



INFLUENCE OF SMASSE ACTIVE LEARNING TECHNIQUES ON STUDENTS' ATTITUDE TOWARDS MATHEMATICS IN SECONDARY SCHOOLS IN BARINGO COUNTY, KENYA

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Abstract:

The study reported in this paper sought to assess whether active learning techniques in mathematics brought about by SMASSE INSET has contributed to, improved students' attitudes in mathematics. This study was based on the Shepperd's Expectancy-value Theory, Theory of reasoned action and the Theory of planned behaviour as proposed by Ajzen and Fishbein (1975 and 1980). The study adopted descriptive survey research design and involved mathematics teachers and students from Baringo North Sub-County. Purposive, proportionate stratified and simple random sampling techniques were used to select a sample of 325 subjects comprising of 11 heads of department, 42 mathematics teachers and 272 students. Piloting was conducted and the data used to test the reliability and validity of research instruments. Data collected using questionnaires was analyzed using both descriptive and inferential statistics that included frequencies and percentages and the t-test. The results show that there were significant differences in students' attitude towards mathematics as exhibited by the higher scores of the students taught by teachers who attended the SMASSE INSET and lower scores for those taught by teachers who had not. The use of the active learning techniques had an influence on students' attitude towards mathematics. Based on the findings, it was recommended that the Ministry of Education should formulate policies that will see teachers not only attend SMASSE INSET regularly but also include more robust and active learning measures that can be implemented by the teachers.

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1. Introduction

The challenge confronting our educational systems is how to transform the curriculum and teaching-learning process to provide students with the skills to function effectively in this dynamic, information-rich, and continuously changing environment. The Millennium Development Goals (MDGs) and Kenya's Vision 2030 are anchored on technology and science where knowledge of mathematics is pertinent. Mathematics is regarded by most people as essential and useful. Its usefulness ranges from social, aesthetic, utility and communication. Mathematics plays a pivotal role in providing a means of studying other disciplines such as sciences, technology, geography and economics. Its usefulness in science, technological activities, economics, education and even humanities (Tella, 2008) has been noted.

Mathematics provides a basic relevant skill in studying other subjects and as identified in earlier research, learners' competency in numeracy in early grades affects their academic achievement more generally in later years and affects how they master other subjects (Oketch et al., 2010). In Kenya, mathematics is a prerequisite subject to many careers like medicine, pharmacy, accounting, finance and banking (University of Nairobi, 2008).

According to Ishenyi (2015), Hughes (2005), Macau (2000) and Friendland (1985), Mathematics forms an essential prerequisite for joining tertiary colleges and universities and useful for self-employment and in professions such as engineering and accounting. Other than the utilitarian role of mathematics, it has communication role as manifested in communication of messages, ideas and research findings numerically and graphically in analysis and decisions making. Mathematics has aesthetic role in the society as manifested in beauties generated from architectural and engineering designs for houses, cars and other models. Mathematics has a social role as it teaches intervals, sequences and series which are applied in social life, for instance, rhythms in the music world and in a variety of entertainments.

Concepts such as diagonals, course and tracks are well applied in games such as soccer, basketball, hockey and swimming among many other games. Besides the roles of Mathematics, many countries of the world have lamented on weaknesses in ways Mathematics is taught and learned in schools (European Mathematical Society, 2012). Other than enabling learners to acquire attitudes and knowledge that is relevant to life after school, it aims at fostering a positive attitude towards appreciating the usefulness and relevance of mathematics to a modern society. A lot of research evidence is accumulating regarding teachers' impact on student's learning experiences in Mathematics.

According to UNESCO (2010) document, mathematics is a core subject in the Kenyan school curriculum for both primary and secondary levels and while poor performance in mathematics is evident in most parts of the country, some areas have a

record of perennial mass failures in the subject as noted by Manoah, Indoshi and Othuon (2011). Poor attitude towards mathematics has often been cited as one factor that has contributed to lower participation of girls in mathematics courses and less success in those courses (Fullarton, 1993). The conceptions, attitudes and expectation of the students regarding mathematics and mathematics teaching have been very significant factor underlying their school experience and achievement (Borasi, 1990, Shoenfeld 1985).

Attitude has been identified as one of the determinants of performance in mathematics (Karue, 2006; Omondi, 2010; Shahid, 2008; Wanjohi, 2011; and George, James, Justus & Zachariah, 2012). Good performance in KCSE examinations has been attributed to student's positive attitude towards the subject. Several studies have revealed that SMASSE has had a positive impact of on student's attitude towards mathematics (Ndiku, 2011; Olick, 2012; and Libiru, 2012). Similar results have also been revealed in the situational analysis reports from the Centre for Mathematics and Science Education in Africa (CEMASTEА). The survey conducted by the SMASSE project impact assessment survey (SPIAS) on teacher participation in the SMASSE INSET and how it affects students' attitude and participation in lessons revealed that the quality of INSET led to a better students' attitude towards mathematics and science subjects (CEMASTEА, 2010).

In response to the continued low achievement in mathematics and sciences, the Strengthening of Mathematics and Science in Secondary Education (SMASSE) Project launched in 1998, through the INSET for teachers was to influence improved instruction and a change of attitude towards mathematics (MOEST, 1998). The INSET approaches were meant to improve teachers' skills and competence (Karega, 2008).

The problems identified in mathematics instruction included among others; attitude towards the subject, inappropriate instructional techniques, inadequate and inappropriate student assignments, inadequate opportunities for classroom interaction and infrequent teacher and student guidance (MOEST, 1998; Njuguna, 2005). There was also a lack of a professional forum for teachers to share their experiences and where they could address areas of difficulty. More so, inadequate development of appropriate instructional materials was also noted to contribute to poor teaching methodology and poor performance in mathematics. The formulation of the SMASSE was therefore meant to provide intervention measures to the worrying situation in mathematics instruction.

The INSET was meant to improve teacher instructional practices with emphasis on improvisation of instructional materials locally, relating instruction to real life situations, enhance learner participation in class and improve teacher skills in work planning, monitoring learning achievement, self and collegial evaluation and utilization of feedback to improve instruction. Despite the importance that is attached to mathematics, poor performance that led to the launch of SMASSE hence active learning has continually dogged the subject.

County Director's analysis of 2014 KCSE showed that in Baringo North Sub-County, out of 2359 students, 82 got A, 76 A-, 88 B+,.....,568 D+, 620 D- and 711 E. 81% of the students scored D+ and below. The dismal performance of students in

mathematics continues to affect the country's growth in terms of technological knowhow and this may negatively impact on the realization of millennium development goals (MDG's) and attainment of vision 2030. The poor performance is attributed to lack of quality teaching and learning pedagogy that may prompt learners to construct knowledge on their own through the guidance of an expert.

Mathematics has been pointed as a subject area that requires practice, if the objectives of teaching the subject are to be achieved. The formidable problem currently facing mathematics education in Kenya is the need to improve the student's performance in mathematics. To actively engage learners in the learning process using constructivist approach to learning, they assert that it has the potential to accelerate, enrich, and deepen skills. Also, it can to motivate, increase interaction and reception of information and engage learners. This helps relate school experience to work practices, giving way to new scenarios which favor both individual and collaborative learning (Yusuf, 2005). There is therefore a need for mathematics teachers to use constructivist methods to transform mathematics lessons into student focused environment with meaningful activities that promote efficient learning.

Teaching methodology that can enhance the learners' participation, engagement, creativity and achievements may result to an improved performance. To improve students' cognitive, affective and psychomotor abilities in mathematics, teachers must explore the use of active learning techniques in instruction. Currently the problem to supplement teaching with the innovative and student-centered techniques can no longer be ignored. There is thus need for transforming mathematics lessons into students focused environment with meaningful activities that promote efficient learning of mathematics in our classrooms. The study reported in this paper sought to assess whether the active learning techniques in mathematics brought about by SMASSE INSET has contributed to improved students' attitudes towards mathematics.

2. Purpose and Objective

The purpose of this study was to assess whether active learning techniques in mathematics brought about by SMASSE INSET has contributed to improved students' attitudes, in secondary schools in Baringo North County. The objective was to determine the influence of use of SMASSE active learning techniques on the students' attitudes towards mathematics.

3. Research Hypothesis

The following null hypothesis was posited for testing at 0.05 level of significance.

H₀: The use of SMASSE active learning techniques does not influence students' attitudes towards mathematics.

4. Methodology

This study adopted a descriptive survey design and involved collection of both quantitative and qualitative data from the teachers of mathematics and students in Baringo-North Sub-County of Baringo County in the republic of Kenya. The heads of mathematics departments, teachers and students were selected using purposive, stratified and simple random sampling techniques respectively. Data was collected using questionnaires and an interview schedule.

The instruments were piloted and their validity and reliability determined before actual data collection. Validity was determined using the experts' help to verify the content, construct and face validities of the instruments and done through consultations with the supervisors, and lecturers from the Department of Science and Mathematics Education. To establish the reliability of the questionnaire, the test re-test method was used. The data from the two tests were subjected to Pearson Product Moment Correlation Coefficient (r) to determine the reliability index.

The R-values obtained for the instruments were 0.87 and 0.89 respectively which was deemed reliable to be used as data collection tool. Data was analyzed using descriptive statistics including computation of frequencies and percentages and inferential statistics involved the t-test to establish the significance in the differences in the mean scores of the students on the variable attitude as dictated by the instructional practices used by teachers who had attended the SMASSE INSET and those who had not and from which interpretations and recommendations are made. All the ethical rules and regulations of carrying out research in Kenya including privacy, confidentiality and openness in data collection were observed throughout the study.

5. Findings on SMASSE Active Learning Techniques and Students' Attitudes towards Mathematics

The objective of the study was to assess whether active learning techniques in mathematics brought about by SMASSE INSET has contributed to improved students' attitudes towards mathematics. Answers were sought on the impact of the instructional practices on student's attitudes towards mathematics as perceived by teachers and students who participated in the study. The students were required to indicate the extent to which they agreed with statements concerning mathematics lessons instructional activities.

The findings are as indicated in Table 1.

Table 1: Students Views on Attitudes towards Mathematics

Items	Agreement		Undecided		Disagreement	
	F	%	F	%	F	%
1. Mathematics is very interesting to me and I enjoy my mathematics lessons.	8	3%	0	0	264	97%
2. My mind goes blank and I am unable to think clearly when doing mathematics.	214	79%	24	9%	34	12%
3. If I am confronted with a new mathematical situation, I can cope with it because I have a good background in mathematics.	8	3%	78	29%	186	68%
4. I can draw upon a wide variety of mathematical techniques to solve a problem.	34	12%	27	10%	211	78%
5. I do not feel that I have a good working knowledge of the mathematics course I have taken.	187	69%	14	5%	71	26%
6. I learn mathematics by understanding the underlying logical principles, not by memorizing the rules.	16	6%	40	15%	216	79%
7. If I cannot solve a mathematics problem, at least I know a general method of attacking it.	32	12%	54	20%	186	68%
8. Mathematics problems are a challenge.	225	83%	0	0	47	17%
9. I have more confidence in mathematics than other subjects.	73	27%	27	10%	172	63%
10. Mathematics classes are interesting, and we learn values useful to life.	57	21%	54	20%	161	59%
11. Mathematics is a very difficult subject to study in school.	206	76%	24	9%	42	15%
12. I intend to take a career related to mathematics to get a good job in future.	84	31%	54	20%	134	49%
13. We are involved in mathematics lessons for critical thinking.	16	6%	40	15%	216	79%
14. Mathematics is one of the easiest subject.	24	9%	48	18%	200	73%
15. Mathematics develop critical thinking in solving problems.	84	31%	27	10%	161	59%
16. Mathematics assignments are less stressful.	78	29%	27	10%	167	61%
17. We always do mathematics activities using the locally available materials.	111	41%	0	0	161	59%
18. I should have dropped mathematics if it was optional.	212	78%	27	10%	33	12%

The results in Table 1 show that on whether mathematics is very interesting and that they enjoy my mathematics lessons, agreement was noted by only 8 (3%) as a majority 264 (97%) of the students disagreed on this statement. The results indicate that still most of the students do not find mathematics lessons interesting and that they do not enjoy. On whether their minds go blank and they are unable to think clearly when doing mathematics, a majority 214 (79%) agreed, 24 (9%) were undecided as 34 (12%) disagreed.

This could be attributed to the low level of motivation during mathematics lessons. On whether the students can cope during lessons because they have a good background in mathematics when confronted with a new mathematical situation, a majority 186 (68%) disagreed, 78 (29%) were undecided as only 8 (3%) agreed. The results show that in most cases, the students cannot cope during mathematics lessons and which can still be attributed to the kind of activities initiated by the mathematics teachers. There was thus need to find out whether the students can be able to draw upon a wide variety of mathematical techniques to solve a problem and as indicated in the findings, only 34 (12%) agreed, 27 (10%) were undecided as a majority 211 (78%) of the students disagreed. The results show that in most cases the students could not solve mathematics problems using various techniques and which could be attributed to limited exposure of students to the problem-solving techniques. Asked about how they feel having a good working knowledge of the mathematics course they have taken, a majority 187 (69%) acknowledged that they do not have the necessary background knowledge in mathematics, 14 (5%) were undecided as compared to only 71 (26%) of the students who disagreed on the statement. The results show that in most cases, the students do not have good working knowledge of the mathematics course they taken, and which is still attributed to the instructional practices in mathematics.

On whether they learn mathematics by understanding the underlying logical principles and not by memorizing the rules, 216 (79%) most of the students who participated in the study disagreed to this statement, 40 (15%) were undecided as compared to only 16 (6%) who agreed. The results show that in most cases students acknowledge that they learn through rote learning as they lack opportunities for them to understand the underlying logical principles in mathematics. There was need to find out the student's feelings about their ability to solve mathematical problems. Asked if they cannot solve a mathematics problem, but at least know a general method of attacking it, 32 (12%) agreed, 54 (20%) were undecided as 186 (68%) most of the students disagreed. The results show that in most cases the students are not able to solve mathematical problems, and which is attributed to the lack of understanding of the methods and techniques of attacking the problems. As indicated 225 (83%), most of the students acknowledge that mathematics problems are a challenge, as compared to only 47 (17%) of the students who noted that the subject is not a challenge. Asked whether they have more confidence in mathematics than other subjects, 73 (27%) agreed, 27 (10%) were undecided as a majority 172 (63%) disagreed. This indicates that in most cases, the students are not confident in solving mathematics problems and which could be attributed to lack of sufficient practice and the non-involvement in hands on activities during mathematics lessons.

On whether mathematics classes are interesting, and that students learn values useful to life, 57 (21%) agreed, 54 (20%) were undecided as 161 (59%) disagreed. The results are indicative of a generally a lack of appreciation of the relevance of mathematics course to life by most of the students. The results indicate that in most cases the teachers do not use appropriate methods and thus students do not find it interesting to learn

mathematics and in cannot be able to see the relevance of the subject to their real-life situations. Asked whether mathematics is a very difficult subject to study in school, a majority 206 (76%) agreed, 24 (9%) were undecided as only 42 (15%) agreed. The findings show that in most cases the students perceive mathematics as a difficult subject and this affects their learning. There was need to find out the student's intention to take a career related to mathematics to get a good job in future and as indicated, 84 (31%) agreed, 54 (20%) were undecided as most 134 (47%) of the students disagreed. The results show that in most cases the students do not want to pursue courses that require or involve mathematics in future.

To establish the instructional practices of teachers, the students were asked whether they are involved in mathematics lessons for critical thinking. As indicated in the findings 16 (6%) agreed, 40 (15%) were undecided as 216 (79%) most of the students disagreed. The results show that in most cases mathematics teachers do not involve the students in mathematics lessons for critical thinking. Asked whether they find mathematics as one of the easiest subject, 24 (9%) agreed, 48 (18%) were undecided as 200 (79%) most of the students disagreed. On whether mathematics develop critical thinking in solving problems, 84 (31%) acknowledge, 27 (10%) were undecided as 161 (59%) disagreed on this statement. The results show that in most cases the students do not acknowledge that mathematics is useful in solving real life problems. On whether mathematics assignments are less stressful very few students 78 (29%) agreed, 27 (10%) were undecided as 167 (61%) disagreed. The findings show that in most cases the students find the mathematics assignments stressful to them and which could be attributed to the ill preparedness of the students to perform mathematical problems. To ascertain whether the teachers use instructional materials in mathematics, students were asked whether they always do mathematics activities using the locally available materials. As indicated in the findings, 111 (41%) agreed, as 161 (59%) most of the students disagreed. On whether they should have dropped mathematics if it was optional, 212 (78%) agreed, 27 (10%) were undecided as compared to only 33 (12%) of the students who disagreed. The results show that given chance, most of the students feel that they can drop mathematics subject.

From the findings, on whether SMASSE INSET has influenced student's attitudes towards mathematics, the results are not in the affirmative. The results show that most of the students who participated in the study indicate that mathematics is not interesting and that they don't enjoy mathematics lessons, their minds go blank and they are unable to think clearly when doing mathematics and that they cannot cope during lessons because as they lack a good background in mathematics when confronted with a new mathematical situation.

The students also indicated that they cannot be able to draw upon a wide variety of mathematical techniques to solve a problem, they don't have the necessary background knowledge in mathematics and that they learn mathematics by memorizing the rules and not by understanding the underlying logical principles.

The students also indicated that they learn mathematical concepts through rote learning and that they lack the ability to solve mathematical problems and lack a general method of attacking mathematical problems. They acknowledge that mathematics problems are a challenge; they generally lack confidence in mathematics as compared to other subjects. Students indicated that mathematics classes are not interesting, and that don't find it useful to life and thus as indicated by most of the students, mathematics is a very difficult subject to study in school. The results show that in most cases the students are not involved in mathematics lessons for critical thinking, do not acknowledge the subject's role in critical thinking, do not find mathematics as one of the easiest subject and they do not want to pursue courses that require or involve mathematics in future.

In most cases the students find the mathematics assignments stressful to them, the teachers do not use locally available instructional materials in mathematics and that given chance, most of the students feel that they can drop mathematics subject. From the results presented, it is vividly clear that most students had a negative opinion towards mathematics instructional practices in their classes. There was need to find out if there were differences in the student's opinions according to their classes as taught by teachers who had attended the SMASSE INSET and those who had not.

To establish the influence of the SMASSE INSET on student's attitude towards mathematics, the student's responses on the attitude scale were scored, means of the scores obtained and tabulated and subjected to independent samples t-test and the findings are as indicated in tables 2 and 3.

Table 2: Group Statistics for Students

	Student	N	Mean	Std. Deviation	Std. Error Mean
Attitude Scores	SMASSE Classes	111	51.3784	13.49482	1.28087
	Non-SMASSE Classes	161	28.1739	10.80889	.85186

The results in output group statistics Table 2 displays the descriptive statistics, the mean scores of the students obtained on the attitude scale administered. The mean score for the students in classes taught by the teachers who had attended the SMASSE INSET was 51.3784 and that of the students taught by teachers who had not attended the SMASSE INSET programme was 28.1739. The difference in the mean scores could be attributed to the instructional practices that involve use of active learning techniques adopted by the teachers who had attended the SMASSE INSET programme that impact on student's attitude towards mathematics subject.

Table 3 indicates the independent samples t- test for the student's attitude towards mathematics.

Table 3: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Attitude Scores	Equal variances assumed	5.030	.026	15.705	270	.000	23.20447	1.47749	20.29559	26.11334
	Equal variances not assumed			15.085	201.699	.000	23.20447	1.53828	20.17130	26.23763

The results in Table 3 of Independent Samples Test, contains the statistics that are critical to evaluating the current research question on differences in the student's attitude towards mathematics. In this case in which the hypothesis is that students taught by teachers who had attended SMASSE INSET programme and those who had not do not differ in their attitude towards mathematics, the t statistic under the assumption of unequal variances has a value of 15.085, and the degrees of freedom has a value of 201.699 with an associated significance level of .000. The significance level tells us that the probability that there is no difference between students' attitude towards mathematics is very small: specifically, less than one time in a thousand would we obtain a mean difference of 23.20447 or larger between these groups if there were really no differences in their attitude towards mathematics subject. Therefore, the null hypothesis stating that the use of SMASSE INSET approaches does not influence students' attitudes towards mathematics is rejected. There were differences in the mean achievements of students with those students taught by the teachers who had attended the SMASSE INSET cycles exhibiting a positive attitude towards mathematics than those taught by the teachers who had not attended the SMASSE INSET cycles. The results point to the realization that the utilization of the ASEI and PDSI approaches as suggested in the SMASSE INSET improves attitude of towards mathematics.

6. Discussion of the Findings

The objective was to establish the influence of use of active learning techniques proposed by SMASSE INSET on the students' attitudes towards mathematics. The null hypothesis stating that there is no influence of use of SMASSE INSET techniques on the students' attitudes towards mathematics was tested. The analysis of the responses to the questionnaire test items shows that there is marked improvement of students, attitude towards mathematics as reflected in the significant differences with the higher means of the students taught by teachers who had attended the SMASSE INSET than of those

taught by teachers who had not attended the programme. Thus, the hypothesis was rejected. The findings revealed that the teacher use of the active learning techniques based on the ASEI and PDSI principles as proposed in the SMASSE INSET led to improved students attitude towards mathematics.

According to the findings from the analyzed results, it was evident that student's attitude towards mathematics was largely because of the instructional practices of their teachers. It should also be noted that attitude develops with time, it does not take time to change a bad attitude and that it only requires a will to change and a supportive environment. The findings of this study agree with those of Yara and Otieno (2010) who observed that students were positive towards teaching approaches that enhanced active learning. The findings also concur with those of Ouko (2004) who noted that interactive lessons with students actively involved and use of various instructional materials contributes significantly to a student's positive outlook at the learning process and the subject matter. Other studies have shown that teachers' attitude changed with the introduction of SMASSE INSET and that the change of attitude seems to have impacted positively on students' attitude (SMASSE, 2008). Similarly, the findings are in accord with those of Wafubwa R. (2014) who investigated the influence of SMASSE's ASEI-PDSI approach in the teaching and learning of mathematics in Rangwe, Division, Homa Bay County, Kenya. She found out that the SMASSE INSET influenced the student's attitude, but there has not been an improvement in student's performance in mathematics.

The findings revealed that despite the use of skills and knowledge generally acquired by teachers to enhance teaching of mathematics, largely, students' attitude towards mathematics did not change in cases where the active learning techniques are not embraced. In such cases most of the learners believed that mathematics was difficult, it was not enjoyable and interesting to learn, they did not have good background of mathematics and that they got confused while attempting to solve mathematics problems. Students' negative attitude towards mathematics was highlighted in the way they intentionally missed mathematics classes, failed to complete mathematics assignment, and did not pay attention during mathematics lessons. Therefore, there is need for teachers to improve their instructional practices by adopting active learning techniques that enhance positive attitude of students towards mathematics.

7. Conclusion

Attitude is an important factor in the process of implementation of a curriculum because a positive attitude towards a subject contributes to successful implementation of that subject. From the study, it was concluded that teachers did not attend SMASSE INSET training cycles regularly; the failure to attend training sessions consistently failed to improve learners' attitudes towards mathematics. Furthermore, teachers' attitudes towards the use active learning techniques as emphasized in the SMASSE INSET was noted positive for the teachers who attended cycles 1 and 2. This shows that the training that teachers undergo cannot bore fruit if they don't adopt active learning techniques in

mathematics instruction. There is need for the teachers to take the INSET training seriously for through them they will acquire skills needed for the teaching of the subject. On the other hand, the government needs to motivate the teachers by remunerating them and appraising them for attending this training. It's the responsibility of the quality assurance department in the ministry of education to ensure teachers adopt the active learning techniques based on the ASEI/PDSI principles in the teaching the subject.

8. Recommendations

It was established that the major issue to be addressed related to attitudes. There is need for the Ministry of Education and other stakeholders to develop a way motivating teachers and learners. Apart from that, Teachers Service Commission ought to develop a policy that would see all mathematics and Science teachers complete all the four cycles of SMASSE INSET to enable them improve instructional practice and hence change learner's attitude towards mathematics. Since SMASSE INSET is a very important innovation, there is need to incorporate the whole of SMASSE programme into the curriculum at teachers training colleges and universities. Fresh graduates should be SMASSE compliant as they leave their training institutions and INSET should only be introduced as a way of sharpening and reinforcing the teacher's skills and competencies in teaching mathematics. The Ministry of Education should come out strongly on sensitizing all the stakeholders on the importance of SMASSE INSET training for all teachers and ensure that follow-up is made by the quality and assurance departments at the National and County levels.

References

- Bolaji, C. (1996). A study of factors Influencing students' attitude towards mathematics in the Junior Secondary schools. *Kano journal of Education*, 3, 24-25
- Bohner, G., & Wänke, M. (2002). Attitudes and attitude change. Psychology Press.
- CEMASTEА (2010). *Monitoring and Evaluation report on District INSET*. Nairobi: CEMASTEА.
- European Mathematical Society Education Committee. (2012). It is necessary that teachers are mathematically proficient, but is it sufficient? Solid findings in Mathematics education on teacher knowledge. *Newsletter of the European Mathematical Society*, 83, 46–50.
- Ernest, P. (2004). Images of mathematics, values and gender. In S. Johnston-Wilder & B. Allen (Eds.), *Mathematics education: exploring the culture of learning*. Routledge.
- Fan, L., Quek, K. S., Zhu, Y., Yeo, S. M., Lionel, Hughes, J.E. (2005). The role of teacher knowledge and learning experiences in forming technology-integrated pedagogy. *Journal of technology and teacher education*, 12(4),201-210.

- Ishenyi, Polycarp Muchesia (2015). *Teacher Trainees Perception towards Computer Use in Mathematics Instruction*. Lap Lambert, Germany, pg 7.
- Karega, M. (2008). *Increasing Effectiveness of South-South Cooperation: the Case of SMASSE Kenya and SMASE-WECESA*, A paper Presented at the Workshop for Practitioners of South-South and Triangular Cooperation During the Fifth Annual United Nations Day for South-South Cooperation on 18 December 2008 at U.N. Headquarters/New York).
- Karue, M. (2006). *Factors associated with poor performance in day secondary schools in Embu district*. University of Nairobi: Unpublished PhD Thesis.
- Kenya vision 2030. (2008-2012). *Towards a globally competitive and prosperous nation*. Government of the republic of Kenya.
- Keitany, V. K. (2014). *Impact of Strengthening Mathematics and Science in Secondary Education (SMASSE) on Student Performance and Attitude Towards Physics in Marakwet West Sub-County*. Unpublished Msc Thesis.
- Kothari, C. R. (2006). *Research Methodology: Methods and Techniques*. New Delhi: New Age International (P) Limited Publishers.
- Kwamboka J. (2012). *Application Of SMASSE's ASEI/PDSI Principles When Teaching Mathematics In Secondary Schools Of Nakuru District*. Kenyatta University, Kenya: Unpublished M.ED Thesis.
- Langat, R. K. (2009). *Impact of SMASSE INSET on students' attitude and performance in Mathematics in secondary schools in Bomet district: Moi University*. Unpublished M.ED Thesis,
- Liburu, M. L. (2012). *The impact of SMASSE project on the teaching and learning of Mathematics in Tigania West District since 2004*. Moi University: Unpublished M.ED Thesis.
- Macau, (2000). *Mathematics and its Role in Civilisation*. Proceedings of the first 2000 international conference held in the World Mathematical Year. University of Lisbon.
- Makewa, L. N., Role, E., Biego, S. (2011). *Teachers' Attitude towards Strengthening Mathematics and Science in Secondary Education through In-service Education And Training (SMASSE-INSET) Project in Nandi Central District, Kenya*. In the *International Journal of Education and Social Sciences (IJESS) Volume 1 (4)*.
- Manoah, S. A., Indoshi, F. C. & Lucas Othuon, O. A. (2011). *Influence of attitude on performance of students in mathematics curriculum*. In *Educational Research, Vol. 2(3) pp. 965-981 March 2011*.
- MOEST (1998). *Findings from baseline survey on mathematics and science teaching in secondary schools in Kenya*. Nairobi. Government Printer.
- Ndiku, L. (2011). *Mathematics Teachers' Attitude towards the SMASSE-INSET in Nandi Central District, Kenya*. Eastern African University. Kenya: Unpublished M.ED Thesis.
- Olick, A. (2012). *The impact of SMASSE training programme on the Mathematics Performance in secondary schools in Bomet district, Kenya*: Unpublished M.ED Thesis.

- Omondi, O. K. (2010). *Teaching and learning resources and academic performance in Secondary schools in Bondo district of Kenya*. Kampala International University, Uganda: Unpublished PH.D Thesis.
- Orodho, A. J (2003). *Essential of Educational and Social Science Research Methods*. Nairobi: Malosa publishers.
- Ouko, C. (2004). SMASSE: An initiative to improve mathematics and science learning In secondary schools. In *Teachers Image: Volume 9 (23)*.
- SMASSE Project (2008). *Statistical Analysis of SMASSE Impact Assessment Survey*. Nairobi: SMASSE project.
- SMASSE Project (1998). *Strengthening mathematics and Science in Secondary Education project*. Ministry of Education, Science and technology, republic of Kenya.
- Shahid, M., & Syedza, S. (2008). *Pakistan Economic and social Review* Vol 46, No 8 (Summer, 2008) pp78-83.
- Sifuna, D. N. & Kaime, J. G. (2007). The effect of INSET programmes in mathematics and science classroom interaction: A case study of primary and secondary schools in Kenya. In the *African Education Review*, Vol. 4 (1): 104-126.
- The Kenya National Examination Council (2006). *2005 KCSE Examination Report*. Nairobi: The Kenya National Examinations Council.
- The Kenya National Examinations Council (2007). *2006 KCSE Examinations Report*. Nairobi: The Kenya National Examinations council.
- The Kenya National Examinations Council (2008). *Essential KCSE Examination Statistics given during the release of 2007 KCSE Examination results on Thursday 28th February 2008*. Nairobi: The Kenya National Examination Council.
- UNESCO (2010). *Education under attack*. Paris: UNESCO.
- Wafubwa R. (2014). *The Influence of Strengthening Of Mathematics and Science in Secondary Education (SMASSE) Project in the Instruction of Mathematics in Secondary Schools of Rangwe Division, Homa Bay County - Kenya*. Kisii University: Unpublished M.ED Thesis
- Waititu, M. M. & Orado, G. N. (2009). *Managing teachers and instruction of mathematics and sciences: Lesson from SMASSE experience in capacity development*. Nairobi: CEMASTE.A.
- Wambui, N. N. (2005). *A study of mathematical achievement using the climbing method in Kenyan secondary schools*. SMASSE project.
- Wambui, N. N. (2002). *Study on Mathematical Achievement using the climbing learning method in Kenyan Secondary school*. Nairobi: SMASSE project. Retrieved on 18th July 2007 from: <http://math.it/grim/21-project/21-malasya-wambui214-217-05.pdf>
- Wambui, N. N. and Wahome, A. N. (2006). *SMASSE Project: Tsukuba Journal of Educational study in mathematics*.
- Wanjohi, C. (2011). *Performance determinants of KCSE Mathematics in Nyamaiya division*. Kampala International University, Uganda: Unpublished M.ED Thesis.

Yara, O. P. & Otieno, O. K. (2010). *Teaching/Learning Resources and Academic Performance in Mathematics in Secondary Schools in Bondo District of Kenya*, Asian Social Science Kampala International University Kampala, Uganda.

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