REVIEWED JOURNAL® of Education Practice [ISSN 2663-127X]

Vol. 4, Iss. 1 (2023), pp 145 – 157, August 31, 2023. www.reviewedjournals.com, ©Reviewed Journals

UTILIZATION OF COMMUNITY RESOURCES IN TEACHING AND IT'S IMPACT ON ACQUISITION OF TRIGONOMETRIC SKILLS IN PUBLIC SECONDARY SCHOOLS: KITUI COUNTY, KENYA

[1*] Peter Mulwa Muthangya, [2] Dr. Florence K. Nyamu, & [2] Dr. David W. Khatete

[1*] Masters Student (Mathematics Education), Kenyatta University, Kenya
[2] Lecturers, Department of Educational Communication and Technology, Kenyatta University, Kenya

Accepted: August 22, 2023

ABSTRACT

This study investigated the utilization of community resources in teaching and its impact on acquisition of trigonometric skills in public secondary schools in Kitui County, Kenya. Bruner's theory of constructivism constituted the theoretical framework for the study. The study adopted a quasi-experimental research design. The study targeted a total of 4,847 respondents comprising 203 teachers of Mathematics and 4,644 form three students from 49 secondary schools in Mwingi Central Sub-County. Stratified and simple random sampling techniques were used to select 485 respondents for the study. The study used questionnaires to collect quantitative data from teachers of Mathematics whereas pre-test and post-test examinations were used to collect data from the students. A pilot study was conducted in three (3) public secondary schools in Mwingi Central Sub-County. Statistical Package for Social Sciences (SPSS) version 22.0 facilitated the analysis of quantitative data. Descriptive statistics such as frequencies, percentages, means and standard deviation were used to analyze quantitative data. Findings of the study showed that most teachers of Mathematics utilized community resources at least once per month in teaching trigonometric concepts in public secondary schools in Kitui County. The community resources frequently utilized by teachers of Mathematics to a great extent in teaching trigonometry included trees, buildings, rivers and community resource centers. The study revealed that a significant difference existed in the level of performance between students exposed to the utilization of community resources and those taught using the conventional methods. The study found that most teachers of Mathematics indicated that students accessed community resources mostly through field trips, nearby shops and factories. The study revealed that most teachers of Mathematics agreed that exposure of students to environment improves their mastery of trigonometric skills and that resources in the schools' locality can help students acquire trigonometric skills. From the findings it was concluded that utilization of community resources enhanced the acquisition of trigonometric skills among students in public secondary schools. The study recommended that Heads of Departments of Mathematics should ensure that teachers of Mathematics utilize community resources in the teaching of trigonometry. All teachers of Mathematics should have practical lessons every week where students are taken outside the school compound to study Mathematics using the community resources available.

***Key Words**: Community Resources, Trigonometric Skills, Mathematics*

CITATION: Muthangya P. M., Nyamu F. K., & Khatete D. W. (2023). Utilization of community resources in teaching and it's impact on acquisition of trigonometric skills in Public Secondary Schools: Kitui County, Kenya. *Reviewed Journal of Education Practice*, 4 (1), 145 – 157.

INTRODUCTION

Trigonometry is a branch of Mathematics that deals with the understanding of concepts and their applications. Its content areas include angles, measurement of angles and their relationships (Rizkianto, Zulkardi, & Darmawijaya, 2013. Trigonometry topics are very important in Mathematics education as trigonometric functions have many applications in fields such as advance physics, mechanical and electrical engineering, music, astronomy and biology as well as exposure to real- world applications of Mathematics and science. It helps students to see value in pursuing STEM-related education (Kesidou & Koppal, 2004; Raju, Sankar & Cook, 2004; Swift & Watkins, 2004). Understanding trigonometric concepts is a requirement for advanced studies in survey, physics, architecture, and other branches of engineering. Similarly, understanding trigonometry serves as a tool for enhancing students' cognitive skills and provides a framework for coordinating concepts such as angles, measurement of angles and lengths, shapes and similarity, vectors, polar coordinates and parametric curves. Trigonometry in the curriculum is therefore a fitting ground for exploring, connecting and relating mathematical ideas, and for meaningful combination of different scientific disciplines.

Studies indicate that acquisition of trigonometric skills depends on utilization of community resources. Whittich (2007) defines community resources as various learning situations through which pupils come into first hand contact with people, places and all things around them. It includes visiting organizations, institutions and neighborhoods or regions of the community, interviewing public officials and community leaders. The study conceptualized community resources to include trees, buildings, rivers, resource centres and resource persons. According to White (2009), community resources bring out realism and they apply the new knowledge and skill to previous learning. This helps create a restructuring of thought. On the other hand, the study defined trigonometry as the area that studies relationships between sides and angles of triangles (Becerra, 2018). Acquisition of trigonometric skills was thus measured by the performance of students in Mathematics.

Effect of various community resources on the acquisition of trigonometric skills by students remains a concern to the educators and researchers in the world as well as Kenya. Studies indicate that General concern about achievement in trigonometric skills aided by the available resources within a given community has been evident for the last 12 years. Scholars today argue that the students should learn to use the environment so as to be successful in Mathematics. The discussion emphasizes new instructional design techniques to produce individuals who can understand and apply fundamental trigonometric skills. A critical and persisting issue is how to identify and make use of various community resources that would aid the achievement of the learning goals for students with different skill and ability levels (Romberg, 2003). This study recommended that innovative instructional approaches and techniques need to be developed to ensure that students become successful learners.

Research studies (Weber, 2005; Moore, 2012; Gür, 2009; Cetin, 2015) revealed that students have difficulties in trigonometry. These difficulties emanate from a number of factors including; lack of motivation, abstractness of trigonometric concepts, lack of understanding of fundamental concepts, and students' inability to connect concepts in trigonometry. Several studies have focused on students' perceptions and understanding of trigonometry. For instance, Weber (2005) explored students' understanding of trigonometry, whilst Wongapiwatkul, Laosinchai and Panijpan (2011) investigated factors that enhance students' conceptual understanding of trigonometry using earth geometry and the great circle.

Rasmussen and Marrongelle (2006) conducted a study on influence of community resources on studying sciences and Mathematics in Canada. The study revealed that using community resources in their classes or taking students on field trips was not a new idea for Mathematics teachers. According to the authors, curriculum reform in Science and Mathematics calls for a new look at using Community resources. The study indicated that utilization of community resources enabled students to talk about their experiences and try to relate what they see to what they have learnt in class. Social discourse and direct experience help students to construct an understanding of the phenomenon and bring constructivism to life.

There are a number of studies done in Kenya on this area with an aim of identifying specific resources which would be useful in acquiring trigonometric skills. For example, a study byMbugua, Kibet, Muthaa and Nkonke (2012) indicated that the unavailability of communityresources should not be a limitation to the learning process. The study advises that studentsshould not restrict themselves to science laboratories as the only resources to learnMathematics. On the contrary, they should make use of resources like unconventional sites,such as fabric store, the tile factory or a hardware store, farm, or ranch. Further, the locationof the school should not be a limitation in this very important quest. All the resources in the locality of a School can be put to purposeful use towards sharpening the trigonometricskills of the students.

Statement of the problem

Kenya Institute of Curriculum Development, in their secondary school education syllabus,gives Mathematics topics and suggest practical activities which are done only in the classroom. Further, the syllabus outlines practical activities that play a key role in development of learners' manipulative, observation and acquisition of trigonometric skills.In addition, training module for secondary school Mathematics teachers on inquiry based learning in Mathematics and science (CEMASTEA, 2017), Mathematics teachers have been taken through step by step approach to inquiry based method of teaching and learningof Mathematics. The module places emphasis on practical work in Mathematics by use ofcommunity resources.

Utilization of community resources is recognized as part of the instructional resources while teaching and learning trigonometry in secondary schools in Kenya. These resources have been used with the aim of improving performance in Mathematics especially in the acquisition of trigonometric skills. With the utilization of community resources, students are expected to post good performance in Mathematics in KCSE. However, despite the utilization of these community resources, analysis of performance in Mathematics in KCSE by students is still low especially in trigonometry. This is because topics in trigonometry contributed to an average of 37.5% of all the difficulty questions in both papers encountered by the students in KCSE from 2011-2020 as indicated by KNEC annual reports. At the same time there was evidence of poor performance in KCSE as indicated by the Mathematics mean scores in 2012 and 2013 when the percentage of trigonometric contributed to 26% and 41.5% respectively of the difficult questions. This showed that performance in trigonometric questions at national level by students played an important role in overall performance in Mathematics which meant the role played by trigonometry topics based questions in overall poor grades in Mathematics could not be ignored.

The poor performance is even worse in Mwingi Central Sub-County which has always posted poorest results in Mathematics compared to other sub-Counties in Kitui County. This is despite utilization of community resources by teachers in teaching and learning trigonometry in secondary schools in the sub- County. To address this problem, this studywas therefore designed to investigate utilization of community resources in teaching and its impact on acquisition of trigonometric skills in public secondary schools in Kitui County, Kenya.

Objectives of the Study

The objective of the study was to investigate the utilization of community resources in teaching and its impact on acquisition of trigonometric skills in public secondary schools in Kitui County, Kenya. The specific objectives of the study were:

- To assess statistical relationship between the utilization of community resources and the acquisition of trigonometric skills in secondary schools in Kitui County.
- To analyze the status of utilization of community resources in acquisition of trigonometric skills in secondary schools in Kitui County.
- To explore the underlying potential of community resources in the acquisition of trigonometric skills in secondary schools in Kitui County.

The study was guided by the following research questions

- What is the statistical relationship between the utilization of community resources and the acquisition of trigonometric skills in secondary schools in Kitui County?
- What is the status of utilization of selected community resources in acquisitionof trigonometric skills in secondary schools in Kitui County?
- What is the underlying potential of utilization of community resources in the acquisition of trigonometric skills in secondary schools in Kitui County?

LITERATURE REVIEW

Theoretical framework

This research was guided by Jerome Bruner's theory of constructivism (Bruner, 1966). This is a learning theory that explains how people acquire knowledge and learn. This makesit the most appropriate theory as it has a direct relation to education. This theory proved that based on current and past experiences, people are able to construct new ideas, concepts and knowledge and their various meanings. This experience can be gained by students evenas they interact with the surrounding community resources. This idea makes the trigonometric concepts that are taught in class become more meaningful and more applicable. Bruner's theory of constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements. According to Bruner, this theory presents that learning is anactive process in which learners construct new ideas or concepts based upon their current or past knowledge. The learner selects and transforms information, constructs hypotheses,and makes decisions, relying on a cognitive structure to do so. The study is also based on the theory of social constructivism which emphasizes on collaborative nature of learning. Lev Vygotsky (1978), proved that cognitive functions originate from social interaction; learners are integrated into knowledge of the community they live. The theory further statesthat reality and knowledge is a product of human social and cultural interaction with eachother and the environment.

Conceptual Framework

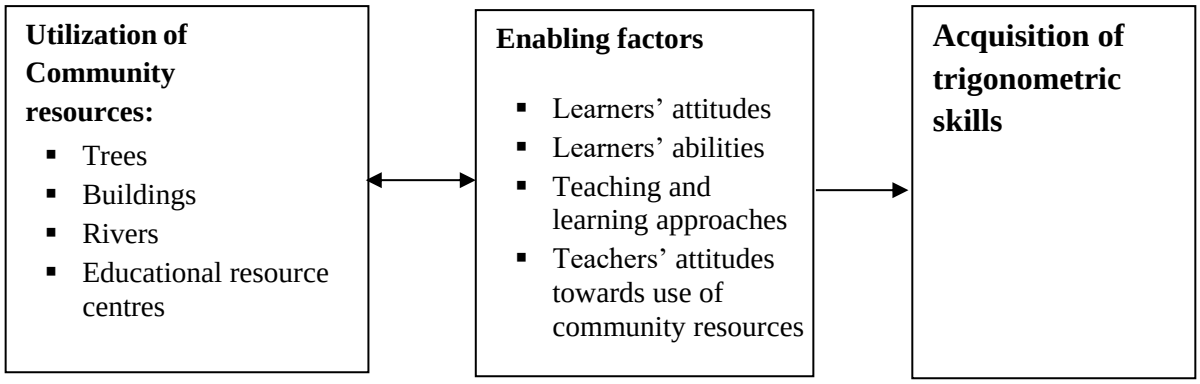

Figure 1: Conceptual Framework

Empirical Review

Relationship between utilization of community resources and the acquisition of trigonometric skills

According to Haan (2002), use of the community resources helps in promoting the problemsolving techniques of the students and also promotes reasoning ability amongst the studentsat the same time. As the students discuss and share perspectives of what they have observed, their shared reasoning helps them to easily solve rather complex problems bothmathematical and real life. It is, therefore, very important that the teacher acts as a guide in helping the students synchronize their arguments to realize the most reasonable solutionin a problem. This further gives meaning to constructivism. Moreover, Taras (2005), viewsthe community as a platform that offers learners opportunities to participate in diverse ranges of physical activities that in turn have positive impact in

acquisition of skills in Mathematics as well as in other subjects learnt in class.

Vivien M. Talisayon, et al (2001) conducted a study in Philippines that proved that emphasis in teaching and learning should be placed on the practical work as opportunitiesof learners to develop their manipulative skills coupled with the hands-on activities whichprovide observable phenomena. The study showed that toys were rich source of teaching and learning trigonometry as they are associated with fun, creativity and discovery and by using them, make the subject more concrete and enjoyable. The study concluded that utilization of community resources improved acquisition of trigonometric skills among students.

Wanza (2008) conducted a study on utilization of community resources on implementationof the Business Studies curriculum in public secondary schools in Machakos, Kenya. Findings of the study revealed that three quarters of the respondents reported that resourceswere available even though they were inadequate. The results further revealed that community resources were not expensive and could be found in the community. The study however did not show the relationship between utilization of these community resources and acquisition of any skills. Further, the study focused on implementation of Business Studies curriculum in Machakos County. This study therefore assessed the relationship between the utilization of community resources and the acquisition of trigonometric skillsin secondary school in Kitui County.

Status of utilization of community resources and acquisition of trigonometric skills

Devine (2008) conducted a study to measure the extent to which using a constraint-based solid modeler during high school Mathematics instruction affects student learning in USA.This study used two intact groups, a control group and an experimental group, to measurethe extent to which using a parametric solid modeler during instruction affects student learning relating to the mathematical principles of areas and volumes of solids. The controlgroup was taught using traditional instructional methods, and the experimental group wastaught using a combination of traditional methods and experimental methods utilizing a constraint-based solid modeler. At various times during each class period, worked throughproblems for the students using a solid modeler. The solid modeling techniques used typically involved creating and constraining a two-dimensional sketch, which was then extruded or revolved to create a solid. Named expressions were used to dimensionally constrain the sketches, with the expression names chosen to match the Mathematics terminology presented in geometry texts. Boolean operations provided opportunities to illustrate the concept of volumetric addition and subtraction. The solids were shaded, rotated, and sometimes sectioned to help the students visualize the shape. When specific information was required for a calculation such as height and diameter of a cylinder, the dimensions were obtained both algebraically and graphically using various measuring functions in the software.

Doiron and Davies (2018) in their study in England on Resource-Based Learning indicatedthat it as an approach that fosters the development of individual students by using the community resources like factories, gardens and town streets as the laboratory of learningand teaching Mathematics. This study revealed that when students visit places like factories, it is not only for the purposes of studies but also an opportunity for excursion. The study concluded that resource-based learning presented best approach that aids skill acquisition in Mathematics. Availability of resources within the learning environment waspresented as an added advantage to the learners who would easily access these resources and incorporate them in their learning process. According to these authors, the communityresource based learning promotes the algebraic skills of the students as it enables them to solve emerging simultaneous problems with more ease. The study also pointed out that the integral aspect of resource-based learning is its flexibility. Students may work alone or cooperatively. They can freely select resources that best suit their learning tasks. The studyfocused on acquisition of algebraic skills in England thus the findings may not begeneralized to acquisition of trigonometric skills in Kenya. The present study therefore established the utilization of selected community resources in teaching and its impact on acquisition of trigonometric skills in Kitui County, Kenya.

Mwangi, Changeiywo and Githua (2018) based their study on constructionist theory of learning to investigate the effects of the use of computer animated techniques on loci duringinstruction on secondary school's students

Mathematics misconceptions in Kitui County, Kenya. Simple random sampling was used to select 207 respondents for the study. A Mathematics Achievement Tests (MAT) adopted from KCSE past Examinations on Loci was used to collect data for the study. Findings of the study revealed that using computerAnimated Loci Technique improves students 'misconception in the topic Loci in particularand Mathematics in general more than when the students are taught using the conventional teaching methods. Even though the study sought to establish the effect of the use of computer animated techniques on loci during instruction, the study failed to show the effect. Further, the study focused on loci and misconception. This study therefore sought to analyze the status of utilization of community resources in acquisition of trigonometricskills in public secondary schools in Kitui County.

Underlying potential of utilization of community resources and acquisition of trigonometric skills

Weber (2005) employed experimental research design to investigate students' understanding of trigonometric functions in the State University of New Jersey, USA. The study revealed that students who received the experimental instruction were able todemonstrate a strong understanding of trigonometric functions. Most of the students wereable to use their understanding of trigonometric functions to recall and derive their properties and justify why they have the properties they do. The interviewed students wereable to articulate the process of computing a sine and were able to use that process to approximate the value of trigonometric expressions. The study concluded that use of community resources provided a shared memory for the class. The event becomes part of the common knowledge of the class and can be referred in subsequent lessons. What is learned is, thus, reinforced and extended in later discussions as the teacher refers to field observations.

Olabode (2013) used historical and descriptive research designs to investigate utilization of community resources for effective sustainability of social studies education in Nigeria. The study revealed that utilization of community resources was a very good means of getting knowledge first hand of confirming and supplementing second hand knowledge. Community resources help in sharpening observation, testing principles and doing everything which social studies requires. Further, the findings indicated that learning becomes more powerful and deeper if students can see continuity from classroom to outdoor experiences, from academic to non-academic domains. It is through this continuityand alignment that helps students to connect and apply their learning across disciplines inand out of the classroom. This conscious effort to help students transfer their knowledge and thinking skills to non-academic contexts is a good way to facilitate transfer learning. This study was done in Nigeria thus the findings may not apply to the context in Kenya. Further, the study focused on social studies therefore the results cannot be generalized to acquisition of trigonometric skills.

The Ministry of Education (2018) conducted a study on improvement of quality of education in secondary schools in Kenya with a special focus on form two students. The study was conducted in sampled schools selected through simple random sampling technique across the country. The findings of the study revealed that almost 90% of form two students did not have minimum competency in trigonometric skills. The study was delimited to educationally and economically disadvantaged areas as well as the poorest andmost vulnerable students in Kenya. The findings of the study may not therefore be generalized to the target population of the current study due to different economic and social status. Additionally, the reviewed study focused on only form two students. The present study therefore targeted form three students and teachers of Mathematics.

METHODOLOGY

The study adopted quasi-experimental research design to investigate the Utilization of community resources in teaching and its impact on acquisition of trigonometric skills in public secondary schools in Kitui County, Kenya. The target populations for the study comprised students in form three and all Mathematics teachers in Mwingi Central Sub- County. Specifically, the studytargeted a total of 4,847 respondents comprising 203 teachers of Mathematics and 4,644 form threes students from 49 secondary schools in Mwingi Central Sub County (RoK, 2021). The study employed two sampling techniques to sample respondents for the study, namely; stratified and simple random sampling techniques. First, stratified sampling technique wasused to categorize the

49 public secondary schools into 3 strata. Second, simple random sampling technique was employed to select teachers of Mathematics from each stratum. The researcher selected a sample size of 485 respondents which represented 10% of the target population. The study used pre-test and post-test examinations to collect data from students whereas questionnaires were used to collect quantitative data from teachers of Mathematics. The researcher used content experts to ensure validity of the questionnaires and pre-test and post- test exams. To ascertain reliability of the instrument, the researcher used Cronbach's Alpha (a) to ensure internal consistency. After the data collection exercise, the researcher checked for the completeness, accuracy and uniformity of the questionnaires from the respondents. Quantitative data was then entered, cleaned and analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0 software. The descriptive statistics mainly frequencies, percentages, means and standard deviations were used to analyze the likert scale data.

FINDINGS

Relationship between utilization of community resources and acquisition oftrigonometric skills

The first objective of the present study was to establish the relationship between utilizationof community resources and the acquisition of trigonometric skills in secondary schools in Kitui County, Kenya.

To achieve this objective, the study used two instruments, namely; Trigonometry Achievement Pre-test (TAP,1) and Trigonometry Achievement Post-test (TAP,2). TAP, 1 was administered to both Control group and Experimental group within one hour. The study had four equivalent control subgroups and four equivalent experimental subgroups. The experimental groups were then exposed to twelve (12), 40-minutes lessons in trigonometry using community resources, whereas the control groups were exposed to thesame content but using conventional methods. Teaching trigonometry took four weeks. After the four weeks, and with help of subject teachers, TAP, 2 which took one hour, wasadministered to both experimental and control groups. The Pre-test mean scores, standarddeviation and t-test for TAP, 1 is presented in Table 1.

Table 1: Pre-Test Mean Scores, Standard Deviations and t-test

Group type	N	Mean	Std Deviation	t-test	
Experimental	232	53.6704	4.3432	t	Sig. (2-tailed)
Control	221	55.7762	5.4047	1.102	.250
Total	453	54.7233	5.374		

The results in Table 1 indicated that the experimental group had a mean score and standarddeviation of 53.67 and 4.34 respectively while the control group had a mean score and standard deviation of 55.78 and 5.40 respectively. Moreover, the findings indicate that theoverall mean score and standard deviation for both the experimental and control group were 54.72 and 5.37 respectively. These results implied that the control group performed slightly better than the experimental group. In an attempt to find out whether the difference in performance between the experimental and control group was significant, the study usedan independent sample t-test at an alpha level of 0.05. Accordingly, the findings show thatp-value of 0.25 was established and indication that there was no significant difference in performance between the experimental and control groups. The groups were therefore comparable and statistically similar thus was suitable for the current study.

TAP,2 was administered after the two groups had been taught using two distinct methods,namely; exposure to selected community resources and the conventional method. The scorefor each student was recorded and the cumulative mean and standard deviation for each group was tabulated. The scores for each group are presented in Table 2.

Table 2: Post-Test Mean Scores, Standard Deviations and t-test

Group type	N	Mean	Std Deviation	t-test	
Experimental	232	68.0733	4.45252	t	Sig. (2-tailed)
Control	221	44.9622	6.42180	20.023	.001
Total	453	56.5178	12.86725		

Table 2. reveals result namely; mean scores, standard deviations and t-test for post-test administered to both groups. Accordingly, the results show that the experimental group had a mean score and standard deviation of 68.07 and 4.45 respectively. On the other hand, the control group had a mean score and standard deviation of 44.96 and 6.42 respectively.These results imply that the experimental group performed better than the control group. The difference in performance could be attributed to the exposure of the experimental group to utilization of community resources. To establish whether there was a difference, a t-test was done at 0.05 significance level. Accordingly, the results in Table 4.3 indicate that t-value of 20.023 was established and a significance of 0.001 which is less than 0.05. These results imply that there is a significant difference in the level of performance between students exposed to community resources and those taught using the conventional methods.Further, the results imply that utilization of community resources enhanced the acquisitionof trigonometric skills. These results agree with Kong and So (2008) who revealed that using the community resources like factories, gardens and town streets as the laboratory oflearning and teaching trigonometry is an added advantage to the learners who would easilyaccess these resources and incorporate them in their learning process.

In addition, the results are in agreement with Haan (2002) who revealed that use of the community resources helps in promoting the problem solving techniques of the students and also promotes reasoning ability amongst the students at the same time. Moreover, thefindings are in line with Taras (2005) whose study revealed that utilization of community resources offers learners opportunities to participate in diverse ranges of physical activitiesthat in turn have positive impact in acquisition of skills in Mathematics as well as in othersubjects learnt in class. Further, Haan (2002) notes that using a school's surroundings andcommunity is a framework within which students can construct their own learning, guidedby Mathematics teachers and administrators using proven educational practices.

Status of utilization of community resources in acquisition of trigonometricskills

The second objective of the study sought to establish the status of utilization of communityresources in acquisition of trigonometric skills in secondary schools in Kitui County, Kenya. "Status of utilization of community resources" in this study implies the frequencyof use or the extent to which community resources are used in teaching and learning. To achieve this objective, the study first sought to establish the frequency of utilizing community resources to acquire trigonometric skills by learners in secondary schools. Forthis objective, questionnaires were administered to Mathematics teachers in order to generate the information. The responses are presented in Table 3.

Table 3: Frequency of utilization of Community Resources

Frequency of use	Frequency	Percent
Daily basis	2	11.8
Twice a week	4	23.5
Once per month	6	35.3
Once per term	5	33.3
Total	**17**	**100.0**

Table 3. shows responses from teachers of Mathematics on frequency of utilization of community resources in teaching trigonometry in public secondary schools in Kitui County.Accordingly, the findings indicate that slightly more than one third (35.3%) of teachers ofMathematics indicated that they utilized community resources once per month. Moreover,one third (33.3%) of the teachers of Mathematics indicated that they utilized community resources once per term. In addition, slightly less than one quarter (23.5%) of the teachers of Mathematics reported that they utilized community resources twice per week. Finally, the findings indicate that only 11.8 % of the teachers of Mathematics indicated that they utilized community resources in teaching trigonometry on a daily basis.

The respondents were further required to indicate the extent to which the students in their Class used community resources using a scale of; 1 – Great Extent, 2- Some Extent, 3- Undecided, 4 – Less Extent, 5 No

Extent. The responses were presented in Table 4.

Table 4: Responses from Mathematics teachers on the extent of utilization of community resources

Community Resource	Great Extent		Some Extent		Undecided		Less Extent		No Extent		Mean	StD. Dev.
	n	%	n	%	n	%	n	%	n	%		
Trees	6	35.3	4	23.5	2	11.8	3	17.6	2	11.8	2.47	1.46
Buildings	4	23.5	5	29.4	4	23.5	3	17.6	1	5.9	2.53	1.23
Rivers	3	17.6	9	52.9	3	17.6	1	5.9	1	5.9	2.29	1.05
EducationalResource centers	8	47.1	3	17.6	1	5.9	4	23.5	1.	5.9	2.24	1.44

Table 4 presented the findings on responses from teachers of Mathematics on the extent of utilization of community resources in acquisition of trigonometric skills. The findings indicate that slightly more than one third (35.3%) of teachers of Mathematics indicated thatthey used trees to a great extent to help students in acquiring trigonometric skills while slightly less than one quarter (23.5%) reported that they used trees to some extent. Moreover, equal numbers (11.8%) of teachers of Mathematics were undecided and did notuse these resources while imparting trigonometric skills to students. The mean and standarddeviation for this item was 2.47 and 1.46 respectively. These findings imply that majorityof Mathematics teachers in Kitui utilize trees to a large extent as resources during teachingand learning of trigonometry in their Mathematics lessons.

As regards utilization of buildings as resources for teaching trigonometry, the findings revealed that slightly more than one quarter (29.4%) of teachers of Mathematics utilized buildings to some extent whereas slightly less than one quarter (23.5%) reported that theyutilized buildings to a great extent. Similarly, the same number (23.5%) of teachers of Mathematics was undecided about utilization of buildings as resources for teaching and learning trigonometry. Moreover, less than one quarter (17.6%) of teachers of Mathematicsindicated that they used buildings to a less extent in teaching trigonometry whereas only 5.9% of the teachers of Mathematics reported that they did not utilize buildings as resourcesfor imparting trigonometric skills to students in Kitui County. The mean and standard deviation for this item were 2.53 and 1.23 respectively. These findings mean that building sare used as resources in teaching trigonometry by most teachers of Mathematics in Kitui County.

Further, findings in Table 4. indicate that slightly more than half (52.9%) of the teachersof Mathematics indicated that they used rivers to some extent as resources for imparting trigonometric skills to students during their Mathematics lessons in Kitui County whereasa sizeable number (17.6%) reported that they used rivers to a great extent. Similar number(5.9%) of teachers of Mathematics reported that they used rivers to a less extent and no extent in teaching trigonometry in Kitui County. The mean and standard deviation for thisitem were 2.29 and 1.05 respectively implying that most teachers indicated that they used rivers as resource for teaching trigonometry in secondary schools in Kitui County.

Moreover, results in Table 4. indicate that almost half (47.1%) of teachers of Mathematicsreported that they utilized educational resource centers to a great extent as resources for teaching trigonometry while slightly less than one quarter (23.5%) of teachers of mathematics indicated they used resource centers to a less extent. Similarly, a sizeable number (17.6%) of the teachers of Mathematics revealed that they used educational resource centers as resources for teaching trigonometry whereas only 5.6% indicated that they used educational resource centers to no extent. The mean and standard deviation for this item was 2.24 and 1.44 respectively implying that most teachers of Mathematics use educational resource centers as resource in teaching trigonometric skills among students insecondary schools in Kitui County.

The findings of this study are in tandem with those of other studies, for example a study by Olsen (2014) observed that a school cannot be realistic if it is confined to the four wallsof the classroom, library or laboratory.

If learners are to develop understanding, concerns and skills essential in the real improvement of human living, they must have every opportunity to learn through extensive first hand, problem solving experience. Books and visual materials are all important, but alone are not sufficient. That is why the communityopens doors for experience between the school and the community. This can be achieved through the use of resource persons, field trips, community surveys, work experiences andservice projects, and visits to factories, firms, social agencies and museums.

Underlying potential of community resources in the acquisition of trigonometricskills in secondary schools

The third objective of this study sought to explore the underlying potential of utilization of community resources in the acquisition of trigonometric skills. "Underlying potential of community resources" in this study implies the frequency of accessing specific sites by learners that will aid in discovering the hidden capacities of community resources and teachers' extent of agreement on statements on utilization of community resources and the acquisition of trigonometric skills. To achieve this objective, teachers of Mathematicswere requested to indicate where students mostly accessed community resources in learning trigonometry. The responses are presented in Table 5.

Table 5: Teachers of mathematics responses on community resources accessed bystudents

Resources	Frequency (n)	Percentage (%)
School compound	4	23.5
Field trips	6	35.3
Factories	2	11.8
Neighbouring environment	5	29.4
Total	**17**	**100.0**

Table 5 showed findings on teachers of Mathematics responses on community resources accessed by students. Accordingly, the findings indicate that slightly more than one third (35.3%) of teachers of Mathematics indicated that students accessed community resourcesmostly through field trips. In addition, the findings show that more than one quarter (29.4%) of the teachers of Mathematics reported that students accessed community resources in the neighbouring environment whereas slightly less than one quarter (23.5%)indicated that students accessed community resources in the school compound. Finally, thefindings contained in Table 5. show that 11.8% of the teachers of Mathematics indicatedthat students the least accessed community resources were factories. Further, respondents were required to indicate their level of agreement with the statements about community resources and acquisition of trigonometric skills using a scale of 1 – strongly agree, 2- agree, 3 – Neutral, 4 - Disagree, 5-strongly disagree. The responses are presented in Table 6.

Table 6: Responses of teachers of Mathematics on statements about communityresources and acquisition of trigonometric skills

Item	S.A		A		N		D		S.D		Mean	Std. Dev.
	n	%	N	%	N	%	n	%	n	%		
Students' exposure to environment improves master trigonometric skills	7	41.2	4	23.5	2	11.8	3	17.6	1	5.9	2.24	1.35
Resources in theschools' locality canhelp students acquire trigonometric skills	6	35.3	3	17.6	4	23.5	3	17.6	1	5.9	2.41	1.33
Mathematics teachers and learners use environment to acquire trigonometric skills	6	35.3	3	17.6	3	17.6	2	11.8	3	17.6	2.59	1.54

Table 6 showed findings of teachers of Mathematics responses on statements about community resources and acquisition of trigonometric skills. Accordingly, the findings reveal that majority (64.7%) of the teachers of Mathematics agreed that exposure of students to environment improves learner's mastery of trigonometric skills while less than one quarter (23.5%) disagreed with the statement. However, only 11.8% of the teachers of Mathematics neither agreed nor disagreed that exposure of students to environmentimproves their mastery of trigonometric skills. The statement had a mean and standard deviation of 2.24 and 1.35 respectively implying that most teachers of Mathematics were in agreement that exposure of students to environment improves their mastery of trigonometric skills.

The findings also show that slightly more than half (52.9%) of the teachers of Mathematicsagreed that resources in the schools' locality can help students acquire trigonometric skills.On the other hand, less than one quarter (23.5%) of the teachers of Mathematics disagreedthat resources in the schools' locality can help students acquire trigonometric skills. However, slightly less than one quarter (23.5%) neither agreed nor disagreed that resourcesin the schools' locality can help students acquire trigonometric skills. The statement had amean and standard deviation of 2.41 and 1.33 implying that most teachers agreed that resources in the schools' locality can help students acquire trigonometric skills.

Finally, the findings in Table 6. reveal that slightly more than half (52.9%) of the teachersof Mathematics agreed that learners and teachers of Mathematics use the environment toacquire trigonometric skills whereas slightly more than one quarter (29.4%) disagreed withthe statement. However, less than one quarter (17.6%) neither agreed nor disagreed that learners and teachers of Mathematics use the environment to acquire trigonometric skills.The statement had a mean and standard deviation of 2.59 and 1.54 respectively implying that majority of teachers of Mathematics in Kitui County agreed that learners and teachersof Mathematics use the environment to acquire trigonometric skills.

These results agree with the findings of Taras (2005) who found that community offers a platform for learners to participate in diverse ranges of physical activities that in turn havepositive impact in acquisition of skills in trigonometry as well as in other subjects learnt inclass. Similarly, the findings are in tandem with that of Sidhu (2019) who indicated thatMathematics as a subject can be 'softened' when appropriate teaching resources gives riseto certain activities that enhance student's participation in Mathematics learning process. In addition, the results concur with Braund and Reiss (2004) who posit that learners shouldgo out of classroom and appreciate the natural world-fascinated by its intricacies and be exited to learn more.

CONCLUSIONS AND RECOMMENDATIONS

First, with reference to the findings of objective one, the study concludes that utilization ofcommunity resources among students in public secondary schools enhances their performance in trigonometry and thus improves their acquisition of trigonometric skills. Second, following the main results regarding status of utilization of community resourcesin acquisition of trigonometric skills, it is logical to conclude that learners access community resources at least once per month. Community resources such as trees, buildings, rivers and educational community resource centers are used by teachers of Mathematics in teaching trigonometry in public secondary schools in Kitui County.

Finally, as regards findings on underlying potentials of community resources in the acquisition of trigonometric skills, the study concludes that students access community resources through field trips, neighbouring environment and factories to improve their mastery of trigonometric skills and that resources in the schools' locality help students acquire trigonometric skills. Mathematics teachers agree that when learners are exposed tothe environment, their mastery of trigonometric skills improves.

Following the main results of this study, the researcher made the following recommendations with a view to improving acquisition of trigonometric skills among students in public secondary schools.

The research made the following policy recommendations

- On the basis of findings of objective one, the study recommends that Heads of Departments of Mathematics in public secondary schools should incorporate the time for utilization of community resources by teachers of Mathematics while teaching in the timetable to ensure that all teachers expose their students to community resources.
- Since utilization of community resources is one of the methods of improving performance of trigonometry, the study recommends that all teachers of Mathematics should have practical lessons every week where all students are taken outside the school compound to study Mathematics using the community resources available.
- Kenya Institute of Curriculum Development should list all the possible communityresources that can be used by teachers of Mathematics while teaching the trigonometry topic in secondary schools in Kenya.

Recommendations for further research

- School based factors influencing utilization of community resources in the acquisition of skills in other Mathematics concepts such as algebra.
- Factors influencing utilization of community resources in the acquisition of skills in Mathematics.

REFERENCES

Becerra, J. (2018). Funciones trigonométricas. Universidad Nacional Autónoma de México.

Bruner, J. S. (1996). Toward a theory of instruction (Vol. 59). Harvard University Press.

CEMASTEA (2017). Training module for secondary school teachers on Inquiry Based Learning in mathematics and science. CEMASTEA: Nairobi, Kenya.

Cetin, O. F. (2015). Student's Perceptions and Development of Conceptual Understanding Regarding Trigonometry and Tigonemetric Functions. *Educational Research Reviews*, 10(3), 338-350.

Devine, K. L. (2008). Using a parametric solid modeler as an instructional tool to teach high school geometry. *Engineering Design Graphics Journal*, 72(2), 11-18.

Gür, H. (2009). Trigonometry Learning. New Horizons in Education, 57(1), 67-80.

Haan, M.d. (2002). Distributed Cognition and the Shared Knowledge Model of the Mazahua: A Cultural Approach. *Journal of Interactive Learning Research*, 13(1), 31-50. Norfolk, VA: Association for the Advancement of Computing in Education (AACE).

Kesidou, S. & Koppal, M. (2004). Supporting goals-based learning with STEM outreach. *Journal of Science, Technology, Engineering and Mathematics Education*, 5(4), 5-16.

Mbugua, Z. K., Kibet, K., Muthaa, G. M., &Nkonke, G. R. (2012). Factors contributing to students' poor performance in Mathematics at Kenya certificate of Secondary education in Kenya: A case of Baringo County, Kenya. *American International Journal of Contemporary Research*, 2(6), 87-91.

Moore, K, C. (2012). Coherence, Quantitative Reasoning, And The Trigonometry of Students. In R. Mayes & L. L. Hatfield, Qualitative Reasoning and Mathematical Modelling: A Drive for STEM Integrated Education and Teaching in Context (pp. 75 – 92). Larmie, WY: University of Wyoming.

Mwangi, S. W., Changeiywo, J. & Githua, B. N. (2018). Effects of the use of computer animated technique on loci during instruction on secondary school students' Mathematics misconceptions in Kitui County, Kenya. *International Journal of Scientific and Technology Research* 7 (1).

Olabode, D. S. (2013). Utilization of Community Resources for Effective Sustainability of Social Studies Education. *International Journal of Science and Research*, 6(2).

Olsen, G. (2014). School and the Community. USA. Prentice Hall.

Raju, P. K., Sankar, C. S. & Cook, J. A. (2004). An innovative method to teach physics to 4-H students. Journal of Science, Technology, Engineering and Mathematics Education, 5(3&4), 53-66.

Rasmussen, C. & Marrongelle, K. (2006). Pedagogical Content Tools: Integrating Student Reasoning and Mathematics in Instruction. *Journal for Research in Mathematics Education*, 37 (5), 388-412.

Rizkianto, Ilham; Zulkardi; Darmawijaya (2013). Constructing Geometric Properties of Rectangle, Square, and Triangle in the Third Grade of Indonesian Primary Schools. *Journal on Mathematics Education*, 4(2), 160-171.

Sidhu, S.K. (2019). The teaching of Mathematics revised and enlarged edition. New Delhi: sterling publisher.

Swift, T. M. & Watkins, S. E. (2004). An engineering primer for outreach to K-4 education.*Journal of Science, Technology, Engineering and Mathematics Education, 5*(3 &4), 67-76.

Taras, H. (2005). Physical activity and student performance at School. *Journal of School health*, *75*(6), 214-218.

Vivien M.T, E.A.B, F.S.G, H.H.C, E.L.F, S.A.U, N.F.N & R.S.T (2001). Science, Mathematics and Technology Literacy: Strategies for the 21st Century. National Institute for Science and Mathematics Education Development-University of Philippines. Diliman, Quezon City 1101, Philippines

Wanza. K. (2008). *Implementation of Business Studies Curriculum in Public Secondary Schools in Machakos Central Division of Machakos District,* Machakos *County,Kenya*. Masters of education thesis Kenyatta University Kenya.

Weber, K. (2005). Students' Understanding of Trigonometric Functions. *Mathematics Education Research Journal*, *17*(3), 91-112.

White, C. (2009). *Learner –Centred Instruction*. California. SAGE publications Ltd.

Whittich, A. W. (2007). *Instructional Technology; its Nature and Use.*New York. Harperand Row.

Wongapiwatkul, Laosinchai and Panijpan (2011). *The International Journal of LearningAnnual Review* 18(2):1-21