Effects of Students' Language Interpretation on Performance in Mathematics in Selected Secondary Schools in Nakuru North Sub-County Kenya

Ruthiga D. Wanjiru*, Kisilu Kitainge and Samikwo Dinah
School of Education, Department of Centre for Teacher Education, University of Eldoret

***Corresponding author's email address:** wanjirudorcas14@gmail.com

Abstract

Over the years, Performance in Mathematics as echoed by the KCSE results has remained poor. Several involvements have been put into place to address this low students' performance in Mathematics in KCSE. The Education Ministry has tried to enhance the teaching of mathematics in most schools by introducing projects such as Strengthening Mathematics and Sciences in Secondary Education (SMASSE), in order to advance performance. However, the students' low performance in Mathematics in KCSE persists. Using this situation as a rationale, this study sought to investigate effect of students' language interpretation on Mathematics performance. Form 3 students in Nakuru North Sub-County participated in the study. The study adopted the following research questions: How do students' interpretation of language influence their performance in mathematics? Does understanding of word problems in mathematics influence performance in mathematics? How do students' analysis of mathematical vocabulary influence performance?. Do students' manipulation of mathematics problems influence performance in mathematics? The origin for the study was the constructivist theory by J. Bruner which recommends for teaching learners to build their meanings of mathematical terminologies. The study used Quasi-experimental design. This design was suitable because the students who participated in the study could only be found in intact classes. The population targeted comprised of all Form 3 students in Nakuru North Sub-County which had a target population of 1926 students in the 35 public schools. Sixteen schools with a population of 731 students formed a sample. Written tests and questionnaire were used to collect data and analyzed using SPSS version 22. The study found that students performed significantly better after they were taught mathematics' vocabularies than before. This study concluded that good performance in mathematics was greatly related to students' understanding of mathematical vocabulary. The study recommends that Mathematics teachers should put more emphasize on definition of mathematical language when presenting content to learners. Students' Mathematics textbooks should have well defined vocabularies to ensure that the students understand them.

Keywords: Investigate, Performance, Interventions, Influences, Definition, Vocabularies

INTRODUCTION

Mathematics is a compulsory and amongst the key subjects at both primary and secondary school levels in Kenya. Mathematics grades are used as a basic entry requirement into courses such as medicine, science education, architecture and engineering among other programmes. Despite the vital role that Mathematics plays in the curriculum worldwide, (Aduda, 2003) observes that there has always been poor performance in the subject at national examinations. As reflected in the KCSE results,

students have not managed to attain a mean mark of 29% which translates to D+ according to KNEC grading system (KNEC Reports.2014-2018).

Table 1: Mathematics KCSE Mean grades

Year	2014	2015	2016	2017	2018
KCSE Mean score (%)	24.02	26.88	20.79	25.48	26.45

Source: KNEC Report 2014 – 2018

Performance in mathematics is below average amongst secondary school students in Kenya and this is one of the reasons for decline in science and technology courses and development (Sa'ad *et al*, 2014). This calls for identification of factors that develop the understanding of mathematical concepts for good performance (Mbugua et al, 2012). A student understanding of mathematical language is highly associated with good performance. Mistakes that are made by students when answering mathematics problems could be due to lack of the students' understanding of mathematical language. Mbugua *et al*, (2012) stated that the important purpose of language in mathematics teaching is to enable both the instructor and scholar to communicate mathematical knowledge with accuracy. In order to comprehend the meaning of words, symbols and contextual knowledge in a mathematical problem, specialized language is paramount to make logical inferences to solve them. According to Howie (2003), studies regarding the effects of language on mathematics performance appear to indicate the importance of language in Mathematics performance. This study set to investigate the effect of students' language interpretation on performance in mathematics and explores the relationship between students' interpretation of mathematics language and their performance in Mathematics.

METHODOLOGY

This study was carried out in public secondary schools selected in Nakuru North Sub-County Nakuru County. The Sub- County had 5 wards namely Bahati, Dundori, Kabatini, Kiamaina and Lanet/Umoja. Nakuru North Sub-County has 35 public secondary schools. These were one National school, three Extra County schools, one County school and thirty Sub- County schools making a total of 35 schools. The area was suitable for the study because it has all the school categories and the schools in this Sub-County have also been posting poor results in Mathematics.

A sample of sixteen schools was randomly selected from the 35 schools. The sample size of the number of schools to participate in this study was calculated using the Nassiuma formula

$$S = \frac{N(C^2)}{C^2 + (N-1)e^2}$$ (Nassiuma, 2000)

Where S = Sample size, N = Population size, C = Coefficient of variation and e = Standard margin of error.

$$s = \frac{35 \times 0.25^2}{0.25^2 + (35-1) \times 0.04^2}$$

$$s = \frac{35 \times 0.0625}{0.0625 + 34 \times 0.0016}$$

$$s = 16$$

Two form three classes from each selected school were involved in the study. The classes used for Administration of Research instrument in the study were intact. Out of the 731 students who participated in the study 358 which is 48.97% were boys while 373 (51.03%) were girls. More girls than boys participated in the study. This is shown in figure 1.

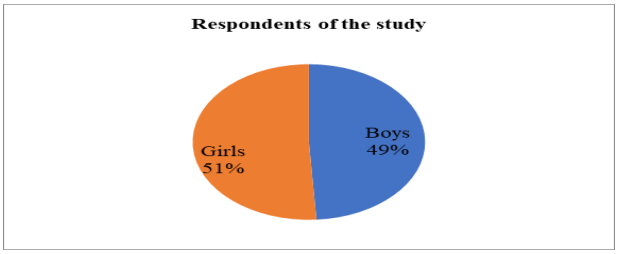

Figure 1: Respondents of the study
Source (Author, 2020)

The study was done using quasi-experimental design where students did a Pre-test and a Post-test. Tests were administered to all Form 3 students from the 16 selected public secondary schools.
The tests and questionnaire yielded quantitative data. The tests were aimed at determining students' interpretation of Mathematical language through their application of Mathematical language. The study used the intact classes and not individual students. According to (Goodwin, 2005) this helps to test the effectiveness of some treatment. The schools had two streams and therefore one class formed the experimental group and the other the control group. The groups were as equivalent as possible.

All the students were given the Pretest. The papers were marked and scores recorded for analysis. After the Pretest, the papers were marked and students given back their scripts. The experimental groups were then given treatment. In the treatment, the mathematics teachers whose schools fell under the study were inducted and given lesson plan on how to teach the mathematics language, vocabularies and solving word problems in Mathematics. Each lesson lasted 40 minutes. The classes were regularly scheduled for seven lessons per week as stipulated in the syllabus. The teaching was conducted in a period of three months. Intact groups of participants were used in an experiment because secondary school classes exist as intact groups (Amina, 2005). The administrators in educational institutions do not allow the dismantling of the intact classes for random assignment (Mugenda, 2008). The researcher hand-picked secondary schools that were 2 streamed. One class formed the control group and the other the experimental group.

During treatment, the learners were given instructions and led through illustrations on how to interpret Mathematics language, meaning of the various Mathematics vocabulary and solving word problems. The teacher allowed the students to solve Mathematics problems and to explore the mathematics language concepts. The teacher asked questions and gave assignments to students. After the instruction period, all the students did a post test, which was marked and scores recorded for analysis. The data analyzed using Statistical Package for Social Sciences (SPSS version 22). Microsoft

Excel statistical package were utilized to run descriptive statistics including percentages and frequency. The quantitative data was analyzed using inferential statistics (t-test), to test for the understanding and application of mathematics language in pre-test and post-test. The study findings were then presented in forms of graphs and frequency tables indicating percentage and frequency.

RESULTS AND DISCUSSION

Pre-test results

The researcher administered a pre-test to the students at the beginning of the research period. It was noted that students were not able to interpret Mathematics language during marking, and the class mean was 31.16%. Only 19% were able to score at least 6 marks out of the 12 marks for the mathematics language interpretation items. 81% could not score the minimum 6 marks. This is shown in figure 2.

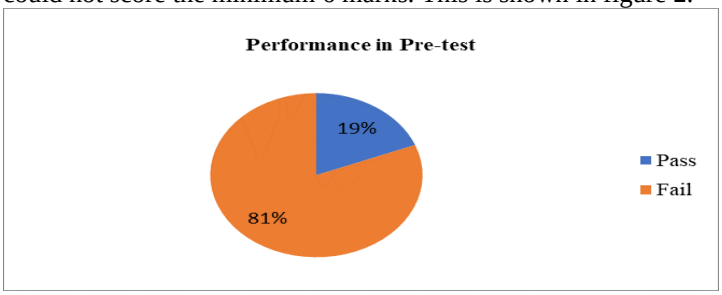

Figure 2: Interpretation of Mathematics language in Pre-test
Source (Author, 2020)

Comparing the performance of boys and girls in the Pre-test, boys had a mean score of 32.56 % while girls had a mean of 29.8%. Boys performed better than girls in the Pre-test. The results obtained were as shown in table 2.

Table 2: Marks obtained in Pre-test

Gender of the respondent	Mean	N	Std. Deviation
Male	16.2849	716	9.80152
female	14.9088	746	8.73919
Total	15.5828	1462	9.29381

Source (Author, 2020)

From the results in Fig 2, boys had a mean score of 32.56 % and girls had a mean score of 29.8%. The mean difference between the two groups was 2.76%.

The areas that were a challenge to students were identified. These challenges included not interpreting the question and not answering the question as it was required. Some of which include;

a) In $\dfrac{\frac{1}{2}\ of\ 3\frac{1}{2}+1\frac{1}{2}\left(2\frac{1}{2}-\frac{2}{3}\right)}{\frac{3}{4}\ of\ 2\frac{1}{2}\div\frac{1}{2}}$, the respondents did not apply BODMAS correctly.

b) Using the table of reciprocals, square roots and squares to find the value of $\frac{8}{\sqrt{0.625}} + (1.64)^{2.}$ Some students did not read or others did not understand that they were required to get the square from the Mathematical table. Thus, those students who got the square from the calculator got it wrong.

c) For $2^{(x-3)} \times 8^{(x+2)} = 128$, the students were expected to write 128 as 2^7 and then solve using the laws of indices.

Post-test Scores

After pre-testing the learners, the teachers administered treatment to the experimental group. The students were taught the various Mathematical words and terms or Mathematics language. A post-test was then given to all the respondents. In the experimental group, 73.2% were able to answer the questions on language interpretation correctly in the Post-test. However, some 26.8% could still not get minimum 6 marks. Performance of problems on interpretation of Mathematics language improved in Post-test. This is as shown in Figure 3.

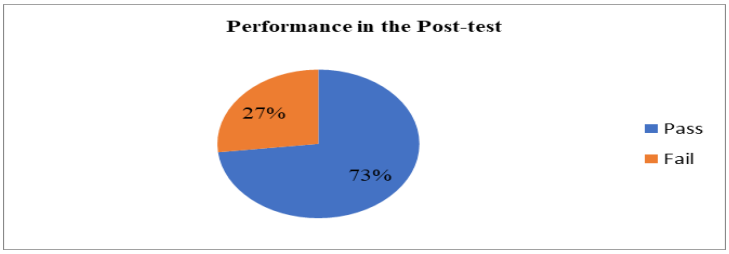

Figure 3: Interpretation of Mathematics language in Post-test
Source (Author, 2020)

The researcher then did a T- test. This is shown in Table 2.

Table 2: T- test between pre-test and post-test on language interpretation in Pre-test and Post-test

Paired Differences **Igoki S. Mercy and Changwony**							
			95% Confidence Interval of the Difference				
Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
16.212	3.571	0.132	-16.471	-15.953	-122.738	730	0.000

Source (Author, 2020)

The T- test gave a p-value of 0.000 (p=0.000). This showed that there is a significance difference between the Post-test and Pre-test. The experimental group performed better in the Post-test. This is due to the treatment given to them. Experimental group performed significantly better than the control group in the Post-test. Thus, performance improved after treatment**.** This is as shown in figure 4.

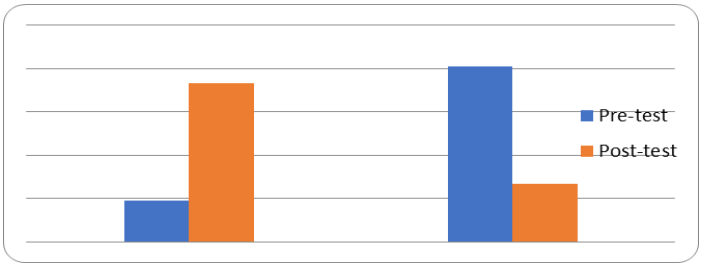

Figure 4: Comparison in performance
Source (Author 2020)

DISCUSSION

The experimental group performed better than the control group. A Pre-test was given to all the respondents. The areas that were a challenge to students were identified, and treatment given to the experimental group. A Post-test was then given to all the respondents. There was a positive relationship between students' interpretation of mathematics language and their performance in Mathematics. Students in the experimental group who were taught the mathematics language and vocabularies performed better than those in the control group in the Post-test. The ability to interpret Mathematical language is a key component in understanding mathematics. Most students have problems in understanding and interrelating symbols as used in mathematics and according to (Wasike, 2006), it is essential to improve students' interpretation of mathematics language. Misunderstanding of the language normally used in Mathematics teaching and tests may challenge students in learning Mathematics and therefore low performance of Mathematics. Poor performance is sometimes due to the difficult language used in the mathematics classroom (Wasike, 2003). To improve performance, students need to understand the mathematical language in a more simplified form (Amadalo *et al*, 2012). When solving word problems, the students must understand the text so as to identify the missing information, find a plan to solve for it and perform calculations. Solving the word problem in mathematics is an important aspect in mathematic learning and mathematical understanding. Although the boys performed significantly better in the Pre-test and Post-test, the difference was not statistically significant. The treatment administered improved the post test results for both boys and girls.

CONCLUSION

The objective of the study was to evaluate how students' interpretation of language influences their performance in Mathematics. In the response to the research question how students' interpretation of language influences performance in Mathematics, the research established that understanding of mathematical language and attainment in mathematics by students in Secondary school is pitiable. Mistakes that learners make when solving mathematics problems is partially because of their insufficient understanding of mathematical language. Performance in mathematics is extremely associated to students' understanding of mathematical language. Understanding of mathematics language can effectively improve students' performance in Mathematics. Good performance in mathematics can be boosted by incorporating mathematical terms' definitions in lessons, prepare quizzes requiring definitions of mathematical terms, structures or symbols and grant marks for definitions. It is important to develop classroom practices that can facilitate the understanding of language and terminologies used in Mathematics.

RECOMMENDATIONS

Based on the major outcomes and the conclusion made, the following key recommendations were made:

1. Students should be taught mathematical vocabulary using appropriate strategies. Include mathematical terms' definitions in lessons, set queries that need mathematical phrases' definitions, structures or symbols and reward marks for definitions.
2. Students should be exposed to Mathematics vocabulary. Mathematical terminologies are a requisite for one to perform well in Mathematics
3. Manipulation of mathematics problems is a problem-solving skill that involves much more than simple calculation. It should be emphasized.

From the study conclusions, the study made some policy recommendations to some chief stakeholders. Further study areas were proposed.

REFERENCES

Adams, T. L. (2003). Reading mathematics: More than words can say. *The Reading Teacher*, *56*(8), 786-795.

Adino, A. (2015). Factors influencing students performance in mathematics in Kenya certificate of secondary education in public secondary schools in Butere sub county, Kenya (Doctoral dissertation, University of Nairobi).

Aduda, D. (2003). Kenya Certificate of Secondary Education, Examination Results Released by Minister of Education. *Daily Nation, Nairobi: Nation Media Group Ltd*.

Ali, H. H., & Jameel, H. T. (2016). Causes of poor performance in mathematics from teachers, parents and student's perspective. *American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)*, *15*(1), 122-136.

Altaftazani, D. H., Rahayu, G. D. S., Kelana, J. B., Firdaus, A. R., & Wardani, D. S. (2020, October). Application of the constructivism approach to improve students' understanding of multiplication material. In *Journal of Physics: Conference Series* (Vol. 1657, No. 1, p. 012007). IOP Publishing.

Amadalo, M. M., Sulungai, M. W., & Toili, W. W. (2012). Teacher Related Factors influencing integration of ICT in Teaching of Mathematics in Secondary schools in Kenya. *African Journal of Education and Technology*, 1-14.

Amin, M. E. (2005). *Social science research: Conception, methodology and analysis*. Makerere University.

Anwar, R. B., &Rahmawati, D. (2017). The Use of Mathematical Module Based on Constructivism Approach as Media to Implant the Concept of Algebra Operation. *International Electronic Journal of Mathematics Education*, *12*(3), 579-583.

Apen, R. (2016). The applicative use of problem solving technique in teaching grammar. *Proceedings of ISELT FBS Universitas Negeri Padang*, *4*(2), 180-187.

Asante, K. O. (2012). Secondary students' attitudes towards mathematics. *IFE Psychologia: An International Journal*, *20*(1), 121-133.

Atkinson, M. J., Kumar, R., Cappelleri, J. C., & Hass, S. L. (2005). Hierarchical construct validity of the treatment satisfaction questionnaire for medication (TSQM version II) among outpatient pharmacy consumers.

Barbu, O. C., & Beal, C. R. (2010). Effects of linguistic complexity and math difficulty on word problem solving by English learners. *International Journal of Education*, *2*(2), 1.

Beal, C. R., Adams, N. M., & Cohen, P. R. (2010). Reading proficiency and mathematics problem solving by high school English language learners. *Urban Education*, *45*(1), 58-74.

Bell, R., & Bell, L. (2002). A bibliography of articles on technology in science education. *Contemporary Issues in Technology and Teacher Education*, *2*(4), 426-446.

Best, P. J., Lennon, R., Gersh, B. J., Ting, H. H., Rihal, C. S., Bell, M. R., ... & Berger, P. B. (2003). Safety of abciximab in patients with chronic renal insufficiency who are undergoing percutaneous coronary interventions. *American heart journal*, *146*(2), 345-350.

Boonen, A. J., van Wesel, F., Jolles, J., & van der Schoot, M. (2014). The role of visual representation type, spatial ability, and reading comprehension in word problem solving: An item-level analysis in elementary school children. *International Journal of Educational Research*, *68*, 15-26

Bryant, D. P. (2009). Working with your child's teacher to identify and address math disabilities. *LD online*, 197-228.

Chow, J. C., & Ekholm, E. (2019). Language domains differentially predict mathematics performance in young children. *Early Childhood Research Quarterly*, *46*, 179-186.

Cooper, D., & Schindler, S. (2014). Business Research Methods. New York: McGraw-Hill Irwin

Cooper, D. R., Schindler, P. S., & Sun, J. (2006). Business research methods (Vol. 9). New York: McGraw-Hill Irwin.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.
Daroczy, G., Wolska, M., Meurers, W. D., & Nuerk, H. C. (2015). Word problems: a review of linguistic and numerical factors contributing to their difficulty. *Frontiers in psychology*, *6*, 348.
Didis, M. G., & Erbas, A. K. (2015). Performance and Difficulties of Students in Formulating and Solving Quadratic Equations with One Unknown. *Educational Sciences: Theory and Practice*, *15*(4), 1137-1150.
Dimitrov, D. M., &Rumrill Jr, P. D. (2003). Pretest-posttest designs and measurement of change. *Work*, *20*(2), 159-165.
Fitzmaurice, O., Cronin, A., Fhloinn, E. N., O'Sullivan, C., & Walsh, R. (2016). Preparing tutors for mathematics learning support. *MSOR Connections*, *14*(3), 14-21.
Fouka, G., &Mantzorou, M. (2011). What are the major ethical issues in conducting research? Is there a conflict between the research ethics and the nature of nursing?. *Health Science Journal*, *5*(1).
Frey, N., Fisher, D., & Smith, D. (2019). *All learning is social and emotional: Helping students develop essential skills for the classroom and beyond*. ASCD.
Gichuru, L. M., &Ongus, R. W. (2016). Effect of teacher quality on student performance in mathematics in Primary 6 National Examination: A survey of private primary schools in Gasabo District, Kigali City, Rwanda. *International Journal of Education and Research*, *4*(2), 237-259.
Gillham, B. (2008). *Developing a questionnaire*. A&C Black.
Gitaari, E. M. E., Nyaga, G., Muthaa, G., &Reche, G. (2013). Factors contributing to students poor performance in mathematics in public secondary schools in Tharaka South District, Kenya.
Githua, B. N. (2002). Factors related to the motivation to learn Mathematics among Secondary School Students in Kenya's Nairobi Province and Three Districts of Rift Valley Province'. *Unpublished Phd. Thesis, Egerton University, Njoro*.
Goodenough, A., & Waite, S. (2012). Real world research: a resource for users of social research methods in applied settings
Goodrum, D., Rennie, L. J., & Hackling, M. W. (2001). *The status and quality of teaching and learning of science in Australian schools: A research report*. Canberra: Department of Education, Training and Youth Affairs.
Grace, D. N., &Irungu, M. N. (2013). Determinants of Academic Performance in Kenya Certificate of Secondary Education in Public Secondary Schools in Kiambu County, Kenya. *Journal of Education and Practice 4 (12)*.
Gray, V. (2004). The language of mathematics: a functional definition and the development of an instrument of measure teacher perceived self-efficacy.
Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-based nursing*, *18*(3), 66-67.
Howie, S. J. (2003). Language and other background factors affecting secondary pupils' performance in Mathematics in South Africa. *African Journal of Research in Mathematics, Science and Technology Education*, *7*(1), 1-20.
Howie, S. (2004). A national assessment in mathematics within an international comparative assessment. *Perspectives in education*, *22*(2), 149-162.
Jameel, H. T., & Ali, H. H. (2016). Causes of poor performance in mathematics from the perspective of students, teachers and parents. *American Scientific Research Journal for Engineering, Technology, and Sciences*, *15*(1), 122-136.
Kelly, C. A. (2006). Using manipulatives in mathematical problem solving: A performance-based analysis. *The mathematics enthusiast*, *3*(2), 184-193.
Kombo, D. K., & Tromp, D. L. (2006). Proposal and thesis writing: An introduction. *Nairobi: Paulines Publications Africa*, *5*, 814-30.
Kosgei, A., Mise, J. K., Odera, O., &Ayugi, M. E. (2013). Influence of teacher characteristics on students' academic achievement among secondary schools. *Journal of Education and Practice*, *4*(3), 76-82.
Kothari, C. R. (2008). Research Methodology, Methods and Techniques (2nd ed., pp. 109-110). New Delhi: New Age Inter- national (P) Limited
Kothari, C. (2017). Research methodology methods and techniques by CR Kothari. *Published by New Age International (P) Ltd., Publishers*, *91*.
Larbi, E., & Okyere, M. (2014). Algebra tiles manipulative and gender differences in learning and achievement in mathematics: A case of Sunyani West Municipality. *differences*, *5*(38).
Laverde, A. C., Cifuentes, Y. S., & Rodriguez, H. Y. R. (2007). Toward an instructional design model based on learning objects. *Educational Technology Research and Development*, *55*(6), 671-681.
Legesse, B. (2014). Research Methods in Agribusiness and Value Chains. *School of Agricultural Economics and Agribusiness, Haramaya University*.
Manoah, S. A., Indoshi, F. C., &Othuon, L. O. (2011). Influence of attitude on performance of students in mathematics curriculum. *Educational research*, *2*(3), 965-981.
Marzano, R. J. (2011). *Formative assessment & standards-based grading*. Solution Tree Press

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.

Mbugua, Z. K. (2012). Influence of Mathematical Language on Achievement in Mathematics by Secondary School Students in Kenya.

Meiers, M., &Trevitt, J. (2010). The digest edition 2010/2: Language in the mathematics classroom.

Mensah, J. K., Okyere, M., & Kuranchie, A. (2013). Student attitude towards mathematics and performance: Does the teacher attitude matter. *Journal of education and practice*, *4*(3), 132-139.

Micheni, M. K., Njeru, A. W., & Wanjiru, B. (2013). Influence of television advertisements on telecommunication companies' consumer psychological buying behavior in Kenya. *International Journal of Social Sciences and Entrepreneurship*, *1*(5), 728-741.

Monoranjan, B. (2015). Constructivism Approach in Mathematics Teaching and Assessment of Mathematical Understanding. Basic Research Journal of Education Research

Morapeli, M. A., &Luneta, K. Difficulties Encountered by Grade 11 Mathematical Literacy Learners When Solving Problems of the Surface Area Of Rectangular Prisms. *for Mathematics Education of South Africa*, 242.

Mugenda, O. M., & Mugenda, A. G. (2012). Research Methods: Quantitative and Qualitative Approaches. Nairobi: Acts Press.

Mulwa, E. C. (2014). A Review of Students' Understanding of Mathematical Concepts of Arithmetic Operations in Eldoret Municipality, Kenya. *Research Journal in Organizational Psychology and Educational Studies (RJOPES)*, *3*(2), 67.

Murray, J. (2013). The factors that influence mathematics achievement at the Berbice campus. *International journal of business and social science*, *4*(10).

Musasia, A. M., Nakhanu, S. B., &Wekesa, W. D. (2012). Investigation of factors that influence syllabus coverage in secondary school mathematics in Kenya.

Mutodi, P., &Ngirande, H. (2014). The Influence of StudentsPerceptions on Mathematics Performance. A Case of a Selected High School in South Africa. *Mediterranean Journal of Social Sciences*, *5*(3), 431.

Nalianya, R. S. (2011). *Factors influencing career choices by students in tertiary institutions in Kenya; a case of Youth polytechnics in Bungoma County* (Doctoral dissertation, University of Nairobi, Kenya).

Nassiuma, D. K. (2000). Survey sampling. *Theory and methods*, *10*(1), 59-63

National Council of Teachers of Mathematics (Ed.). (2000). *Principles and standards for school mathematics* (Vol. 1). National Council of Teachers of.

Nicol, D. (2010). From monologue to dialogue: improving written feedback processes in mass higher education. *Assessment & Evaluation in Higher Education*, *35*(5), 501-517.

Njoroge, P. M., &Nyabuto, A. N. (2014). Discipline as a factor in academic performance in Kenya. *Journal of Educational and Social Research*, *4*(1), 289.

Nor, F. M., Aziz, M. A., & Jusoff, K. (2011). Should English for teaching mathematics and science (ETeMS) in Malaysia be abolished. *World applied sciences journal*, *12*(Special Issue on Creating a Knowledge Based society), 36-40.

Ogula, P. A. (2005). Research methods.

Ongong'a, J. J., &Akaranga, S. I. (2013). Work ethics for lecturers: an example of Nairobi and Kenyatta Universities.

Orodho, J. A. (2005). Techniques of writing research proposals and reports. *Education and Social Sciences*.

Orodho, A. (2004). Techniques and Social Science Research Methods Nairobi.

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.

Padilla, A. M., Fan, L., Xu, X., & Silva, D. (2013). A Mandarin/English two-way immersion program: Language proficiency and academic achievement. *Foreign Language Annals*, *46*(4), 661-679.

Papanastatsiou, C. (2010). Linkage of attitudes and performance of Mathematics among students in middle level schools. *International Journal of Education*, *102*, 34-39.

Ramdhani, M. R., Usodo, B., & Subanti, S. (2017, November). Student's mathematical understanding ability based on self-efficacy. In *Journal of Physics: Conference Series* (Vol. 909, No. 1, p. 012065). IOP Publishing.

Rosli, R., Goldsby, D., & Capraro, M. M. (2013). Assessing students' mathematical problem-solving and problem-posing skills. *Asian social science*, *9*(16), 54-60.

Rubenstein, R. N., & Thompson, D. R. (2002). Understanding and supporting children's mathematical vocabulary development. *Teaching Children Mathematics*, *9*(2), 107-112.

Sa'ad, T. U., Adamu, A., & Sadiq, A. M. (2014). The causes of poor performance in mathematics among public senior secondary school students in Azare metropolis of Bauchi State, Nigeria. *Journal of Research & Method in Education*, *4*(6), 32.

Sahendra, A., Budiarto, M. T., & Fuad, Y. (2018). Students' representation in mathematical word problem-solving: exploring students' self-efficacy. In *Journal of Physics: Conference Series* (Vol. 947, No. 1, p. 012059). IOP Publishing.

Samuelsson, M., & Samuelsson, J. (2016). Gender differences in boys' and girls' perception of teaching and learning mathematics. *Open Review of Educational Research*, *3*(1), 18-34.

Sila, M. P. (2014). *Factors influencing students' performance in mathematics in Kenya certificate of secondary education (KCSE); A case of Kathonzweni District in Makueni County, Kenya* (Doctoral dissertation).

Siregar, N. C., Rosli, R., Maat, S. M., & Capraro, M. M. (2019). The effect of science, technology, engineering and mathematics (STEM) program on students' achievement in mathematics: A meta-analysis. *International Electronic Journal of Mathematics Education*, *15*(1), em0549.

Solano-Flores, G., & Trumbull, E. (2003). Examining language in context: The need for new research and practice paradigms in the testing of English-language learners. *Educational Researcher*, *32*(2), 3-13.

Stahl, S. A. (2005). Four problems with teaching word meanings. *Teaching and learning vocabulary: Bringing research to practice*, *95*.

Suleiman, Y., & Hammed, A. (2019). Perceived Causes of Students' Failure in Mathematics in Kwara State Junior Secondary Schools: Implication for Educational Managers. *International Journal of Educational Studies in Mathematics*, *6*(1), 19-33.

Tambychik, T., Meerah, T. S. M., & Aziz, Z. (2010). Mathematics skills difficulties: A mixture of intricacies. *Procedia-Social and Behavioral Sciences*, *7*, 171-180.

Thatcher,R.W.(2010).Validity and reliability of quantitative electroencephalography. *Journal of Neurotherapy*, *14*(2), 122-152.

Verschaffel, L., Van Dooren, W., Greer, B., & Mukhopadhyay, S. (2010). Reconceptualising word problems as exercises in mathematical modelling. *Journal für Mathematik-Didaktik*, *31*(1), 9-29.

Wachira, C. N. (2016). *Causes of poor performance in mathematics in secondary schools: a case of Nyandarua north sub county, Kenya* (Doctoral dissertation, Karatina University).

Wanjiru, B. N. (2015). *Effects of mathematical vocabulary instruction on students' achievement in mathematics in secondary schools of Murang'a County, Kenya* (Doctoral dissertation, Kenyatta University).

Wasike, D. W. (2003). Effect of Socialized Mathematical Language 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*.

Wekesa, D. W. (2006). Effectiveness of a Language Based Program in School Mathematics on Students Understanding of Statistics. *Eurasia journal of Mathematics, science and technology education*, *2*(3), 79-87.

Yonson, D. L. Solving word problems performance of students in L1 (Mother Tongue) and L2 (English language).

Yushau, B., & Omar, M. H. (2015). Mathematics performance and its relation to English language proficiency level of bilingual Arab university students. *Indian Journal of Science and Technology*, *8*(13), 1-15.

Zakaria, E., Chin, L. C., &Daud, M. Y. (2010). The effects of cooperative learning on students' mathematics achievement and attitude towards mathematics. *Journal of social sciences*, *6*(2), 272-275.