effectively utilized the learners' prior knowledge and question- rich environment in their lessons but teachers were rated poor in making classroom conducive for group work, utilization of learning materials and students' activities. The results from the above study are subjective since the researcher used only one method to collect data.Furthermore; the views of important stakeholders were not factored in. The researchers seemed to have just rated teachers on some given parameters, without disclosing the teacher strategies in implementing learner-centered pedagogy. The present study differs from the above study in the sense that the above rated teachers on the implementation of some aspects of student-centered teaching, while current investigated the strategies used in the implementation of student- centered teaching innovation in Bungoma Central Sub-County, Kenya in the context of declining performance in mathematics.

A study by Kimosop (2012) on impact of ASEI innovation on science teachers in larger Baringo district revealed that there was high positive change in work performance after being trained in ASEI though there was low mean scores in science and mathematics. In Nkueni division, Meru County, M'Kiambi (2013) established that ASEI teaching methodology had contributed to improved performance in KCSE mathematics. The above studies did not reveal the strategies employed by teachers in implementing ASEI teaching innovation, which the current study sought to establish in public secondary schools in Bungoma Central Sub-County.

Anyango (2006) conducted a study in Bomet district to investigate the impact of ASEI innovation on mathematics performance in secondary schools. The study adopted a descriptive survey conducted in 16 Public secondary schools in Bomet district. The researcher used purposive sampling to select 16 teachers out of 112 teachers. Stratified random sampling was used to select 16 public secondary schools in the study district. The data collected from the 16 respondents were organized, edited and analyzed using descriptive statistical methods such as mean, frequencies, percentages. The findings of this study revealed that; benefited from ASEI training by sharing experiences and used locally improvised teaching materials which consequently improved mathematics performance. The study concluded that the most effective teaching method in learner - centered approach was using locally improvised teaching materials, which had enhanced good performance in mathematics. However, from the study above, a sample 16 teachers out of 112, selected purposively cannot give valid conclusions for a whole district. The current study sought to establish the strategies used by teachers in implementation of ASEI innovation by taking into account the views of Principals, Deputy Principals and Heads of department selected by saturated sampling.

The study by Abongo (2013) in Rachuonyo South district revealed that though ASEI innovation had impacted positively on pedagogical skills and attitude of biology teachers ,some aspects of student centered teaching were weak and irregular in biology lessons. The study also did not reveal the missing aspects. Irungu and Mugambi (2013) in Muranga South district found that majority of teachers were unwilling to be observed by others during teaching and learning and rarely used modern technology. This study also

did not reveal teaching strategies used by teachers in implementing ASEI. The present study sought to establish the strategies employed by teachers in the implementation of ASEI innovation in the context of declining performance in mathematics in Bungoma Central Sub-County secondary schools.

2.3 Challenges in the Implementation of ASEI Innovation in Mathematics

In a study on the effectiveness of culturally relevant pedagogy and it's viability in the theory in classroom practice, Evelyne (2010) realized the challenges to conceptualizing and actualizing culturally relevant pedagogy and it's viability in the theory in classroom practice. These included; raising the cultural biases, addressing systematic roots of racism in school policies and practices and adequately equipping pre-service and in-service teachers with knowledge of how to implement theories into practice.

A study on the practice of inquiry based learning(IBL) as advocated for by the PRIMAS project in Europe,revealed many difficulties which teachers encountered in the implementation of IBL.The challenges were summarized into three categories; systematic restrictions, classroom management and resource restrictions (PRIMAS,2011). The wide syllabi, limited time and the existing assessment practice hindered serious uptake of IBL.Teachers experienced lack of appropriate text books, teaching materials, inaccessibility to computers and laboratory. Teachers lacked support from school authorities and uncooperative colleagues.(PRIMAS,2011).Teachers in all the PRIMAS countries suffered from lack of resources for the implementation of IBL.In some countries especially in the Eastern Europe the problem of lack of resources was more severe with regard to implementation of IBL.

Clarke (2001) noted that although pedagogical innovations may have an impact on trainees in terms of satisfaction and knowledge gain, it is not all certain that such innovation will necessarily result in changes in performance in the work place. Khattak and Abassi (2010) in Pakistan found that teaching innovation had not been useful and applicable to trainees due to lack of resources at their places of work. Ramatlapana (2009) investigated the perception of science and mathematics teachers on pedagogical innovation in Botswana and found out that the innovation offered insufficient skills to sustain the implementation of the strategies solicited by the innovations. The study also revealed lack of regular follow-up activities led to lack of impact of the innovation. Studies by Clarke,Khattak and Abassi and Ramatlapana highlighted challenges which hamper effective implementation of pedagogical innovations. The current study investigated the challenges of implementing ASEI teaching innovation in the context of declining performance in mathematics in Bungoma Central Sub-County, Kenya.

Sunzuma,Ndemo,Zinyeka and Zezekwa(2010), carried out a study in Zimbabwe to find out the factors that hindered the implementation of learner-centered teaching methods in mathematics at secondary school level. From the study, the constraints included examination assessment requirements, time factor, resources especially textbooks, language barrier, teachers' subject matter content and minor ones such as the size of the classes and heavy planning involved. Whereas the above study focuses on challenges of implementing learner-centered teaching in general, the present study differs from the above one in the sense that the present's concern is the challenges of implementing learner-centered teaching in the context of declining performance.

A study by Azuka etal (2013) on the attitude of primary teachers towards the use of learner-centered learning methods in teaching mathematics in Nigerian schools revealed that teachers faced lack of materials and time as the major impediments to learner-centered learning in Nigerian schools. A similar study by Kamarudin and Leong (2011) in their study on implementation of four year primary mathematics curriculum in Brunei Darussalam, Berakas-Lambak area. This study used, school questionnaires, teacher questionnaires, pupil questionnaires and interview, semi-structured interviews. Quantitative and qualitative data gathered from lesson observations were used to generate detailed perspectives about each of the nine lessons to characterize the practices of the ten intended skills in the implementation of the new year 4 mathematics curriculum in those classrooms.

The researchers found out that all teachers viewed the programme as challenging and needing a lot of time for preparation. The mathematics teachers expressed need for more teaching /learning resources including computers, internet access and teaching aids. Also parental involvement, motivation and guidance seemed to be inadequate at home. The study also revealed that most teachers were able to implement the programme but the pupils did not perform as well in international level test item. Whereas the above studies addressed the challenges of implementing learner-centered pedagogy in mathematics in primary schools, the present study sought to establish the challenges of implementing learner-centered teaching innovation in secondary schools in Kenya.

Sifuna and Kaime (2007) carried out a study on the effectiveness of ASEI innovation on classroom interaction in four districts in Kenya. The study used interviews, lesson observation and focus group discussion. The study established that though, the ASEI innovation had exposed the teachers to student-centered teaching, this was not reflected in their classroom practices, which were largely teacher dominated. This was partly attributed to large classes, the use of English as a second language and pressure to cover the syllabus. Wabwile (2013) in his study in Trans-Nzoia district, also, conducted that ASEI goals would not be achieved because of some concerns about class sizes and teachers' workload and teachers' welfare.

A study by Asembo (2013) in Westlands district, Nairobi County revealed that teachers were receiving little help from administrators. Supervision was lacking as Heads of department only concentrated on checking schemes of work and records of work covered at the expense of lesson plans. The study showed that 66.7% of the Heads of department rarely checked lesson plans, while 60% of them never supervised lessons in class. The study by Sifuna and Kaime, revealed the challenges of ASEI implementation in four districts, while the study by Asembo's revealed the challenges in one district, however the present study is concerned with challenges of ASEI implementation in one district with declining performance in mathematics.

The study by Kahare (2011) in Lari district Central Province revealed high workloads due to understaffing and lack of sufficient resources as the main challenges that affected successful implementation of ASEI innovation in physics in mixed day schools, though

the performance in physics had improved performance, in mixed day schools. The study also established that that only few teachers improvised, evaluated lessons and used ASEI lesson. The results suggest that physics teachers in these schools face challenges in the implementation of ASEI.However the results in the above study can only be generalized to physics teachers in mixed day schools. The present study's concern was the challenges faced by mathematics teachers in implementation of ASEI in secondary schools in the context of declining performance in mathematics.

Rotich and Mutisya, (2013) carried out a study in Bomet district to evaluate the impact of ASEI innovation on students' attitude and academic performance in biology in secondary schools in Kenya. The result shows that there is positive attitude of students towards the learning of biology in secondary schools. The research further revealed that teachers partially applied ASEI skills because of little supervision of the ASEI innovation implementation. The study recommended further training and collaboration of both head teachers and Quality Assurance Officers. Kipng'etich (2013) also studied the impact of ASEI innovation on students' attitude and performance in mathematics in secondary schools in the same district and found out that the innovation had greatly improved the attitude of students towards mathematics and teacher's teaching approaches and methodology.However, this did not translate to good performance.

Kipkoech (2011) found that low morale was a challenge that teachers encountered in the implementation of ASEI innovation in Kericho sub-county. The findings of the study revealed that although ASEI pedagogy had been implemented in the district, performance in mathematics and science was still very poor in most schools. The studies done by

Kipkoech, Kipng'etich, Rotich and Mutisya, indicated that ASEI innovation had greatly changed the attitude of students towards sciences and mathematics but then the question was why the performance in mathematics and sciences was still low despite implementation of ASEI innovation. This question was not addressed in the studies above. The present study sought to establish the challenges faced by mathematics teachers in the implementation of ASEI in the context of declining performance in mathematics in Bungoma Central Sub-County, Kenya.

Odawa, Okwara, Murundu and Bantu (2014) did a study in Emuhaya district, Vihiga County. The purpose of this study was to assess impact of biology teachers' perspectives on ASEI teaching innovation on Classroom Practices. The study adopted ex-post facto and survey research designs. It involved 35 biology teachers, 20 heads of science departments and 3 biology ASEI trainers drawn from 20 public secondary schools in Emuhaya District, Kenya selected by saturated sampling technique. Data was collected using: questionnaires, interview schedule and document analysis guide. The study revealed that; teachers perceive ASEI as an important although its impact on their classroom practice is low due to its curriculum structure, and understaffing. The above study was concerned with impact of teacher perception on practice of the ASEI innovation though it revealed some challenges. Furthermore it did not take into account the input of Principals and Deputy Principles who are charged with supervision of teacher activities in the schools. The findings therefore are not inclusive since they lack the input of key stakeholders and may be defective. The present study investigated the challenges faced by mathematics teachers in the implementation of ASEI innovation in the context

of declining performance in mathematics by administering questionnaires to mathematics teachers and interview schedules for Principals, Deputy Principals and heads of department.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

This study adopted the descriptive survey research design. Orodho (2005) states that descriptive survey approach are used in preliminary and exploratory studies to allow researchers to gather information, summarize, present and interpret for the purpose of clarification. Descriptive survey is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals. It is used when collecting information about peoples' attitudes, opinions (Kombo and Tromp, 2001). Descriptive survey design helped to determine the general characteristics and facts about ASEI practice. The descriptive survey aimed at describing the nature of existing conditions and determining the relationship that existed between the independent and dependent variables (Orodho, 2005).The descriptive survey was to yield information about ASEI innovation in relation to teachers' attitude, strategies and challenges in the implementation of ASEI pedagogy in mathematics.

3.2 Area of Study

This study was carried out in Bungoma Central Sub-County, which lies between latitudes 0.57ºN and 0.78ºN and longitudes 34.72ºE and 34.77ºE. The Sub-County covers an area of approximately 232.60 square kilometers with a population of approximately 144,951 persons. The Sub-County head quarter is Chwele town whose geographical location is (0.78ºN, 34.63º E).It is bordered by Bungoma East Sub-county to the East, Mount Elgon and Bungoma West Sub-Counties to the West, Kimilili Sub-County to the North and Bungoma South Sub-County to the South. The study Location has fifteen public

secondary schools, which are fairly old, some having been put up in the late 1960s and early 1970s.The schools are fairly well staffed with TSC personnel in all subjects and most schools have electricity and enhanced accessibility owing to good road network. The study area is agriculturally rich with maize and sugarcane farming as the main economic activity. The residents are economically stable and well able to finance education of their children. The ASEI innovation was initiated in the region in the year 2004 to retrain teachers for effectiveness in the teaching of mathematics and sciences in order to revamp performance in these key subjects. The Bungoma Central Sub-county mean score in KCSE mathematics in the year 2008 for the first cohort of students was 3.1450.This was higher than some neighboring Sub-counties namely Bungoma west (2.5880) and Bungoma East (2.946). The mathematics mean scores in KCSE mathematics in the study area have been increasing over time since inception of ASEI innovation, although in some schools performance has been declining. This study went out to establish the attitude, strategies and challenges of teachers in the implementation of ASEI innovation in Public Secondary Schools in Bungoma Central Sub-County.

3.3 Study Population

The study Population was 2 DQASOs, 15 Principals, 15 Deputy Principals, 15 Heads of departments and 42 Mathematics teachers, in Public Secondary Schools in Bungoma Central Sub-County. Bungoma Central Sub-County has 15 public secondary schools.

3.4 Sample Size and Sampling Techniques

The study covered 15 public secondary schools. The sample comprised of 2 DQASOs,14 Principals, 14 Deputy Principals, and 14 Heads of department and 38 mathematics teachers selected through saturated sampling technique.

The sample size for each category of respondents was determined by the formula

$$N = \frac{Z^2 Pq}{d^2}$$

as recommended by (Mugenda & Mugenda, 2003).Where Z is the Standard normal deviate at 95 % confidence level and P is the proportion in the target Population estimated to have the characteristic being measured. Taking P=0.5 and Z value corresponding to 0.05 level of Significance (95% confidence level),

$$N = \frac{1.96^2 \times 0.5 \times .0.5}{0.5^2} = 384$$

Since the target Population of N for each category of respondents is less than 10,000 the final sample size for each category of respondents is determined by the formula

$$n_f = \frac{n}{1 + \frac{n}{N}}$$

Where N=384

From the above formula, the sample size for various respondents was obtained as follows;

Teachers $n_f = \frac{42}{1 + \frac{42}{384}} = 38$, Heads of department $n_f = \frac{15}{1 + \frac{15}{384}} = 14$,

Deputy Principals $n_f = \frac{15}{1+\frac{15}{384}} = 14$ and Principals $n_f = \frac{15}{1+\frac{15}{384}} = 14$.

Table 3.1: Population and Sample composition

Respondent	Population	Sample	Sample as % of Population
Quality Assurance and Standards Officers	2	02	100.00
Principals	15	14	93.33
Deputy Principals	15	14	93.33
Heads of department	15	14	93.33
Mathematics teachers	42	38	90.48
Total	**89**	**82**	**92.13**

Source: DEO's Office, Bungoma Central Sub-County (2012).

3.5 Research Instruments

This study used interview schedules and questionnaires to collect data. The description of the research instruments was as follows;

3.5.1 Principals' Interview schedule (PIS)

This instrument was administered to Principals. It contained both closed and open-ended items to solicit views and ideas from Principals on ASEI innovation in relation to teachers' attitude, strategies and challenges in the implementation of ASEI pedagogy. Appendix I

3.5.2 Deputy Principals' Interview Schedule (DPIS)

This instrument was administered to Deputy Principals. It contained both closed ended items and open-ended items to solicit views and ideas from Deputy Principals in relation

to teachers' attitude, strategies and challenges in the implementation of ASEI innovation. Appendix II

3.5.3 Mathematics Head of Department Interview Schedule (MHODIS)

This instrument was administered to mathematics Heads of departments. The questions were based on certain aspects of teachers' attitude, strategies and challenges in the implementation of ASEI innovation. The questions were both closed-ended and open-ended. Appendix III

3.5.4 Mathematics Teachers' Questionnaire (MTQ)

This instrument was administered to teachers of Mathematics. The questions were based on certain aspects of teachers' attitude, strategies and challenges in the implementation of ASEI innovation. The questions were both closed -ended and open- ended. Appendix IV

3.5.5 Sub-County Quality Assurance and standards Officers' interview schedule (SCQASOI)

This instrument was administered to Quality Assurance and standards Officers. The questions were based on certain aspects of attitude, strategies and challenges in the implementation of ASEI innovation in mathematics. The questions were both closed -ended and open- ended. Appendix V

3.6 Validity of Instrument

Validity is the degree to which results obtained from the analysis of data ,actually represents the phenomena under study (Mugenda, & Mugenda, 1999).To check the content validity of the questionnaires, they were presented to experts from the Department of Educational Management and Foundation in Maseno University for

examination and necessary necessary modification made to the final instruments.

3.7 Reliability of Instrument

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda & Mugenda,2003).To enhance reliability of the questionnaires, a pilot study was done involving 4 Mathematics who were not part of the sample. Test-retest method was used where questionnaires were administered twice to the same respondents after an interval of two weeks. The scores were correlated using Pearson moment correlation co-efficient and obtained correlation co-efficient of 0.7.

3.8 Data Collection Procedure

The researcher first sought permission from the National Council for Science and technology through the School of Graduate Studies, Maseno University. In Stage one, the researcher sent notification letters to the D.E.O, Principals of sampled schools. In stage two, the researcher visited each sampled school to interview Principals, Deputy Principals and Heads of department and to distribute questionnaires to mathematics teachers to fill. The third visitation involved collection of filled questionnaires from teachers and interviewing the DQASOs.

3.9 Data Analysis

Data was analyzed both quantitatively and qualitatively. Closed ended responses were coded such that a question requiring a response of "NO'' as 2 and a "YES "as 1. In addition, close ended responses were summarized using a likert scale with five choices; strongly agree (5), agree (4), undecided (3), dis-agree (2), strongly disagree (1) from which mean rates were computed. The number of respondents for each choice was multiplied by the score for each choice, and then the total sum of the scores divided by

the total number of respondents to obtain a mean rating. For instance if the number of respondents for strongly agree,agree,undecided,disagree and strongly disagree were 4,3,2,1 and 2 respectively,then the mean rating was computed as follows;(5×4)+(4×3)+(3×2)+(2×1)+(1×2) to obtain a total score of 42 which is then divided by total number of 12 respondents to obtain a mean rating of 3.5.

Any score of 3 and above was taken as being indicative of positive attitude. A score below 3 was taken as being indicative of negative attitude.The responses were transferred into a summary sheet by tabulating. They were tallied to establish frequencies, which were then converted to percentages of the total number of responses in relation to the research objectives. Qualitative data, which was captured from open ended questions requiring explanations, were recorded word for word. Similar answers were tallied to determine the frequencies of each response. The number of respondents giving similar answers was converted to percentages. Frequency counts were done and summaries put on spreadsheet for analysis.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Attitude of Mathematics Teachers towards Implementation of ASEI Innovation

Table 4.1: Mathematics teachers' attitude towards Implementation of ASEI Innovation in Schools with improved Performance (n=30)

STATEMENT		SA	A	U	D	SD	Total	MR
ASEI innovation is a waste of time and resources	**F**	00	00	04	09	17	**30**	
	%	00	00	13	30	57	100	
	Score	00	00	12	18	17	47	**1.57**
ASEI is not practical in our school set –up	**F**	00	06	00	24	00	**30**	
	%	00	20	00	80	00	100	
	Score	00	24	00	48	00	72	**2.40**
I like ASEI innovation	**F**	05	17	04	00	04	**30**	
	%	17	57	13	00	13	100	
	Score	25	68	12	00	04	109	**3.63**
ASEI innovation solves problems in mathematics teaching	**F**	05	17	00	04	04	**30**	
	%	17	57	00	13	13	100	
	Score	25	68	00	08	04	105	**3.50**
I enjoy teaching mathematics using ASEI	**F**	05	17	04	00	04	30	
	%	17	57	13	00	13	100	
	Score	25	68	12	00	04	109	**3.63**
Overall mean rate		**75**	**228**	**36**	**74**	**29**	**442**	**2.95**

From table 4.1, the overall mean rate for attitude of teachers towards implementation of ASEI innovation in schools with improved performance, 2.95. These results implied teachers had a negative attitude towards implementation of ASEI innovation. However, from the results teachers appreciated ASEI innovation (3.63) and teaching mathematics using ASEI methodology (3.63). Teachers believed that ASEI innovation solved their

teaching problems (3.50) which implied positive attitude towards the training. Teachers also disagreed with the statements that ASEI innovation is a waste of time and resources (1.63) and that ASEI innovation was not practical (2.42). When the HODs in schools with improved performance were interviewed, majority of them (80%) had the opinion that mathematics teachers were very positive towards improvising teaching/ learning materials, performing demonstrations to demystify the teaching of mathematics, involving students in teaching and learning of mathematics and appreciated the ASEI innovation.

When the Deputy Principals in schools with improved performance were interviewed, majority of them (79%) had the opinion that mathematics teachers were very positive towards improvising teaching/ learning materials, performing demonstrations to demystify the teaching of mathematics, involving students in teaching and learning of mathematics and appreciated the ASEI innovation. When the Principals in schools with improved performance were interviewed, majority of them (82%) had the opinion that mathematics teachers were very positive towards improvising teaching/ learning materials, performing demonstrations to demystify the teaching of mathematics, involving students in teaching and learning of mathematics and appreciate the ASEI innovation. However, some HODs, D/Principals and Principals were of the view that teachers had negative attitude towards making ASEI lesson plans .Most of them stated ‘‘Mathematics teachers hardly prepare ASEI lesson Plans… ’’

Results from interview with Quality assurance and Standards Officers revealed that some mathematics teachers had negative attitude towards ASEI innovation and this translated into partial implementation of ASEI innovation in schools. A good number of teachers (50%) did not like attending ASEI training because of not being given incentives like allowances. One of the Officers stated ‘‘Mathematics teachers don’t like ASEI teaching approach because of not being given allowances during training ...’’ These results revealed reluctance of some teachers in the implementation of ASEI innovation, implying negative attitude.

From the results, it is evident that although teachers have negative attitude towards implementation of ASEI teaching innovation, they at the same time displayed positive attitude towards some aspects of the innovation.This finding agrees with Azuka, etal, (2013), in Nigeria who concluded that although learner-centered teaching enhances students’ learning experiences in mathematics, there was a significant difference in the mathematics teachers’ attitude towards the use learner-centered teaching among individual teachers. Inyenga (2002) also noted that mathematics teachers do not appreciate the role of innovation in their individual continuous professional development and consequently slow down the attainment of the innovation objectives.

The results also indicated that teachers (50%) partially implement ASEI teaching innovation as evidenced by their reluctance to prepare ASEI lesson plans. This agreed with the findings of Liburu (2004) in Tigania west district that though ASEI innovation

had influenced steady performance in KCSE mathematics, teachers implemented ASEI principles partially. Ndirangu and Nyaga (2013) also concluded that majority of the teachers (70%) were implementing ASEI partially because of self and task concerns which affected implementation,while only 5% of them implemented ASEI innovation fully. Irungu, Mugambi (2013) also observed in their study that although there was some significant improvement in performance of sciences and mathematics as a result of ASEI practice, a lot needed to be done to improve the attitude of teachers.

Kahare (2011) also observed that although ASEI innovation had positively impacted on the teaching of physics and subsequent improved performance in Lari District, only a small percentage of teachers improvised, evaluated the lessons and used student-centered teaching with experiments and improvisation. Asembo (2013) in Westland district in Nairobi County concluded that mathematics teachers had a negative attitude towards ASEI innovation. The study indicated that only (33.3%) of teachers felt that ASEI innovation had affected their teaching since it had enhanced their professional development. Ndirangu and Nyagah (2013) in their study observed that there were teachers' concerns which affected implementation of ASEI innovation and so should not presume that once ASEI innovation had been adopted and the initial training completed, the intended users will put it into practice. Teachers needed support to effectively implement the ASEI innovation.

Table4.2: Mathematics Teachers' Attitude towards implementation of ASEI Innovation in Schools with declining Performance (n=08)

STATEMENT		SA	A	U	D	SD	Total	MR
ASEI innovation is a waste of time and resources	**F**	00	00	01	03	04	08	
	%	00	00	13	37	50.00	100	
	Score	00	00	03	06	04	13	**1.63**
ASEI innovation is not practical in our school set –up	**F**	00	02	00	06	00	30	
	%	00	25	00	75	00	100	
	Score	00	08	00	12	00	20	**2.50**
I like ASEI innovation	**F**	01	06	01	00	00	**08**	
	%	13	74	13	00	00	100	
	Score	05	24	03	00	00	32	**4.00**
ASEI innovation solves problems in mathematics teaching	**F**	01	05	00	01	01	**08**	
	%	12	64	00	12	12	100	
	Score	05	20	00	02	01	28	**3.50**
I enjoy teaching mathematics using ASEI	**F**	01	05	01	00	01	08	
	%	12	64	12	00	12	100	
	Score	05	20	03	00	02	30	**3.75**
Overall mean rate		**15**	**72**	**09**	**20**	**07**	**123**	**3.08**

The overall mean rate for attitude of teachers towards implementation of ASEI in schools with declining performance was 3.08, which meant that teachers were positive towards implementing ASEI innovation. The study revealed that teachers appreciated ASEI innovation (4.00) and teaching mathematics using ASEI methodology (3.75). Teachers believed that ASEI innovation solved their teaching problems (3.50) which implied positive attitude towards the training. Teachers also disagreed with the statements that ASEI innovation was a waste of time and resources (1.63) and that ASEI innovation

was not practical (2.42) which implied positive attitude towards implementation of ASEI. The mean rates above indicated that teachers generally had positive attitude towards implementation of ASEI innovation in their schools.

When the HODs in schools with declining performance were interviewed, majority of them (77%) had the opinion that mathematics teachers were very positive towards improvising teaching/ learning materials, performing demonstrations to demystify the teaching of mathematics, involving students in teaching and learning of mathematics and appreciate the ASEI innovation. Quite a number of them stated ‘‘ASEI teaching approach has made teachers thorough in lesson preparation and delivery…’’ These findings implied that teachers were positive towards implementation of ASEI innovation.

When the Deputy Principals in schools with declining performance were interviewed, majority of them (80%) had the opinion that mathematics teachers were very positive towards improvising teaching/ learning materials, performing demonstrations to demystify the teaching of mathematics, involving students in teaching and learning of mathematics and appreciate the ASEI innovation. Notable remarks from some Deputy Principals were ‘‘ASEI teaching approach can do miracles if it is well streamlined…’’.These findings implied that teachers were positive towards implementation of ASEI innovation. For the Principals in schools with declining performance, majority of them (73%), had the opinion that mathematics teachers were very positive towards improvising teaching/ learning materials, performing

demonstrations to demystify the teaching of mathematics, involving students in teaching and learning of mathematics and appreciated the ASEI innovation. In fact one of them stated ‘‘ASEI teaching has done miracles in mathematics in this school… ’’.These views of HODs ,Deputy Principals and Principals concurred with the results in table 4.2 above, which revealed that mathematics teachers in schools with declining performance had a positive attitude towards implementation of ASEI innovation with the overall mean rate of 3.08.

Qualitative data from the interview with Quality assurance and Standards Officers revealed that mathematics teachers (80%) were very positive towards improvising teaching/ learning materials, performing demonstrations to demystify the teaching of mathematics, involving students in teaching and learning of mathematics and appreciated the ASEI innovation.Infact one of them said ‘‘ASEI innovation is working in schools,what is needed is just to streamline it..’’.These results suggested teachers’ positive attitude towards implementation of ASEI innovation.

The results above agreed with what Yiğit (2008) concluded in his study in Trabzon, Turkey, that most teachers had positive attitude towards the use of instructional innovation which had enhanced their teaching practices as well as pupils’ learning. Abdulkafi (2004), also, concluded in his study in Syria that teachers’ positive attitude towards technology had impacted on their educational practices. A study by Azuka et al, (2013) also found that mathematics teachers in Nigerian schools were positively disposed

to the use of learner-centered teaching and preferred to use it in schools and it consequently students learning experiences had been enhanced. The results were in agreement with Sulungai's (2011) findings in Kakamega South district that most mathematics teachers had a positive attitude towards computers and were convinced of the positive role that computers could play in the teaching and learning of mathematics.Makewa (2011) also concluded in his study education in Nandi central district that Mathematics teachers with a more positive attitude toward ASEI program tended to apply the ASEI pedagogy.

The variance in attitude towards implementation of ASEI innovation is in line with what Le Van and Roger (2009) highlighted in Vietnam on the need to bridge the gap between the idealized world of innovation designers and the realistic world of teachers who are essential to the implementation of innovation. These results also agreed with Ndirangu and Nyagah (2013) who in their study observe that there are teachers' concerns which affect implementation of ASEI innovation. Irungu and Mugambi (2013) also concluded that although there was some significant improvement in performance of sciences, and mathematics, a lot needed to be done to improve the attitude of teachers. Teachers need support to effectively implement the ASEI innovation and so should not presume that once ASEI innovation has been adopted and the initial training completed, the intended users will put it into practice.

Azuka etal, (2013), in Nigeria ,also, concluded that though learner-centered teaching enhances students' learning experiences in mathematics, there was a significant difference in the mathematics teachers' attitude towards the use of learner-centered

teaching among individual teacher. These views concurs with the qualitative data that teachers had partially implemented the ASEI innovation in schools. From the results above it is clear, a lot needs to be done on the attitude of teachers towards practice of ASEI innovation in all schools to prevent more schools slipping back into poor performance in KCSE mathematics. The difference in teacher attitude towards ASEI teaching innovation among teachers could be the reason for the declining KCSE means scores in Bungoma Central Sub-County.

4.2 Strategies used by Teachers in the Implementation of ASEI Innovation

Table 4.3: Mathematics Teachers' responses on Strategies used in Implementation of ASEI Innovation (n=30), (n=8)

Strategy	Schools with improved performance n=30		Schools with declining performance n=8	
	Frequency	(%)	Frequency	(%)
Peer lesson study	15	50.00	04	50.00
Team teaching and lesson Planning	27	90.00	00	00.00
Giving of incentives	24	80.00	00	00.00
Organizing group work/learning	00	00.00	04	50.00
Mounting internal inspection and close supervision	11	37.00	00	00.00

From Table 4.3, the study revealed that, mathematics teachers practiced peer lesson study (50%), team teaching and lesson planning strategy (90.00%), motivation through giving

incentives (80.00%), group work (50.00%) and mounting regular internal inspections (37.00%) as strategies to implement ASEI innovation.

Results of interview with HODs indicated that majority of HODs, believed that teachers used internal inspections to implement ASEI innovation in their schools.Other HODs believed, that teachers used peer lesson study, team teaching, and giving incentives to implement ASEI pedagogy. Some stated ‘‘ Team teaching and the Principal’s support are the factors behind our improved performance in mathematics…’’.

Interview with D/Principals, revealed that majority of D/principals believed that mathematics teachers used strategies such regular follow-ups and provision of adequate teaching and learning materials to implement ASEI innovation in their schools. Interview with Principals in schools with improved performance, revealed that majority of principals believed that mathematics teachers used strategies such as regular follow-ups, internal inspections, provision resources such as models and charts and frequent briefs to implement ASEI innovation in their schools.A few other Principals had the opinion that teachers used strategies such as giving incentives to teachers who practice ASEI teaching methodology

Qualitative data from schools with improved performance revealed that there was partial implementation of ASEI innovation with teachers employing; group discussion, peer teaching, improvisation of teaching /learning materials such as models and preparation of ASEI lesson plans

Qualitative data from interview with Quality assurance and standards officers revealed that teachers were using improvised mathematics boards to teach mathematics and had created mathematics hour as a result of ASEI innovation. The Officers stated ‘‘nowadays mathematics teachers appreciate teamwork… ’.One Officer stated ‘‘Nowadays teachers consult with colleagues over difficulty areas in mathematics and are passionate in their teaching of mathematics…’’.From the interview with DQASO, teachers appreciated team work and peer lesson study. Teachers seemed inspired and committed in their work. Interview with DQASO also revealed that motivation of students and teachers, frequent testing, team teaching, provision of necessary resources as strategies used in schools to implement ASEI innovation. The results in table 4.3 concurred with the views of, HODs, Deputy Principals and Principals that mathematics teachers used strategies such as giving incentives and mounting regular internal inspections, peer lesson study and group work.

The results from interview with Quality assurance and standards officers indicate that teachers use peer lesson study to implement ASEI teaching innovation.This result agreed with the findings of Irungu and Mugambi (2013) in Muranga South district that teachers were willing to be observed by their colleagues in the teaching of mathematics which suggested peer lesson study. Maklad (2008) and Takahashi (2006), also, observed that lesson study was an important strategy in the implementation of learner-centered teaching in Japan.

The foregoing study also revealed teachers used team teaching and lesson planning strategy to implement ASEI innovation. Thus teachers were improvising simple common mathematics boards and models to demystify mathematics and had created mathematics hour. Teachers were consulting with colleagues over difficulty areas in mathematics. This finding, also, agreed with what Irungu and Mugambi (2013) observed that some teachers were willing to be observed by their colleagues in the teaching of mathematics which suggested team work.

The study also revealed that motivation through giving incentives was a strategy to implement ASEI innovation. This was in line with the findings of the ASEI innovation impact assessment survey conducted for 5 years from 2004 to 2008 in Kenya which revealed that teachers' effectiveness had improved because of the Principals' encouragement and giving incentives. Failure by some Principals to motivate their teachers could be the reason for declining performance in KCSE mathematics in some schools (SMASSE Project, 2008). Pham (2010) in Vietnam also concluded that implementation of learner-centered teaching needed changes in both school infrastructure and peoples' perceptions. The study also revealed that mathematics teachers used group work/learning to implement ASEI innovation. This finding is in line with what Adula and Kassahun (2010) found in three selected schools in Jimna and neighbouring towns in Ethiopia that teachers used group learning, though they were rated poor in making classroom conducive for group learning.

From the study, it also, emerged that mounting regular internal inspections was a strategy employed by teachers to implement ASEI pedagogy in schools. Thus schools mounted, regular follow ups, frequent staff briefs on the need to practice ASEI teaching methodology, maintenance of proper records for easier follow up and checking students' books and provision of adequate teaching /learning materials such as, books, models and charts to implement ASEI innovation.

The foregoing results were in agreement with Ingvarson and Mackenzie (2002) in their study in the state of Victoria, Australia, who concluded that administrative support and follow-up assistance received after inception of an innovation, maximizes returns from the investment in the innovation. The finding also concurred with what Ramatlapana (2009) concluded in Botswana that lack of follow up activities after inception of an innovation leads to lack of impact of the innovation. Wang (2012) also concluded in China that successful implementation of innovations, required continuous revision and perfection of the innovation and assistance given to incompetent staff by the Principal. Thus effective interventions were found to be key factors to guarantee the success of the innovation.

From Table 4.3, the study revealed that, teachers in schools whose performance in KCSE mathematics had improved used four strategies including team teaching and lesson planning, motivation through giving incentives, peer lesson study and, mounting regular

internal inspections to implement ASEI innovation while teachers in schools whose performance in KCSE mathematics had declined used two strategies to implement ASEI innovation including teaching group work and peer lesson study. Thus schools with declining performance seemed to employ fewer strategies as compared to schools with improved performance. This could probably explain the declining performance in Bungoma Central Sub-County.

The findings agreed with the conclusions of Abongo (2013) in Rachuonyo South district that though ASEI innovation had impacted positively on pedagogical skills and attitude of teachers, some aspects of aspects of student-centered teaching were weak and irregular in lessons. The results also agreed with the conclusions of Barbara (2006) in Windhoek, that almost all teachers were using the same strategies which were teacher- centered and the most appropriate teaching strategies advocated for mathematics as the literature review pointed out were not used and consequently the performance in national examinations in mathematics had been poor.

On the whole the results agreed with Le Van and Roger (2009) in his study in Vietnam to explore how teachers implemented a curriculum innovation and highlighted the need to bridge the gap between the idealized world of innovation designers and the realistic world of teachers who are essential to the implementation of innovation. Trump Foundation (2012) observed that learner-centered teaching innovations though highly

effective, are very difficult to practice. Implementation of learner-centered pedagogy and changes in the classroom practice had proved to be problematic, particularly in developing nations (Schweisfurth, 2013).

From the foregoing results, strategies such as mounting regular internal inspections, teacher motivation through incentives and peer lesson study and group work are useful strategies in effectively implementing ASEI innovation in secondary schools in Bungoma Central Sub-County. Qualitative data revealed other strategies used by teachers in the implementation of ASEI innovation such as acquisition and adequate use of resources such as models, charts and textbooks, creation of mathematics hour involving daily practice of mathematics, Maintenance of proper records, checking students' work and adequate staffing with qualified mathematics teachers.

4.3 Challenges faced by Teachers in the Implementation of ASEI Innovation

Table 4.4: Mathematics Teachers' responses on the Challenges faced in the Implementation of ASEI Innovation (n=30), (n=8)

Challenge	Schools with improved Performance n=30		Schools with declining Performance n=8	
	F	(%)	F	(%)
Limited time	13	43.00	04	50.00
Inadequate teaching/ learning materials	09	30.00	04	50.00
Large classes	13	43.00	00	00.00
Negative attitude of students towards mathematics	09	30.00	00	00.00
Understaffing	04	13.00	00	00.00
Poor entry behavior	04	13.00	00	00.00

From table 4.4, the study revealed that mathematics teachers faced the challenges of limited time (43.00%,50.00%), Inadequate teaching/ learning materials(30.00%,50.00%), large class sizes (43.00%), students' negative attitude towards mathematics (30.00%), low entry behavior of students (13.00%)and understaffing (13.00%) in the implementation of ASEI innovation.

From interview with HODs, majority, had the opinion that students' negative attitude towards mathematics, limited time and understaffing were the greatest challenges to the implementation of ASEI innovation by teachers in their schools. A small number of

HODs viewed ;inadequate teaching /learning resources, poor entry behavior and large classes as challenges in the implementation of ASEI innovation.Infact some of them remarked ‘‘mathematics teachers actively involve students in lessons only when time and resources allow… ’’.

Results from interview with D/ Principals, revealed that majority of the D/Principals had the opinion that; understaffing was a challenge faced by mathematics teachers in the implementation of ASEI innovation in schools. Others had the opinion that; limited time, inadequate teaching /learning resources and lack of incentives were the greatest challenges to the implementation of ASEI innovation in schools. From interview with Principals ,majority of the Principals had the opinion that limited time and understaffing, students’ negative attitude towards mathematics were the greatest challenges to the implementation of ASEI innovation in schools. One of them stated ‘‘ ASEI teaching innovation does not work well in a situation where students have negative attitude towards mathematics and yet you are chasing time to complete syllabus, with limited human resources… ’’. Involving learners to actively participate in lessons requires a lot of time to plan for the activities and to implement. Other principals had the view that; students’ poor entry behavior, absenteeism and inadequate teaching learning resources were challenges to the implementation of ASEI innovation in schools. Thus more resources and man power were required to effectively implement ASEI teaching methodology.

The views of Heads of department, Deputy Principals and Principals agreed with the results in table 4.4, that teachers experienced the challenges of inadequate resources, limited time, poor entry behavior, large class size, negative altitude of students towards mathematics and understaffing in the implementation of ASEI innovation.

Qualitative data from interview with DQASO revealed that mathematics teachers faced various problems in their efforts to implement ASEI innovation. The problems faced included lack of administrative support where some administrators ,took long to procure requisite materials for the teachers , limited time to enable teachers involve learners in lessons. Other challenges included heavy workloads due to understaffing, poor entry behavior of students, negative school culture in mathematics, pressure to cover syllabus, large class size, inadequate resources and lack of co-operation from colleagues. The study revealed that poor entry behavior, large class size, understaffing, lack of resources, limited time, lack of incentives, teachers' negative attitude towards the subject, lack of support from administrators. Interview with DQASO revealed that very few teachers prepare ASEI lesson plans due to pressure to cover the syllabus and large classes. The result also indicated that very few teachers improvised teaching/ learning materials. However, teachers had a belief that ASEI innovation was workable in the school set-up if it was well streamlined.

From the results, involving learners to actively participate in lessons requires a lot of time to plan for the activities and to implement, pressure to cover syllabus makes teachers

to rush over content which is practical in nature because of limited time. These results agreed with what Kamarudin and Leong (2011) concluded in their study in Brunei Darussalam that all teachers viewed the implementation of innovations as challenging and needing a lot of time for preparation. Azuka et al (2013) also concluded in Nigerian schools that mathematics teachers faced limited time as an impediment to activity –based learning in Nigerian schools.

The study also revealed that inadequate teaching/learning resources ((30.00%, 50.00%) were a challenge in the implementation of ASEI innovation in schools. Thus more resources such as text books, models, charts and man power were required to effectively implement ASEI teaching methodology. These findings are in line with what Khattak and Abassi (2010) found out in Pakistan that innovations had not been useful and applicable to trainees due to lack of resources at their places of work. This is also in agreement with what Azuka et al (2013) concluded in Nigerian schools that mathematics teachers faced lack of materials which affected implementation of learner-centered learning in Nigerian schools. Kahare (2011) in Lari district Central Province also observed that lack of sufficient resources affected successful implementation of ASEI innovation.

From the results in table 4.3 ,mathematics teachers faced the challenge of large class sizes (43.00%) in the implementation of ASEI innovation .Large class sizes owing to high pupil- teacher ratio in most schools make implementation of ASEI innovation very

difficulty. These results are in agreement with the conclusions of Sifuna and Kaime (2007) in four districts that though the ASEI innovation had exposed the teachers to student centered teaching, it was not reflected in their classroom practices, which were largely teacher dominated partly due to large classes. Wabwile (2013) also concluded in Trans-Nzoia that ASEI goals would not be achieved because of some concerns about class sizes and teachers' workload.

From the study also, students' negative attitude towards mathematics (30.00%) was a challenge in the implementation of ASEI innovation. In addition, qualitative data revealed that positive attitude towards mathematics was one of the factors contributing to improved performance. Thus the notion students have towards mathematics that the subject is hard made implementation of innovations difficulty. These results agreed with what Kamarudin and Leong (2011) concluded in their study in Brunei Darussalam that all mathematics teachers viewed the implementation of teaching innovations as challenging due to pupils negative attitude towards the subject.

The study also revealed poor entry behavior of students (13.00%) as a challenge in the implementation of ASEI pedagogy. The results agreed with what Kamarudin and Leong (2011) in Brunei Darussalam found out about the need for parental involvement, motivation and guidance at home for pupils to perform well in mathematics. Kamarudin and Leong observed that most teachers were able to implement the programme but the pupils did not perform as well in international level test item because of inadequate parental motivation and guidance at home.

From the study, understaffing (13.00%) was a challenge in the implementation of ASEI innovation in schools. This results agreed with what Wabwile (2013) found out in Trans-Nzoia district that there was teachers' concern about heavy work load which hampered the achievement of ASEI goals. The findings also concurred with Odawa, Okwara, Murundu and Bantu (2014) who observed that the impact of ASEI innovation in Emuhaya was insignificant due to its curriculum structure and understaffing. The study by Kahare (2011) in Lari district Central Province also concluded that high workloads due to understaffing affected successful implementation of ASEI innovation.

From the study limited time (43.00%, 50.00%) and inadequate teaching/ learning materials (30.00%, 50.00%), were common challenge faced by teachers in all schools. Interestingly, the study revealed that mathematics teachers in schools with improved performance faced more challenges than their colleagues in schools with declining performance in the implementation of ASEI innovation. Qualitative data revealed that students' negative attitude, poor entry behavior and understaffing in mathematics were the common challenges in the implementation of ASEI innovation. Qualitative data revealed other challenges as absenteeism and lack of incentives.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

5.1.1 The Attitude of Mathematics Teachers in the Implementation of ASEI Innovation

The overall mean rating for attitude of teachers towards implementation of ASEI innovation in schools with improved performance was 2.95 which meant that teachers attitude towards implementing ASEI innovation was negative. The study, however, revealed that teachers appreciated ASEI innovation (3.63) and teaching mathematics using ASEI methodology (3.63). Teachers believed that ASEI innovation solved their teaching problems (3.50) which implied positive attitude towards the training. Teachers also disagreed with the statements that ASEI innovation is a waste of time and resources (1.63) and that ASEI innovation was not practical (2.42) which implied positive attitude towards implementation of ASEI pedagogy. The results above agreed with Principals', D/Principals and HODs' opinions that mathematics teachers were very positive towards improvising teaching/ learning materials, performing demonstrations to demystify the teaching of mathematics, involving students in teaching and learning of mathematics and appreciated the ASEI innovation which implied positive attitude towards implementation of ASEI.

The overall mean rating for attitude of teachers towards implementation of ASEI teaching innovation in schools with declining performance was 3.08 which meant that teachers

were positive towards implementing ASEI pedagogy. The study revealed that teachers appreciated ASEI innovation (4.00)) and teaching mathematics using ASEI methodology (3.75). Teachers believed that ASEI innovation solved their teaching problems (3.50) which implied positive attitude towards the training. The results above agreed with Principals', D/Principals' and HODs' opinions that mathematics teachers were very positive towards improvising teaching/ learning materials, performing demonstrations to demystify the teaching of mathematics, involving students in teaching and learning of mathematics and appreciated the ASEI innovation. Qualitative data revealed that there was partial implementation of ASEI innovation and teachers had negative attitude towards ASEI lesson plans.

5.1.2 Strategies used by Mathematics Teachers to Implement ASEI Innovation

The study revealed that, mathematics teachers used five main strategies to implement ASEI innovation including; peer lesson study (50.00%), team teaching and lesson planning (90.00%), motivation through giving incentives (80.00%) to teachers, group work (50.00%) and mounting regular internal inspections (37.00%) and This results were in agreement with the views of Principals, Deputy Principals, Heads of department and Quality Assurance and Standards officers. Schools with declining performance used fewer strategies in the implementation of ASEI innovation.Qualitative data revealed other strategies used by teachers in the implementation of ASEI innovation such as acquisition and adequate use of resources such as models, charts and textbooks and creation of mathematics hour involving daily practice of mathematics and adequate staffing with qualified mathematics teachers.

5.1.3 Challenges faced by Mathematics Teachers in the Implementation of ASEI Innovation

The study revealed that mathematics teachers faced various challenges in the implementation of ASEI innovation including limited time (43.00%, 50.00%).These findings was in agreement with the opinion held by majority of the DQASOS, Principals, D/Principals and HODs.

The study also revealed that inadequate teaching/learning resources (30.00%, 50.00%) were a challenge in the implementation of ASEI. This finding agreed with the views of most DQASOs, D/Principals and Heads of department. Mathematics teachers also experienced the challenge of large class sizes (43.00%) in the implementation of ASEI innovation.

From the study also, students' negative attitude towards mathematics (30.00%) was a challenge in the implementation of ASEI innovation. This finding was agreement with the opinions of DQASOs, Principals and Heads of Departments. From the study, understaffing (13.00%) was a challenge in the implementation of ASEI innovation in schools. Majority of the DQASOs, Principals, D/principals and HODs viewed understaffing as a challenge to the implementation of ASEI innovation in schools. The study also revealed low entry behavior of students (13.00%) as a challenge in the implementation of ASEI pedagogy. This finding agreed with the views of a small number of HODs that low entry behavior was a challenge in the implementation of ASEI

innovation. The findings above agreed with the opinions of majority of the DQASOs and Principals.

Qualitative data revealed that students' negative attitude, low entry behavior, understaffing, inadequate teaching resources and limited time, lack of administrative support and of co-operation from colleagues were common challenge faced by mathematics teachers in were the common challenges in the implementation of ASEI innovation.

From the study, inadequate teaching resources and limited time were common challenge faced by teachers in all schools. Interestingly, the study revealed that mathematics teachers in schools with improved performance faced more challenges than their colleagues in schools with declining performance in the implementation of ASEI innovation.

5.2 Conclusions

5.2.1 Attitude of Mathematics Teachers towards Implementation of ASEI Innovation

With regard to attitude of teachers the following conclusions were made;

i. Mathematics teachers' attitude towards implementation of the ASEI innovation was positive in schools with declining performance.

ii. Mathematics teachers' attitude towards implementation of the ASEI innovation was negative in schools with improved performance .

iii. There was partial implementation of ASEI innovation due to differences in teacher attitude towards the innovation.

iv. Negative attitude of mathematics teachers towards implementation of ASEI innovation had negatively impacted on the performance in KCSE mathematics in Bungoma Central Sub-County.

v. Mathematics teachers had negative attitude towards ASEI lesson plans.

vi. Mathematics teachers had positive attitude towards implementation of some ASEI aspects in schools with declining performance.

5.2.2 Strategies used by Teachers in Implementation of ASEI Innovation

With regard to strategies used by teachers to implement ASEI innovation the following conclusions were made;

i. That, Mathematics teachers in Bungoma Central Sub-County secondary schools used five main strategies to implement the ASEI innovation such as peer lesson study ,team teaching and lesson planning ,motivation through incentives ,group work , mounting regular internal inspections ,adequate use of models, charts and textbooks and adequate staffing with qualified mathematics teachers to implement ASEI innovation in schools in Bungoma Central Sub-County.

ii. Teachers in schools with declining performance in KCSE mathematics used fewer strategies including peer lesson study and group work to implement ASEI innovation in their schools in Bungoma Central Sub-County.

iii. That, teachers in schools with improved performance in KCSE mathematics used more strategies than teachers in schools with declining performance Bungoma Central Sub-County.

5.2.3 Challenges faced by Mathematics Teachers in the Implementation of ASEI Innovation

With regard to challenges faced by teachers the following conclusions were made;

i. That mathematics teacher in all schools faced the challenges of limited time, students' negative attitude towards mathematics, low entry behavior of students and understaffing, inadequate teaching /learning resources, large class size, lack of administrative support and lack of co-operation from colleagues in the implementation of ASEI innovation in schools in Bungoma Central Sub-County.

ii. Those teachers in schools with improved performance faced more challenges than teachers in schools with declining performance Bungoma Central Sub-County.

iii. Inadequate teaching resources and limited time were common challenge faced by teachers in all schools

5.3 Recommendations

From the findings of the study, various recommendations can be made related to policy and further research

5.3.1 Recommendations for Policy

5.3.2 With regard to Attitude of Teachers towards Implementation of ASEI Innovation, the following recommendations were made;

i. Mathematics teachers' positive attitude towards implementation of ASEI innovation in schools with declining performance needs to be enhanced through

motivational incentives to enhance good performance in KCSE mathematics and to prevent schools sliding farther into poor performance in KCSE mathematics in Bungoma Central Sub-County.

ii. Teachers need to be motivated and encouraged to embrace the ASEI pedagogy fully in order to realize better performance in KCSE mathematics in Bungoma Central Sub-County.

iii. Mathematics teachers to be encouraged to make and use ASEI lesson plans.

5.3.3 With regard to Strategies Teachers use in the Implementation of ASEI Innovation, the following recommendations were made;

i. Internal inspections, team teaching, provision of adequate resources, peer lesson study are important strategies that can help to realize the objectives of ASEI innovation if well streamlined in Bungoma Central Sub-County public secondary schools.

ii. Schools with declining performance should device more strategies such as adequate use of resources such as models, charts and textbooks, creation of mathematics hour involving daily practice of mathematics, adequate staffing with qualified mathematics teachers to effectively implement ASEI innovation so as to reverse the declining trend.

iii. Administrators of under performing school should do bench marking in schools which have successfully used ASEI innovation to improve performance in KCSE mathematics.

iv. Administrators of under performing school should motivate their teachers for successful implementation of ASEI innovation in schools.

v. The Teachers' Service commission should post more trained mathematics teachers in Bungoma Central Sub-County.

vi. Mathematics teachers should adequately make use of available resource to achieve ASEI objectives.

5.3.4 With regard to Challenges Teachers face in the Implementation of ASEI Innovation, the following recommendations were made;

i. Adminsitrators and policy makers should address the challenges of limited time, students' negative attitude towards mathematics, low entry behavior of students, understaffing, inadequate teaching /learning resources, large class size, and team work in order to realize good results in mathematics through ASEI teaching innovation in schools in Bungoma Central Sub-County.

ii. Teachers in schools with declining performance in KCSE mathematics need to be serious since they have fewer challenges to realize better performance.

iii. School administrators should provide mathematics teachers with more teaching/learning resources for effective implementation of ASEI innovation.

iv. Mathematics teachers should sacrifice to work within the limited time to practice ASEI innovation.

v. The Teachers service commission should post more mathematics teachers in all schools for full implementation of ASEI innovation in schools and consequently improve performance in KCSE mathematics.

5.4 Suggestions for Further Research

Those interested in carrying out further research could carry out studies on

i. Influence of ASEI teaching and learning resources on students' academic achievement in mathematics in Bungoma Central Sub-county.

ii. Influence of Principals' leadership style on effective implementation of ASEI innovation.

iii. Factors influencing students' negative attitude towards mathematics despite ASEI innovation in Bungoma central Sub-County.

iv. Factors influencing teachers' negative attitude towards ASEI lesson plans.

v. Why some schools in Bungoma Central Sub-County secondary schools perform well in KCSE mathematics despite many challenges faced by teachers in the implementation of ASEI innovation.

vi. How teachers deal with challenges of implementing ASEI innovation in Bungoma Central Sub-County public secondary schools.

vii. Why mathematics teachers have negative attitude towards implementation of ASEI teaching innovation?.

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APPENDIX I: Principals' Interview Schedule(PIS)

Section A: Background information

1) How do you rate the performance in mathematics in your school? Improving /declining

2) What factors contribute to the rating in 4 above?

SECTION B: **Information on the attitude of teachers in the implementation of ASEI training in the teaching and learning of mathematics**

3) Have your mathematics teachers attended ASEI training? **YES/ NO**

4). Do your teachers like ASEI training?

5). To what level have your mathematics teachers implemented the use of ASEI classroom practice?

6. What is your view on the following statements with regard to ASEI training?

i. ASEI training is very helpful in improving performance in mathematics in my school

ii. ASEI training is a waste of time and resources

iii. ASEI training is not practical in our school set-up

iv. Teachers do improvise mathematics teaching and learning materials

v. Teachers do make ASEI lesson plans

vi. Teachers do demonstrations in mathematics teaching

vii. After ASEI training teachers demonstrate new skills and knowledge of teaching Mathematics

viii. ASEI solves problems of teaching mathematics

ix. Teachers like ASEI training

x. Teachers involve students in the teaching and learning of mathematics

SECTION C: Information on strategies in the implementation of ASEI innovation in mathematics

7) What change have you noticed in your mathematics teachers as a result of ASEI training?

SECTION D: Challenges in the implementation of ASEI innovation in the teaching and learning of mathematics

8) What challenges do your mathematics teachers encounter in their efforts to implement ASEI approaches in your school?

APPENDIX II: : Deputy Principals' Interview Schedule (DPIS)

Section A: Background information

1) How do you rate the performance in mathematics in your school? Improving /declining

2) What factors contribute to the rating above?

Section B: **Information on the attitude of teachers in the implementation of ASEI training in the teaching and learning of mathematics**

3) Have your mathematics teachers attended ASEI training? **YES/ NO**

4). Do your teachers like ASEI training? YES / No

5). To what level have your mathematics teachers implemented the use of ASEI classroom practice?

6) What is your view on the following statements with regard to ASEI training?

i. ASEI training is very helpful in improving performance in mathematics in my school
ii. ASEI training is a waste of time and resources
iii. ASEI training is not practical in our school set-up
iv. Teachers do improvise mathematics teaching and learning materials
v. Teachers do make ASEI lesson plans
vi. Teachers do demonstrations in mathematics teaching
vii. After ASEI training teachers demonstrate new skills and knowledge of teaching Mathematics
viii. ASEI solves problems of teaching mathematics
ix. Teachers like ASEI training
x. Teachers involve students in the teaching and learning of mathematics

Section C: Information on strategies in the implementation of ASEI innovation in mathematics

9) How do you ensure that mathematics teachers practice ASEI approaches in your school?

10) What change have you noticed in your mathematics teachers as a result of ASEI training?

11).What resources have you availed to teachers to enable them implement the ASEI classroom practices?

SECTION D: Challenges in the implementation of ASEI innovation in the teaching and learning of mathematics

12) What challenges do your mathematics teachers encounter in their efforts to implement ASEI approaches in your school?

APPENDIX III:Mathematics Head of department Interview Schedule (MHODIS)

Section A: Background information

1) How do you rate the performance in mathematics in your school? Improving / declining

2) What factors contribute to the rating above?

SECTION B: **Information on the attitude of teachers in the implementation of ASEI training in the teaching and learning of mathematics**

3) Have your mathematics teachers attended ASEI training? **YES/ NO**

4). Do your teachers like ASEI training? YES / No

5). To what level have your mathematics teachers implemented the use of ASEI classroom practice?

6.) What is your view on the following statements with regard to ASEI training?

i. ASEI training is very helpful in improving performance in mathematics in my school
ii. ASEI training is a waste of time and resources
iii. ASEI training is not practical in our school set-up
iv. Teachers do improvise mathematics teaching and learning materials
v. Teachers do make ASEI lesson plans
vi. Teachers do demonstrations in mathematics teaching
vii. After ASEI training teachers demonstrate new skills and knowledge of teaching Mathematics
viii. ASEI solves problems of teaching mathematics
ix. Teachers like ASEI training
x. Teachers involve students in the teaching and learning of mathematics.

SECTION C: Information on strategies in the implementation of ASEI innovation in mathematics

7) What change have you noticed in your mathematics teachers as a result of ASEI training?

SECTION D: Challenges in the implementation of ASEI innovation in the teaching and learning of mathematics

8) What challenges do your mathematics teachers encounter in their efforts to implement ASEI approaches in your school?

APPENDIX IV: Mathematics Teacher's Questionnaire (MTQ)

This questionnaire aims at gathering information on the attitude, strategies and challenges in the implementation of ASEI innovation in mathematics in public secondary schools in Bungoma central Sub-county. The information obtained will lead to recommendations that will help improve performance in mathematics in Bungoma central Sub-county. You are requested to assist by filling in the questionnaire. This is a purely academic exercise and your responses will be treated confidentially. Kindly answer the following questions as honestly as possible.

Section A: Background information

1) How do you rate the performance in mathematics in your school?

Improving [3] declining [1]

2) What factors contribute to the rating in 1 above?

SECTION B: Information on the attitude of teachers in the implementation of ASEI innovation in the teaching and learning of mathematics

4) Have you ever attended ASEI training? **[YES] [NO]**

5) Do you like the ASEI training? [**YES] [NO]**

6). To what level have you as a mathematics teacher implemented the use of ASEI classroom practice? Fully = [3], partially = [2] and not at all = [1]

7). Indicate your degree of agreement with the following statements with regard to ASEI training. **KEY: SA- Strongly Agree A- Agree U- Undecided D- Disc-agree SD-Strongly dis-agree**

STATEMENT	SA	A	U	D	SD
I like ASEI training					
ASEI training is a waste of time and resources					
I do improvise mathematics teaching and learning materials					
I do make and use ASEI lesson plans					
I do demonstrations in my mathematics lessons					
I involve students in the teaching and learning of mathematics					
After ASEI training, I practice the new skills of teaching mathematics					

SECTION C: Information on strategies in the implementation of ASEI innovation in mathematics

8) How do you as a mathematics teacher implement ASEI approaches in your school?

SECTION D: challenges in the implementation of ASEI innovation in the teaching and learning of mathematics

9) What challenges do you encounter in your efforts to implement ASEI approaches in your school?

APPENDIX V: Sub-County Quality Assurance and Standards Officer Interview Schedule (SCQASOIS)

1. What is the attitude of mathematics teachers towards ASEI innovation?
2. What strategies do mathematics teachers use to actualize ASEI innovation?
3. What changes have you noticed in teachers as a result of ASEI practice?
4. What challenges do mathematics teachers encounter in the efforts to actualize/implement ASEI pedagogy in secondary schools?
5. To what extent have mathematics teachers implemented ASEI innovation in the district?

APPENDIX VI: MAP OF BUNGOMA CENTRAL SUB-COUNTY