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Effects of Teaching through Problem - Solving on Students' Performance in Mathematics in Secondary School in Murang'a County, Kenya

John G. Kigamba, Dr. Benson Njoroge Wanjiru and Dr. Miheso-O'Connor Marguerite

ABSTRACT: *Students' weak curriculum outcomes in Mathematics at National examinations of secondary school education have been of concern to primary and secondary stakeholders. The concern was that results determines student's participation in science oriented programmes at tertiary level. Many interventions have been put in place to avoid the effects but poor performance persisted. Science programmes support Kenya development agenda as described in the current vision 2030 including social, economic, political technological and industrial development. The study examined effect of teaching through problem – solvingon students' achievements in Mathematics in secondary schools in Murang'a County, Kenya. This County is oneof 47 counties, but it was favoured because of climatic condition and assessable roads to schools. The study investigated students' performance in Mathematics for those taught using problem - solving strategies with those taught using conventional strategies. The study employed quasi – experimental design using Solomon Four Group model. The accessible form three target population was 28485 students in 340 secondary schools in Murang'a County. These schools were purposely stratified into four categories according to their performance in national examination past four years. Four schools from each stratum were randomly distributed into four groups. Two groups E1 and E2 were assigned as experimental groups whereas other two C1 and C2 as control groups. A total of 16 schools: 8 schools experimental and 8 schools control. Sample size of 544 students and 16 teachers were involved in the study. Pretest and posttest Students' Mathematics achievement Questionnaire were constructed by national examiners and moderated by senior examiners not in sampled schools. Eight schools participated in pre-test in E1 and C1 and all 16 schools received post- test Mathematics achievements testsafter intervention. In order to establish significance means difference between students taught through problem – solving and those taught through conventional strategies paired t –tests and Cohen's d effect measure were used. Problem – solving method improved students' performance and teachers should embrace facilitating Mathematics in an environment contributing to better achievement.*

Keywords: *Mathematics achievement; Problem Solving; performance;*

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I. Background to the Study

Mathematics instruction and learning involves the learner, teacher and the society. In order to achieve the intended aims and goals, the three must be involved (Lesh & Zawajewki, 2007). This study involved learners and teachers through problem – solving to obtain meaningful solutions to mathematical problems. The learner was involved directly in solving real life problems. This was done using problem - solving strategies in specified learning conditions in secondary schools. These conditions provided different learning situations under controlled classrooms. The core target of high quality Mathematics education is development of problem - solving abilities (Hull, Balka & Miles, 2011).

Mathematics skills could be effectively passed through concentrated Mathematics instructional teaching strategies which promote learners retention and understanding. Therefore, in this study focused on effects of teaching through problem - solving strategy on students Mathematics achievement in secondary schools of Murang'a County, Kenya. This study weighed the importance on teaching Mathematics in context of problem - solving and enquiry - oriented environments in which was characterized by teacher "helping students to construct mathematical ideas while given profound opportunity in learning process" (Lester, Masingila, Mau, & Raymond, 1994).

This study involved learners in organized groups to face the challenges of learning Mathematics in secondary schools. Students who were weak found it significantly difficult, although normal rationalization is usually associated with poor Mathematics abilities. Their difficulties included basic Mathematics facts, reading and interpreting problems. The study was carried out in order to determine whether using problem – solving approach in learningand teaching Mathematics in secondary schools of Murang'a County has any effects on

students' achievement. These provided learners with an opportunity to be creative, investigate and explore the solutions to unfamiliar problems. The learners worked in collaboration in small groups learning through plenty of discussion, solving problems in untried situations which were encouraged through problem - solving instructional strategy. Despite efforts by stakeholders in Murang'a County their concern of Mathematics achievement have been on plummeting.

II. Literature Review

Problem – solving strategy as goal of learning Mathematics had been justified by a number of educational theories learning. These contribute to improving students' achievement in Mathematics. This study used three main theoretical literature review social constructivism, problem – solving and production theory. Constructivism is carefully planned to be a philosophical viewpoint about the nature of facts which are an epistemological bearing as advocated by Piaget, Bruner and Vygotsky (McLeod& Adams, 2015). Problem – solving is measured to be higher order cognitive process and intellectual function. These theories were improved by Polya model in problem - solving. The production theory relates social constructivism and problem – solving to make the required achievement on students.

Historically problem – solving has been the heart of educational objectives in which parents and teachers expect to achieve from their students as they shape capability in problem – solving for future generation (Saeed, Shahvarani & Behzadi, 2012). In the contemporary educational systems, teachers are expected to facilitate process of learning in which students are responsible and self-directed to solve Mathematics problems. Student have reproduced standard solutions or techniques provided by their textbooks. Minimum time was dedicated to teaching learners how to carry out investigative process.

In Malaysia, students' performances at secondary school level of education remained very low and continued to decrease. Mathematics achievement test in TIMSS in 2012 clearly indicates how well students in Singapore have done. The poor Mathematics performance of the students becomes a major concern among Malaysian educational stakeholders. This brings about the need for the government to look at the policy for teaching Mathematics. This policy was then commenced and takes up properly after a period of five years in the level of education.

According to Singer and Voica (2013), in life, everyday peoplesolve common problems in order to satisfy their various needs. Problem - solving is a long – life process which is practised in and out of school.Miheso-O'Connor (2009) noted that students in Kenya are engaged in activities of demonstrated algorithm by their teachers in a procedural level which does not assist students' development of conceptual understanding.

The foundation of all sciences and technology is Mathematics whose functional role affects society in sciences, technology and business enterprises. The teaching of Mathematics in classroom is contributing factor to good performance of students in Mathematics. Therefore, teaching Mathematics remains significant challenge which could be addressed by learning through problem – solving to improve students achievement in Mathematics. Secondary schools Mathematics students in Murang'a County had been performing poorly at KCSE. The students Mathematics results for 2017 has 28.7% of the candidates scored grade C- and above, indicating that over 70% of students scored D+ and below. This shows that most students in Murang'a County had challenge in pursuing programmes which comprising science orientation at higher education and tertiary level (KCSE Examination Report, 2018).

Problem – solving being critical component of comprehensive 21st Century Mathematics education since it invokes key skills in the present day's students as critical thinkers and problem solvers to achieve SDG (Lawson, 2016). Mathematics forms the basis of our decision making in many disciplines in our lives. Therefore, learning and facilitation in Mathematics constitute the heart of education. Learning Mathematics aims to link school to everyday life giving skills required. Students acquired necessary techniques for workforce needed in fostering Mathematical thinking (Suurtamm, Quigley, & Lazarus, 2015). Mathematics involves learning how to solve problems. The mathematical investigation and presenting concepts in good communication of discovered concepts and ideas making connections to daily basis on contemporary life.

This study focused on providing background that engage in an important recreation role to effect teaching Mathematics through problem – solving approach to improve achievement in Mathematics in secondary schools in Murang'a County. The idea of improving students' Mathematics achievement became driving force for this study to be undertaken to fill this gap. This research has shown that learners enhanced their content transfer and improved their achievement through learning through problem – solving.

This study applied Vygotsky's socio-cultural theory which describe human learning as a social process helping the young mathematicians to apply human intelligence in Mathematics cultural society (Vygotsky, 1978). In constructivist classroom, teachers focus on moving learning from teachers' centredness support to students' centredness relationships. Teacher no longer an "expert" who pours knowledge into passive students in classroom but director allowing students contributes to learning. The students however should not wait like

empty vessels to be filled. According toVygotsky's constructivist model, students have strong desire to be actively involved in process of Mathematics learning through problem – solving (Doolittle & Hicks, 2001). The learning becomes interesting for the student. This in turn causes students to change their attitude towards Mathematics. Students become more attentive, eager; think independently to discover Mathematics themselves through Mathematics constructivism (Kaur & Yeap, 2009).

The constructivist classroom environment is a place where both teachers and students contribute in knowledge development. Problem – solving in Mathematics causes dynamic of ever-changing real worldview to develop ability to solve problems successfully. These will stretch inactive individual learners who wait to be drilled and memorize facts to active participants in learning. To execute the mandate of problem – solving, it takes to consideration what student currently believes and experienced with correct or incorrect solutions. The special consideration for this question gives the student an opportunity to make directly and decisively independent decisions on Mathematics learning which bears fruitful results on Mathematics achievement (Acosta –Tello, 2010). Literature review for a paper should not exceed a page. Remove all unwanted information though I see some content that should have been put inthe background as you unravel your study

III. Objectives

The study was guided by following objective to compare students' performance on Mathematics for those taught using problem - solving strategies with those taught using conventional methods in secondary schools in Murang'a County. To establish the significance of the study investigated the difference between students taught through problem – solving and those taught using conventional approach. Problem – solving approach used in this study applying constructivism where students construct knowledge through their experiences.

IV. Research Methodology and Design

The preciselymethodology was applied in this research study wasquasi – experimentalrespond to research hypotheses.The effects of independent variables used in class were moderated by intervening dependent variables.Solomon Four Group design was preferred by researcher to overcome the problem of pretest sensititation while maintaining the benefits associated with conducting pretest. It also avoids difficulties connected with the posttest. The design achieves this objective by random assigning participants groups to either receive or not receive pretest. Then randomly allocating these two factors of treatment and pretest where four conditions were created (Crano, Brewer and Lac, 2014). Therefore, two control and two experimental groups were created to reduce influence of confounding variables. This accomplished by randomly giving four schools per category to two experimental and two control groups.

The category of schools was stratified depending on their four previous years KCSE performances. The stratification was necessary because in Kenya after primary school students are admitted into four category of schools National, Extra- county, County and Sub –county school depending on their performance although their performances varied. The design allow the researcher establish that whether pretest itself has effect on participants before treatment commenced. The study checkedwhether there was significant effect on student achievement scores when problem – solving used comparing the scores of control groups and experimental groups after treatment. One of the treatment groups and one of the controls received pretest. The influence of the pretest by contrasting differences in posttest scores between both groups that received the educational treatment.Form three class was used in this study since they had been in secondary school for a reasonable period.

The data analysis addressedthehypothesis (Creswell, 2014). The statisticaldata collected is presented in tablesandanalysed using descriptive and inferential statistics. The Analysis of Variance ANOVA was used to test hypotheses on performance in post - test achievement test and t –test was used for pre - test. The reason for using the F – test is that the four means obtained during post - test can be compared simultaneously. The analysed students' responses for both descriptive and inferential data at significance level set at $\alpha < 0.05$. The effect sizes value was interpreted using Cohen's (1988) categorization of effect sizes.

V. Research Findings

The objective compared students' performance on Mathematics those taught using problem - solving strategies with those taught using conventional methods in secondary schools in Murang'a County.

This examined the hypothesis that there was no statistically significant difference between means of students' scores in the control group who were taught using conventional methods and those taught through problem – solving strategy in experimental group in pre – test and post – test achievements scores.

The conceptual and cognitive growths in Mathematics weredetermined by achievement test complying with pre-test and post-test questionnaires. Students'were expected to learn Mathematics through problem - solving strategy while others through conventional strategies. This study established that the students'

conceptual understanding was developed better using problem – solving rather than procedural knowledge using conventional methods in secondary schools in Murang'a County.

Solomon four group design used revealed that various combinations of tested and untested groups with treatment and control groups' results are weighed against each other. These allowed the investigationdeal with extraneous factors that may have or have not influenced the results. E1, C1, E2, and C2 are exactly the same in all four categories according to their previous national examination. They were drawn from four similar schools with the same standards. These can only be done by stating sub – hypothesis regarding performance of assorted permutations.

The first sub - hypothesis that there was no significant difference on Mathematics achievement (performance) pre – test mean scores between of experimental group E1 and control group C1.

This study used accessible population of Form three students since they had already learnt Mathematics in Form one and two secondary school. Pre –test and post – test items were drawn included these levels. Most teachers continued longing for better Mathematics achievement for their students. There was evidence of weak Mathematics performance using previous years Kenya National Examination Council results. The pre – test measured whether students were at same level in their categories and groups. The effects determined in following tables affirmed the second objective and hypothesis on students Mathematics performance.

The pre-test involved experimental, E1 and control, C1 groups. The results of pre – test performance per stratum are shown in table 1.

Table 1: Pre – test Performance per Category Experimental and Control

Category	No of respondents	Mean	Standard deviation	No of respondent	Mean	Standard deviation
A	33	54.67	6.79	45	50.44	8.79
B	35	44.94	11.09	35	42.57	10.74
C	40	28.75	13.36	40	30.48	7.71
D	20	25.55	15.15	27	14.70	9.65
Combined	**128**	**39.36**	**16.39**	**147**	**36.57**	**15.79**

Source: Murang'a County Field data, 2018

Table 1made known that there was nodifference in mean scores between group except from the categories which were due to entry point at secondary school from primary schools for instance comparing categories A and D. The categories A, B, C and D pre – test had Cohen's d 0.54, -0.22, -0.16 and 0.80 effect shows that were moderate, near zero and moderate shows no significant mean difference during the pre – test. The objective was to determine the role played by problem - solving approach on student achievement scores at secondary schools in Murang'a County before treatment. The two groups participating during pre – test were Experimental group (E1) and Control group (C1) conducted before commencement of treatment to E1 and E2. The resultsonstudents' performance of combinedexperimental E1 and control C1groups'pre – testswere recorded in table 2.

Table 2: Students Pre – test Performance per Group

Combined group	NUMBER	MEAN	VAR	STDEV	Standard error	95% Confidence	T–value
E1	128	39.36	268.66	16.39	1.454	36.52 - 42.20	0.174
C1	147	36.57	249.22	15.79	1.307	43.02 - 39.12	
Combined	**275**	**37.87**	**259.26**	**16.01**	**0.969**	**35.97 - 39.77**	
Difference		2.79					

Source: Murang'a County Field study, 2018
VAR: Variance
STDEV: Standard Deviation

Table 2;show that students from experimental group E1 performed slightly better than students from control groups C1 in the pre-test Mathematics performance.This was affected by the mean score of schools in category D, since mean is usually affected by extreme values.

The hypothesis tested that there is no significant difference in mean scores between achievement of control, C1 and experimental group, E1 in pretest.

Table2, revealedthat independent statisticalt-test was insignificant difference in the mean scores of pre-test for the experimental (E1) and control groups (C1) at $t(274) = 0.174$, $p = 0.1528$ at $\alpha = 0.05$ where $p < 0.05$. This clearly indicated that students' performance in pre - test was similar and their level of understanding in problem - solving is the same.Table2, also illustrated that there was no significant means difference between control and experimental groups. The mean difference was statistically insignificant at $\alpha = 0.05$ as $t = 0.174$ with small effect size of $d_s = 0.17$ from Cohen's power test interpretation. This confirmed that the two groups were of the same strength in terms of Mathematics achievement test before intervention was initiated.

The hypothesis which stated that there was no significant difference in mean scores on effects in students' performance onthose taught using problem - solving approach and others taught using convention method was retained. This finding agrees with Njoroge & Githua (2013) who in their study found that there was no statistical significance between experimental and control groups' difference in pre - test Mathematics Achievement Test before commencement of the intervention on cooperative learning strategy.

Treatmentcommencedon experimental groups E1 and E2, where students were taught using problem - solving whereas control groups C1 and C2 taught using conventional methods. The questionnaire forpost - test was administered to participants in their respective schools in all categories after intervention. The post-test was containing composed twenty items which were based on similar topics as in the pre –test. The subject matter involved were discussed during intervention applying problem – solving and conventional methods.

Table 3, has shown that Mathematics achievement of combined experimental group performed better than control group in post-test. The data in table 1 and 2 revealed that there was significant means difference between both experimental groups E1 and E2 and both control groups C1 and C2. Table 3 presents combined data both combined experimental and control groups.Table 3 shows that control groups C1 and C2 have t - value 1.775 which is less than critical 1.96 at 95% confidence interval. As t – score is within this value, there is nothing to suggest there is any difference between the two means and the hypothesis is accepted.

Table 3: Mathematics Achievement Post–Test for Combined Experimental and Control Groups

Variables	No of respondents	Mean score	Standard deviation	Standard error	95% confidence interval	
					Lower	Upper
Post – test E1	128	48.91	15.42	1.368	46.24	51.58
Post – test E2	126	45.80	14.24	1.274	43.31	48.29
Combined	**254**	**47.37**	**14.90**	**0.937**	**45.54**	**49.20**
Difference		**3.11**			**-2.46**	**2.70**
Post –test C1	147	38.15	16.26	1.346	35.52	40.78
Post – test C2	143	34.92	14.53	1.219	32.54	37.30
Combined	**290**	**36.56**	**15.49**	**0.911**	**34.48**	**38.04**
Difference		**3.23**			**-2.42**	**2.59**

Source: Murang'a County Field data, 2018

Table 3 indicates difference between mean scores of the experimental groups E1 and E2 and control groups C1 and C2 with intention of showing post – test was found to be significant at 0.05 levels. When the two experimental E1 and E2 combined and two control C1 and C2 combined yielded Cohen's d 0.71 which had moderate positive effect. Hence,

Null hypothesis there is no significant difference the mean scores of experimental group and control group on post –test was rejected.

This study focused on providing background that engage in an important recreation role to effect on teaching Mathematics through problem – solving approach to improve achievement in Mathematics in secondary schools in Murang'a County. The idea of improving students' Mathematics achievement became driving force for this study was undertaken to fill this gap. This research has shown that learners enhanced their content transfer and improved their achievement through learning through problem – solving. The students taught using problem – solving had better achievement than those taught using conventional methods. These indicated that the intervention had significant effect on the Mathematics performance. The implication was that when learning Mathematics through problem - solving strategies, students' performance had significant effect.

Students' Mathematics achievement was enhancedin each category during post – test as shown in Table 4

Table 4: Post – Test Performance per Category

	Experimental E1 and E2 combined				**Control C1 and C2 combined**			
Category	**NO.**	**Mean**	**STDEV**	**C.I.**	**NO**	**Mean**	**STDEV**	**C.I**
A	66	61.14	8.66	59.05-63.23	90	46.60	11.2	44.29-48.91
B	62	54.46	9.58	52.07- 56.84	61	43.31	9.53	40.92– 45.70
C	72	38.42	9.64	36.19- 40.65	77	31.63	10.87	29.20–34. 06
D	54	34.32	14.14	30.55- 38.09	62	28.67	12.32	15.60 -21. 74
Combined	**254**	**47.37**	**14.90**	**45.54- 49.20**	**290**	**36.56**	**15.49**	**34.78– 38.34**

Source: Murang'a County Field data, 2018

Table 4 has shown that students' who were presumed to be of low ability, the study shows that there were significant gains in Mathematics achievement after intervention of E1 & E2. The control groups C1 & C2 did not improve in the Mathematics achievement. The effect size is Cohen's d is 0.71 which was moderate positive effect in combined groups. The slight difference between E1 post - test and E2 post - test category of

secondary schools explains effect that pre - test has had upon treatment. Further, it shows there was statistical mean score differences between the experimental groups E1 and E2 control groups C1 and C2. The evidence was enough to accept the null hypothesis that the mean scores between control groups and experimental groups were significant.

There was no significant difference between performance experimental category groups E1 and E2 although E1 did pre - test. Similarly, determined that there was no significant difference between categorycontrol groups C1 and C2 without any effect of pre – test. The study found that classrooms community and culture promote students Mathematics achievement in all types of schools. The findings conclude that there is significant improvement in Mathematics achievement between those students who used problem - solving and those students who used conventional strategies. The decision of comparing means scores of experimental and control group proved the supremacy of problem – solving over conventional methods. These demonstrated success of application to problem – solving in pedagogical skills of teaching Mathematics.

The research finding results of all four groups are shown by Table 5 post - test performance per group.

Table 4: Post – Test Performance per Group

Combined group	Number	Mean	Standard deviation	Standard error	95% C -I	T –value
E1	128	48.91	15.42	1.368	46.24-51.58	
C1	147	38.15	16.26	1.346	35.52-40.78	
E2	126	45.80	14.24	1.274	43.31-48.29	
C2	143	34.92	14.53	1.219	32.54-37.30	
Total	**544**					

Source: Murang'a County Field data, 2018

Table 5, have shown ANOVA hypothesis testing is applied revealed that the tabulated values in ANOVA. These results were analysed using ANOVA to investigating null hypothesis.

Hypothesis isthat there is no statistically significant difference between means of post - test scores on students' achievement in Mathematics while taught through problem – solving strategy to experimental group againstthosein control group taught using conventional methods.

The hypothesis tested was insignificant differences between post - test experimental groups mean scores and the post - test control groups mean scores, with($t = 1.967$) and ($t = 1.96$) and small effect size of $f = 0.18$. The post - test items develop on higher order thinking skills that required students to reason before applying procedure for getting solutions. The assessment involving synthesis and evaluation levels asclassifiedby Blooms (1956) taxonomy of cognitive objectives categorization. This shows that a problem – solving strategies Mathematics teaching and learning can assist students to reason and help them to develop creative and critical thinking.This improves students Mathematics understanding of concepts, hence achieve better performance.

Students' achievements significantly improved when teachers were aware of how to help students construct knowledge applying problem – solving in Mathematics. Students' understanding of unfamiliar situations was overcome through intuitive solution methods students' usedwhen they solving problems. Teachers utilized knowledge of classroom environment when planning and conducting instruction in Mathematics allowing students' collaborative interactions.

Table 6 gives the result of the ANOVA of the means difference in the post - test scores.

Table 5: ANOVA Post – test Performance on Four Group Means Difference

	Number	Mean	Variance	Between groups	Within groups
E1	128	48.91	237.72	583.17	229.82
C1	147	38.15	264.39		
E2	126	45.80	202.80		
C2	143	34.92	211.03		
Combined	544	41.95			

Source: Murang'a County Field data, 2018

S_B^2: The between group Variations

S_W^2: The Within group Variations

Table 6, demonstrated that there were significant mean differences in the student performance in post - test between four groups. The null hypothesis was then concluded.

The test hypothesis states that, there were no statistically significant differences between means on students achievement in Mathematics in secondary schools of Murang'a County to those taught through problem - solving approach and those taught using conventional strategies in post -test.

Analysis of variance (ANOVA) carried out on post - test scores on students Mathematics achievement. $F(540) = 2.537$, $p = 0.01$, $\alpha = 0.05$ where $p<0.05$. The study concluded that problem - solvingemployed inlearning Mathematics increasesstudents'achievement (performance) rather than instructing through conventional approach. Therefore, hypothesis which was statedstudents'performance in Mathematics when taught using problem - solving approachis better than those taught using conventional strategies during post - test in secondary schools in Murang'a County.

This was a quasi – experimental involving social interaction process developed to effect the change in performance and attitude of the learners. The Scheffe' post hoc test was done since the researcher was interested in the mean difference between experimental and control groups irrespective of pretest experience. The test compares two means at a time using possible combinatorial of means. The critical value F' = 12.84 for F (3, 540) compares with E1 versus E2 = 2.672 and C1 versus C2 = 3.29 revealed that experimental and control groups themselves have no significant difference. The combinations E1 versus C1 = 34.47, E1 versus C2 = 57.52,E2 versus C1 = 17.78, andE2 versus C2 = 35.20 which are greater critical value F'. The conclusion that there are significant differences in performance of experimental and control groups showing that intervention on teaching using problem – solving.

Therefore, hypothesis was rejected since this result was statistically significant. There is enough evidence to reject the claim since the groups which received pre – test and those given post – test only shows that intervention had been effective. The acceptance that teaching through problem – solving improves student Mathematics achievement have the different opinion with Kirtikar (2013) who reacted on the criticism that conventional teaching trigger critical thinking in class discussion. The cognitive skills and holistic learning environment for students through problem – solving could be encouraged in secondary schools Mathematics teaching in Murang'a County. This study had given an idea that teaching Mathematics through problem - solving developed better Mathematics achievement.

This study supported knowledge of social constructivism theory where students constructed knowledge in their classroom experiences rather than absorbing what they were told. The constructivist views the student as an active learner who in the process of struggling with a problem obtains a solution. The learner usually get deep understanding of Mathematics concepts since problem – solving provides an opportunity to students to explore ideas and given a chance to extend their creativity.This study complete the gap that using problem – solving strategies improvesstudents achievement in Mathematics rather than integrated conventional strategies in view of the fact that it becomes learner – centred rather than teacher – centred.

The mathematical modeling approach as the effective strategy for educating and learning Mathematics.This study used the language to help the student to be able to interpret the Mathematics problem and make meaningful way to device the plan to solve it.The teacher role changes from designing and selecting problems to be used for instructions to a guider and a participant in a classroom environment. This is new pedagogical trends in 21st century Mathematics teaching should involve integrating problem - solving for competency in the classroom. Beyond promoting Mathematics problem – solving, it fosters development of valued life skills and disposition goals important for students' long life learners. This means that students do not only use Mathematics for academic purposes, but also as future adults who can take part in challenging ventures. The teachers who participated in intervention noted that engaging students in problem - solving activities improves student perseverance, independence, critical thinking skills and general communication. There is more information listed here than is necessary.

VI. Limitations and Future Research

The main limitation of this study was provision of classroom environment and human resource to effectively apply problem – solving strategies in teaching Mathematics. The teachers in experimental groups were encouraged to provide learning environmental using real world materials to assist learners to create and enjoy Mathematics.

Study recommended that teachers provide students with opportunities to interact in a favourable rich environment to solve problems. Students actively participate to finding individualized solutions applying problem – solving strategies. This happens when teachers encourage and give opportunities students to share and compare their answers. Students further contrast their methods is general idea of this research where problem – solving involves individual solution with activities in small groups and whole class. This is enhanced through classroom interaction and creating class communication providing students with confidence in problem – solving. This increases student Mathematics achievement through problem – solving activities through problems and assignments.

VII. Conclusion

The study used problem – solvingStudents are actively involved increasing enjoyment and social skills in communication. Problem – solving provided an opportunity for young mathematician to explore ideas to improve their achievement. This approach was an effective instructional strategy to improve students Mathematics achievement. This was done by providing students appropriate opportunities to be engaged freely in problem – solving activities. The study has shown that a general problem - solving strategy has been successful in secondary schools practice even in all categories.The students develop a habit of mint to support ones' idea or request the opinion of another. This implies that they develop logical thinking, not restricted to Mathematics, but have willingness to have a dialogue. Teachers also noted that problem solving has influence in social relations. The classroom is a Mathematics community whose impact of social dynamics in their trust that they could figure out things themselves or that they could use their peers as resources (Wathall, 2016).

The study adds to the literature of learning of Mathematics through problem - solving activities. These activities were done in an environment encouraging students to interact freely and discover concepts themselves. This improved conceptual growth, attitude change, build confidence and create a community of young Mathematicians who care for each other. The current study did detest that problem - solving is desired teaching approach preferred rather conventional strategies.This study differs from other researches by encouraging the teacher to apply constant interventions to direct students to the critical thinking. This was aligned to 21st century pedagogical trends in teaching Mathematics through integrating problem –solving for competency in the classroom (Wathall, 2016).

Concluded that developed, planned and executed problem - solving instruction can significantly improve students' achievement in Mathematics in secondary schools. Mathematics can effectively be instructed applying problem - solving strategies to promote Students' interest towards Mathematics. This could be done by fully prepared lesson using problem - solving strategy which more of student - centred rather than teacher - centred. The teacher through planned intervention that involve students in problem –solving student develop perseverance, independence, thinking skills, general communication and support others ideas helping them to be social. These skills are life skills through which assist them to take part in challenging ventures.

VIII. Recommendations

Mathematics teachers should embrace teaching using problem - solving method to improve the academic achievements on students in secondary schools. To achieve this government through Kenya institute of curriculum development (KICD) should transform the current textbooks of Mathematics in conventional based learning to problem - solving. Therefore the existing curriculum should be improved to including more problems – solving rather than conventional methods.

The Mathematics teachers training institution should be preparestudent to using problem – solving learning approach. This would build the student teachers confidence in applying the problem - solving strategies in their classrooms. Government through KICD develop curriculum which is problem – solving oriented in order to improve students achievement in Mathematics in secondary schools. This will includeextensive training program, seminars and workshops to be organized for Mathematics teachers in secondary schools to enable employ problem - solving method in the classrooms.

The government has task that training of Mathematics teachers who would use problem – solving approach to improve Mathematics achievement in secondary schools. Government also must provide the incentive that attract and retain competent, fully prepared qualified teachers. The schools should assure Mathematics teachers a good classroom environment and conditions to effective teaching including a reasonable class size. The teacher – educators should put emphasis on teacher preparation using problem – solving so that processes and essential content of Mathematics is fully integrated. The learning activities involving teachers' trainee allow them opportunities to form connections between procedures and outcomes of problem – solving.

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