PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 31, 2011

EFFECTIVENESS OF TEACHING PREPARATIONS ON MATHEMATICS ACHIEVEMENT: THE CASE OF KENYA

Maurice Musasia Amadalo, Duncan Wekesa Wasike
Masinde Muliro University of Science and Technology, Kakamega, Kenya
E-mail: mmamadalo@yahoo.com, duncanwasike@yahoo.com

Joseph Mulei Wambua
Katulani Secondary School, Kitui, Kenya
E-mail: jmwambua@yahoo.com

Abstract

Despite playing a central role in peoples' daily life, the average Kenyan secondary school students' mathematics score in national examinations has consistently averaged below 40%. The contribution of teachers' lesson preparations and subsequent delivery leading to this poor result has not been investigated sufficiently in Kenyan secondary schools. This is especially so for topics deemed to be difficult. The present study investigated the effect of teacher preparations when teaching the topic "Vectors" to form three secondary school students. The instructional plans impact on achievement as well as on skills performance in Mathematics formed the objectives of the study. The Solomon- four experimental design was adopted. Professionally drawn Instructional Plans provided the treatment. Students' achievement was determined using a Mathematics Achievement Test, MAT. The study determined that the use of the instructional plans improved students' achievement and skill performance compared to the control group. Consequently use of instructional plans when teaching mathematics was recommended for improved students' achievement. Emphasis on students' stepwise skill performance rather than insistence on acquisition of correct answers during problem solution in mathematics was recommended.
Key words: *mathematics achievement, mathematics lesson preparations, skill performance, vector operations.*

Introduction

Mathematics can be conceived as a subject that deals with numbers, shapes, algebra, measurement, and a variety of other more specialized but nevertheless familiar topics which give the subject its flavor (Costello, 1991). However, learning mathematics means more than this. It involves some memory capacity skills. These include the ability to acquire and retain knowledge, learning of new facts and skills, conceptual structures identification, problem-solving and acquisition of proper attitudes concerning mathematics (Costello, 1992).

Mathematics plays a central role in all people's daily life. The Cockroft Report (1982) has identified its' usefulness at home, workplace, commerce and industry. Rukangu (2004) has described mathematics as "Queen of Science" as well as "King of all school subjects". The subject develops student's logical thinking, accuracy of expression, and increases spatial awareness. It is seen as a catalyst for scientific and technological advancement.

International surveys carried out by Trends in International Mathematics and Science Study (TIMSS) in 1995,1997, 2003 covering 40 countries across the globe showed a general low students' achievement in mathematics (Maweu, 2005). In Kenya, the mean mark of mathematics by students in the 2005 Kenya Certificate of Secondary Examination (KCSE) was 31.91% which was a drop from 37.20% in 2004, according to the Kenya National Examination Council (KNEC, 2005). The same report showed that in 2005, over 50% of the candidate scored less than 30.05%. In 2003, students' achievement in Mathematics had dropped to 38.62% from 39.39% in 2002. These trends show a generally low students' achievement in mathematics. This low performance has been a source of concern for parents, teachers and other education stakeholders. This concern is based on the multitude of resources invested in the students' education. Unless drastic measures are taken, the students could continue to achieve dismally. Their participation in economic and professional activities would be severely hampered since Mathematics is the link pin in such activities. The Vision 2030 policy, which hopes to see Kenya become a middle level economic state will be hard to achieve. This is because of the central role mathematics and science dependent technology plays in driving the economy forward (Amadalo, 1998).

Studies have been carried out to find out the possible explanation for the low achievement. Makunja (2004) found out that there was little thoroughness in teachers' competency when preparing and using instructional products. Preparation naturally leads to a clear link between utilising instructional products and effective teaching. Simpson (2001) notes that teachers' competence in instructional design helps the teachers to develop expertise in teaching that topic. The effort put in the preparation opens up the teachers' mind to various possibilities that can arise during the actual teaching/learning encounter. Consequently this process allows the understanding of the various problems that the students' may have. This understanding makes the teacher come with the best instructional plans. Farrant (1980) has shown that a close relationship exists between teaching techniques and students' achievement.

Too (2004) found out that students mainly learn mathematics through the experiences their teachers provide. The teaching episodes encountered shape the students' understanding of concepts and skills. Improvement of mathematics learning for all students requires effective mathematics teaching in all classrooms (NCTM, 2000). Hayman (1970) notes that teaching involves giving reasons, showing and weighing evidence, acting according to principles, and drawing conclusions on relevant evidence to justify learning action. This view is further echoed by Simpson (2001) who found that lessons that are well structured will be learnt smoothly and be more satisfying for all. Such lessons will give the less able mathematics learners in a class a sense of achievement. Similarly such lessons are capable of stretching the more able learners in ways that will open up even more interesting avenues for them.

In his study, Kihara (2002) found out that use of interactive teaching approaches contributes significantly to students' achievement in mathematics. This is because such approaches involve students in active learning processes and provide them with reasonable control over their learning. The strengthening of Science and Mathematics in Secondary School Education (SMASSE) report (2004) showed that if students were exposed to strategies that promote interactions, then this usually led to high achievement scores in mathematics. Nyambura (2004) found out that teachers who spent most of their teaching time demonstrating how to solve questions, asked questions, and gave lectures usually ended up with passive mathematics students. Meaningful mathematics interactions can only be achieved when the learners take center stage and become the active drivers and participants in the mathematics lessons.

Studies by Rukangu (2004) and Kihara (2002) showed that the possible explanations for low students' achievement in mathematics were teaching/learning strategies, student's attitude and teacher characteristics. Since the essence of teaching is to make the content easily understood by the students, the teacher needs to identify what preparations need to be made for the students to understand the content being taught. This calls for making notes for himself to look at when working through the examples and checking the answers before asking the class to do them (Simpson, 2002). It may be necessary to list all the relevant pieces of information that might be required such as definitions, formulae, possible discussions routes, questions to be asked at each stage of the lesson or activity. This makes the teacher to become an expert at teaching because the students' problems are clearly understood and anticipated beforehand. Thus, the teachers should know how to prepare and plan lessons that will reveal students' prior knowledge and then design experiences and lessons that will respond to and build on that knowledge.

Statement of the Problem

The actions of the teacher are of crucial importance in the learning/teaching process. Yet due attention has not been focused on how lessons are prepared and organised prior to actual classroom execution when teaching Kenyan secondary school mathematics. This study sought to find out how deliberately constructed instructional preparations affected students achievements of concepts and manipulative skills in mathematics. The performance due to the instructional plans was contrasted with that due to usual secondary school mathematics methodology. The topic used for the study was Vectors.

Research Purpose and Objectives

The object of the study was to investigate the potency of utilising deliberately prepared instructional plans to gauge their effect on learning a new topic, Vectors, in a form three secondary school setting. Specifically the study was guided by following specific research objectives:

1. To investigate the effect of teachers' use of instructional plans on students' achievements in the topic "Vectors"
2. To investigate the effect of teachers' use of instructional plans on students' Skill performance in the topic "Vectors"

Methodology of Research

The Participants

The research involved 155 upper secondary school students (form 3 level) derived from Makueni district in Kenya. All the participating schools were co-educational public district schools. Four (4) schools were selected out of target population of the twenty five (25) schools. Simple Random Sampling was used to select one whole stream from each school to form part of the sample. The respondents in each of the groups E1, E2, C1, and C2 were 34, 38, 46 and 37 respectively. The streams selected were considered realistic since no member of the class was left out. The sample size could allow for both descriptive and inferential statistical analysis (Mugenda & Mugenda, 1999).

Instruments and Procedures

The study adopted the Solomon Four Experimental design. This design was considered vigorous enough to counter any confounding factors. The study involved two experimental groups E1, E2 and two control groups C1, C2 One experimental group, E1, and one control group, C1, were pre-tested. The groups E1 and E2 were exposed to ten (10) mathematics lessons in "Vectors" taught using instructional plans which formed the treatment. The control groups were exposed to the same content but were taught using the traditional method of teaching in the secondary schools. All the four groups were post-tested.

The instructional plans identified the lesson objectives, provided learning activities and spelt out detailed worksheet activities. The treatment was developed to ensure interaction and control of the learning experiences by the students. The plans identified the step by step teaching of the concepts and skills, evaluation procedures, and details of identified tasks on the activity sheets.

The Mathematics Achievement Test (MAT) that was used to test achievement contained two sections. Section I dwelt on recall questions in "Vectors" while section II dwelt on skill performance. The test items were drawn from aspects of: Vector and scalar quantities, column vectors, position vectors, midpoint theorem, vector magnitude, equivalent vectors, and vector translation.

Statistical Analysis of Findings

One way Analysis of Variance (ANOVA) was used to check for significance of the achievement on both section I and II of the MAT sections for the treatment groups and the control groups. Anova was used in order it to allow the examination of variation of mean performances within and between the two groups involved in the research (Kothari, 2009) at the 0.05 confidence limit. The independent samples t-test was carried out to pinpoint the direction of difference in performance.

Results of Research

The source and performance on the pre-test items is indicated in Table 1 below.

Table 1. Table showing students' relative performance on aspects of vectors.

Aspect	Group							
	E1				C1			
	Frequency Correct	%	Frequency Wrong	%	Frequency Correct	%	Frequen-cy Wrong	%
Vector quantities	5	14.7	29	85.3	8	17.4	38	82.6
Scalar quantities	2	5.9	32	94.1	4	8.7	42	91.3
Examples	4	11.8	30	88.2	3	6.5	43	93.5
Equivalent vec-tors	0	0.0	34	100.0	0	0.0	46	100.0
Column vectors	1	2.9	33	97.1	1	2.2	45	97.8
Position vectors	0	0.0	34	100.0	0	0.0	46	100.0
Midpoint	6	17.6	28	82.4	5	10.9	41	89.1
Magnitude	2	5.9	32	94.1	1	2.2	45	97.8
Translation	0	0.0	34	100.0	0	0.0	46	100.0

From Table 1, it can be noted that majority of the students (over 82.0% of the respondents for both E1 and C2) did not have prior knowledge about Vectors. This is especially so on the more crucial aspects like equivalent vectors, column vectors, magnitude and translation of vectors. The ranges of marks obtained by the students were summarized as shown in Table 2 below

Table 2. Range of scores in pre-test of the MAT.

Range of scores (%)	Group			
	E1		C1	
	Frequency	%	Frequency	%
0-20	33	97.1	44	95.7
20- 40	1	2.9	2	4.3
0ver 40	0	0.0	0	0.0

Table 2 indicates that the mean mark in the pre-test was 11.3% and 12.4% for groups E1 and C1 respectively. From the table, it can be noted that a majority of the students had scored less than 20% in the pre-tests. The scores attest to the fact that the students had little prior knowledge about vectors. The two groups' performance was considered comparable, making the groups suitable for the study.

After the groups were exposed to the same content in 10 lessons, all of them were post-tested. Groups E1 and E2 underwent the treatment whilst C1 and C2 were the control groups, taught using the traditional mode. The results are shown in Table 3 below.

Table 3. Post-test counts in section 1 of the MAT.

Vector aspect	Group performance							
	E1		E2		C1		C2	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Vector quantities	32	94.1	36	94.7	40	87.0	34	91.9
Scalar quantities	33	97.1	34	89.5	41	89.1	33	89.2
Examples of vector/scalar quantities	33	97.1	30	78.9	42	91.3	31	83.8
Equivalent vectors	30	88.2	35	92.1	37	80.4	28	75.7
Mid point	29	85.3	34	89.5	34	73.9	29	78.4
Magnitude	29	85.3	31	81.6	31	67.4	27	73.0
Translation	31	91.2	32	84.2	32	69.6	28	75.7

The results in Table 3 show that overall, the section I of the MAT, which tested recall of basic concepts in vectors was well understood. This is because over 87.0 % of the students did not have difficulty in remembering definitions of vector and scalar quantities. Also, over 78.0% of the students could give correct examples of vector and scalar quantities. As for conditions for two vectors to be equivalent, over 75.0 % of the students in each group got them correct. Also, over 69.0 % scored correctly on statements about application of translation to an object in each group.

From the above results, the overall indication is that the students performed well in problems requiring recall of basic knowledge in vectors. This was an indication that students normally do not have a lot of challenges in routine recall of definitions and working out examples in mathematics. However, to establish if there was a significant difference in the scores obtained in section I of the MAT, a one-way ANOVA was done and the results are shown in Table 4 below.

Table 4. An ANOVA of the post test scores in section I of the MAT.

Source	df	SS	M S	F-ratio
Between groups	3	227.17	75.72	2.69*
Within groups	151	4250.32	28.15	
Total	154	4472.15		

$F_{0.05\,[3,151]} = 2.609$

From the table, the calculated F ratio value (2.69) is greater than the tabulated F ratio value (2.609). This implies that there is difference in understanding of these basic concepts in vectors by the different groups. Again, to establish if the scores were statistically different, a step-by-step t-test of the group combinations was done. The results are shown in Table 5 below.

Table 5. An independent samples t-test for the groups in section I of the MAT.

Groups	df	t-value
E1Vs E2	70	1.18
E1 Vs C1	78	3.48*
E1Vs C2	69	2.59*
E2 Vs C1	82	5.14*
E2 Vs C2	73	4.23*
C1 Vs C2	81	1.12

*means significant

Table 5, establishes that there was no statistical difference between purely experimental and purely control groups respectively. The t-ratio values of 1.18 and 1.12 for E1 Vs E2 and C1 Vs C2 respectively are less than the table value. Determining the t-test for the various combinations of E and C showed that the groups' performance were significantly different. There was an indication that the students in experimental groups had mastered more in definitions, and on examples of vectors and scalar quantities than those in control groups.

Post-test Analysis of the Skills Performance Test

The second objective of the study investigated the effect of teachers' use of instructional plans on students' skills performance on "Vectors". This was done in section II of the MAT. Students' ability to systematically work out correct answers to questions in the aspects tested in section I was determined. These aspects, which accounted for 58% of the total marks include: Displacement, vector diagrams, column vectors, multiplication by a scalar, midpoint, magnitude and translation. Students, scores in these aspects are shown in table 6 below.

Table 6. Students' scores in section II of the MAT.

Range	Number of students							
	E1		E2		C1		C2	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
0-14	0	0.0	0	0.0	4	8.7	2	5.4
15-29	3	8.8	3	7.9	13	28.3	8	21.6
30-44	4	11.8	7	18.4	5	10.9	6	16.2
45-59	27	79.4	28	73.7	24	52.1	21	56.8

From Table 6, it can be noted that none of the students in the experimental groups E1 and E2 had scored less in than 14%. However, 4 and 2 students in control groups C1 and C2 respectively had scored 14% and below. Again, 3 (8.8%) and 3 (7.9%) students in groups E1 and E2 respectively scored marks in the range 15-29% while there were 13 (28.3%) and 8 (21.6 %) students in groups C1 and C2 respectively in the same range. Finally, those students who scored over 30% were 31 (91.2%) and 35 (92.1%) from groups E1 and E2 respectively while it was 29 (63.0 %) and 27 (73.0%) students for C1 and C2 respectively.

The results indicate that those students who were taught using instructional plans mastered more content and could work out clearly these mathematical sums compared with those in the control groups. It is evident that use of instructional plans had positive influence on students' skill performance in mathematics. The instructional plans emphasize more on mastery of the concepts and procedures in working out the sums.

The number of students in each group who scored correctly or wrongly in each aspect of the topic vectors was analyzed and the results are shown in table 7 below.

Table 7. Post-test counts in section II of the MAT.

Aspect	Group							
	E1		E2		C1		C2	
	Correct	Wrong	Correct	Wrong	Correct	Wrong	Correct	Wrong
Displacement Vectors	28	6	34	4	29	17	25	12
Column vectors	30	4	28	10	27	19	26	11
Scalar multipli-cation	27	7	31	7	32	14	24	13
Mid point	32	2	35	3	31	15	30	7
Magnitude	29	5	30	8	24	22	21	16
Translation	25	9	29	9	32	14	31	6

Table 7 indicates that 82.4% and 89.5% of students in groups E1 and E2 respectively scored full marks in displacement while 63.0% and 67.0 % in C1 and C2 respectively scored the full marks in the same. In the aspects of multiplication of a vector by a scalar, midpoint and magnitude which are deemed difficult by students, over 79.0% and 78.0% in groups E1 and E2 respectively had mastered these concepts correctly as compared to 52.0 % and 56.0 % in control groups C1 and C2 respectively. In translation, over 69.0% of students in control groups had mastered this aspect while it was over 73.0% in experimental groups. This indicates that if teachers adopt the use of the instructional plans, then students' mastery of these aspects would greatly improve as evidenced by the high percentage in experimental groups standing at over 73%.

In order to determine if these scores in section II of the MAT had statistical significance, a one-way ANOVA was done. The results are shown in table 8 below.

Table 8. ANOVA of section II scores.

Source	df	SS	MS	F-ratio
Between groups	3	6911.58	2303.86	22.27*
Within groups	151	15620.96	103.45	
Total	154	22532.54		

* - Means significant $F_{0.85\ [3,151]} = 2.609$

From Table 8, the calculated F value (22.27) is greater than the tabulated F value (2.609). This indicates that there is difference in skill performance in vectors between the groups. To establish if this performance was statistically significant, an independent samples t-test was done. The results are shown in table 9 below.

Table 9. Independent samples t-test for section II scores of the MAT.

Groups	df	t-value	c-value
E1 Vs E2	70	0.85	1.67
C1 Vs C2	81	1.13	1.67
E1 Vs C1	78	4.74*	1.67
E1 Vs C2	69	3.56*	1.67
E2 Vs C1	82	6.06*	1.67
E2Vs C2	73	4.55*	1.67

* - Means significant

From Table 9, it was established that the scores were statistically significant and different for the groups in section II of the MAT. This indicated that students in the experimental groups had mastered more in skill performance as compared to those in control groups. This further showed that use of instructional plans by the teachers enabled them to teach progressively/systematically because the learning activities and objectives to be achieved had been identified. This enabled the students to master more in skill performance. The conclusion that can be drawn in that use of instructional plans by the teachers resulted in improved performance by the experimental groups as compared to the control groups.

Discussion

These findings of the study are in agreement with Wasike (2003) who found out that teachers use of teaching notes that have simplified language and relevant examples in mathematics leads to improved achievement. The language will be at the level of the students for whom English is not a first language. In many cases English is a second or third language of communication for the learner. Studies by Clarke et al (2009) and Simpson (2001) are also in concurrence, suggesting that if the teachers are engaged significantly in preparations before going to class, they will be engaged in organizing activities that are meaningful for the students. Such preparations anticipate the difficulties that the students will encounter. The instructional plans then stipulate deliberate measures that can be adopted when these difficulties are encountered. The resultant changed attitude emanating from this anticipation leads to improved interactions and subsequently, good grades.

The findings by Fuchs et al (1999) add credence to the current research findings. They showed that as a result of deliberate preparations by the teachers, the students showed increased interest in problem solving leading to better performance. Mathematics essentially involves a hands-on approach by the students. The more the learners are involved in the actual personal working out of the sums and the problems, the more adept they become at arriving at the required solutions. Indimuli (2003) equally found out that where the teacher uses lesson plans with identified learning tasks, there is improved achievement by the students in mathematics. Activities considered exploratory, elaborative and applicative are brought to bear on the learning task at hand. The students are given time to present their own individual view points and to test these out against those of other group members. The lesson preparation plans allow this individual inputs and views during the group discussions.

Kay and Knaack (2008) found out that overall students' performance increased significantly as a result of using well prepared objects. This finding is line with the results of the present study. However, Nyambura (2004) found out that the teaching methodology does not contribute significantly to students' performance. She argued that students' cognitive ability, rather than the teachers' input in the teaching/learning process, is the dominant determinant of that individual student's performance. Again, Yara and Otieno (2010) attribute students' performance on availability, proper planning, and use of teaching resources. Their study focused attention on teaching approaches such as the ones suggested in the current study.

Conclusions

From the findings of this study, the following conclusions can be drawn.

i) Teacher lesson preparations in terms of clearly identifying the learning tasks, objectives and worksheet activities to be done during all mathematics lessons. The E1 and E2 groups performance was superior performance on both the achievement and skills aspects of the study. These groups were involved in systematized activities unlike the C1 and C2 groups.
ii) Students acquire enough basic theory in mathematics by both modes of learning. The manipulative skill performance was a challenge as can be deduced from the scores in section II of the MAT particularly for the control groups.
iii) Use of pre-planned or identified learning tasks which can be worked out individually, in pairs or in groups is a great boost to the understanding of concepts in the topic "Vectors". More so, the worksheet activities help in improving students' skill performance because the teacher can easily gauge the mastery level of the students and so modify their teaching approach.
iv) Where the teacher has identified the perceived difficult aspects, identification of corrective steps is relatively easy.

These findings have pointed out the importance of advance and adequate teacher lesson preparations for the benefit of the learner who is the beneficiary of the teaching – learning process.

Recommendations

From the foregoing discussions, the following recommendations have been made.

i) Teachers should make thorough preparations, write them down and use them as guides during instruction. This will ensure that individual differences amongst the students are catered for. In instances where teachers attended lessons, without well-planned teaching steps and guides, the students' performance was low in both achievement and skills as is evident from score of students in control groups C1 and C2.
ii) Mathematics instruction should emphasize the manipulative steps involved in arriving at a solution. This skill allows easy tracing and re-enactment of individual steps in case of failure to arrive at the correct solution. The findings have shown that all students achieve reasonably well general academic performance. However only the groups which have utilized a system that shows steps (E1 and E2) could demonstrate the required steps.
iii) That the instructional plans used in this study be adopted for teaching the topic of "Vectors" which is deemed difficult by students.

References

Amadalo, M. M. (1998). *An investigation of Aspects of Concept Formation and their Representation by Secondary School Pupils in Science.* Unpublished PhD Thesis, Kenyatta University, Nairobi, 2-3.

Clarke, P. A. J., Thomas, C. D., and Vidakovic, D. (2009). Pre-service Mathematics Teachers' Attitudes and Developing Practices in the Urban Classroom: Are they "Winging" it? *Research and Practice in Social Sciences,* 5(1), 22-43.

Cockroft, W. H. (1982). *Mathematics counts: A report of the committee into the teaching of mathematics in schools*. London: Her majesty's stationery office.

Costello, J. (1991), *Teaching and learning mathematics*, Routledge: New York, 11-16

Farrant, S. J. (1997). *Principles and practice of education*. Longman: Essex.

Fuchs, L. S., Fuchs, D., Kahns, K., Hamlett, C. L., & Katzaroff, M. (1999). Mathematics performance assessment in the classroom: Effects on Teacher Planning and student problem solving. *American Educational Research Journal*, 36(3), 609-646.

Hayman, T. R. (1970). *Ways of teaching.* J.P. Lippincot Company: New York.

Indimuli, J. (2004). *The role of lesson preparation in management of learning challenges in secondary schools, Bungoma District*. Unpublished M.Phil thesis, Moi University, Eldoret.

Kay, R., and Knaack, L. (2008). Investigating the Use of Learning Objects for Secondary School Mathematics. *Interdisciplinary Journal of E-Learning and Learning Objects,* 4, 270-289.

Kihara, J. M. (2002). *The extent to which KCPE mathematics results predict performance in mathematics at KCSE. A case of National Schools*. Unpublished Thesis, Kenyatta University: Nairobi.

Kothari, C. R. (2009). *Research methodology: Methods and Techniques, 2nd Revised Edition*. New Age International Ltd: New Delhi, 257-259.

Makunja, C. (2003). *Teacher competence in instructional design: a case of Bungoma District*. Unpublished M.Phil Thesis, Moi University, Eldoret.

Maweu, S. M. (2005). *Preference for mathematics based careers and attitude towards mathematics among secondary school students in Makueni district*. Unpublished Masters' Thesis, Kenyatta University, Nairobi.

Mugenda, O. M., & Mugenda, A. G. (1999). *Research Methods: Quantitative and qualitative approaches*, ACTS Press: Nairobi

National Council of Teachers of Mathematics, NCTM (2000). *Curriculum and Evaluation Standards for School Mathematics*. Reston, VA.

Nyambura, G. (2004). *Determination of classroom discourses patterns that enhance mathematics learning in selected public schools, Nakuru district, Kenya*. Unpublished Thesis, Kenyatta University: Nairobi.

Rukangu, S. M. (2004). Contributions of ineffective teaching learning of mathematics to regional disparities in socio-economic development in Africa, *ATWS*, Vol 2: Kenya Chapter.

Simpson, A, (2001). *Teaching and Assessing Skills in Mathematics*. Cambridge University Press: London.

Simpson, A. (2002). *Teaching and assessing skills in mathematics*. Cambridge University Press. London

SMASSE (2004). *Report on strengthening of Science and Mathematics in Secondary School Education*, Vol. I.

Too, J. K. (2004). *Towards effective mathematics instruction: A classroom study of questioning, task supervision and learning activity in Secondary Schools in North Rift Valley Province, Kenya*. Unpublished D.Phil Thesis, Moi University: Eldoret.

Wasike, D. W. (2003). *Effects of a socialized mathematical languages module on students' understanding of mathematics and their perception of the learning environment: a case of form two students of Bungoma District, Kenya*. Unpublished Thesis, Egerton University: Nakuru.

Yara, P. O., and Otieno, K. O. (2010). Teaching/Learning Resources and Academic Performance in Mathematics in Secondary Schools in Bondo District of Kenya, *Asian Social Science*, 6(12), 126-132.

Advised by Raffaele Pisano, European Society for the History of Science, Italy

Received: *April 23, 2011* Accepted: *May 26, 2011*

Maurice Musasia Amadalo	PhD, Physics Education, Senior Lecturer and Chairman, Science and Mathematics Education Department, Masinde Muliro University of Science and Technology, P.O BOX 190-50100, Kakamega, Kenya. E-mail: mmamadalo@yahoo.com Website: http://www.mmust.ac.ke
Duncan Wekesa Wasike	Med, Mathematics Education, Lecturer, Science and Mathematics Education Department, Masinde Muliro University of Science and Technology, P.O BOX 190-50100, Kakamega, Kenya. Email: duncanwasike@yahoo.com Website: http://www.mmust.ac.ke
Joseph Mulei Wambua	MSc, Mathematics Education, High School Teacher, Katulani Secondary School, P. O. Box 425, Kitui, 90200 Kenya. E-mail: jmwambua@yahoo.com Website: http://www.mmust.ac.ke