



**INFLUENCE OF UTILIZATION OF MATHEMATICS
INSTRUCTIONAL MATERIALS ON DEVELOPMENT OF
MATHEMATICAL COMPETENCIES AMONG GRADE ONE
LEARNERS IN NAKURU COUNTY, KENYA**

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Abstract:

Mathematics is an important aspect in life. Early development of mathematics skills leads to early acquisition of mathematical competencies. For effective acquisition of mathematical competencies in early years, instructional materials are required to enhance development mathematical skills. Studies conducted in Kenya have not adequately focused on the use of instructional materials to develop mathematical competencies. This has hindered learning, making learners assume a passive role in their learning. The purpose of this study was to investigate the influence of use of instructional materials on acquisition of mathematics competencies. The study was guided by Bruner's theory of instruction. Correlation research design was used in this study. The independent variables were: types of mathematics instructional materials in grade one classrooms, utilization of instructional materials during mathematics instruction as well as investigating the influence of instructional materials on acquisition of mathematics skills. The dependent variable was acquisition of mathematical competencies. The study was carried out in Nakuru East Sub County, Nakuru County. The target population was both private and public primary schools in Nakuru East Sub County. Grade one learners and teachers were the participants. Purposive, stratified and random sampling methods were used to select an appropriate sample for the study. Research instruments used were: lesson observation schedule, interview schedule for teachers and a competency checklist. Pilot study to test the instruments was carried out in two private schools and two public primary schools from the study area. Data was qualitatively and quantitatively analyzed. The study established that few grade one teachers in public schools utilized instructional materials

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during mathematics instructions. It was also established that instructional materials influenced acquisition of mathematics competencies. The study recommends that teachers and other key stakeholders should invest more resources to ensure availability of adequate instructional materials for learners. It also recommends that school management should invest more to ensure adequate and right instructional materials are availed to enable learners and teachers have all the basic requirements required for better teaching and learning.

Keywords: mathematics; competence; instructional materials, grade one

1. Introduction and Background of Study

Mathematics is an important element in human life. Human beings use it daily as a tool to facilitate their life. As a result of its significant value, teaching and learning of mathematics should be approached in ways that help learners develop positive attitude towards it, (Goktepe & Ozdemir, 2013). This helps children from an early age to believe that, mathematics is part of life and that it makes life easier. Utilization of IM during instruction of any learning activity enables learner to understand, enjoy and manipulate abstract concepts (Adipo 2015). The ultimate goal of using IM during teaching and learning process is to enable learners make abstract concepts a reality.

Studies conducted in Germany, England and United States showed that use of teaching/learning materials supported instructional practices. A study by Mischo & Maab (2013) in Germany, for instance found out that instructional materials affected teaching and learning of mathematics. In addition, they noted that IM aided in improving performance in mathematics by 85.3%. In addition, Leone, Wilson & Mulcahy, (2010) reported that use of IM had high positive influence on pupils' math competency in American schools. Although instructional materials had a relationship with performance of low achieving grade six learners who were the target population of the study, the target population of this study was grade one learners in Nakuru East Sub County. In addition, the purpose of the study was focused on the modeling performance of low achieving students from families with a low socio-economic status as compared to the purpose of this study which was to find out the effects of instructional materials on acquisition of mathematical competencies among grade one learners in Nakuru East Sub County.

In African countries, studies have shown that, use of mathematics instructional materials has been embraced. A paper by Iji, Ogbole & Uka (2013) in Nigeria reported that due to utilization of improvised instructional materials, learners taught in geometry improved their mean achievement scores. This was because the improvised IM brought about competitiveness and enlivened learning for students. This paper showed that acquisition of the intended skill was achieved, but the focus was only one concept, geometry. It did not cover other areas in mathematics. Further, the study was carried out among upper basic education level students in Nigeria. Thus, there was a need to carry out this study to find out the influence of instructional materials on

acquisition of mathematics skills as per the curriculum design among grade one pupils in Nakuru East Sub County.

In South Africa, Smith & Hardman (2014) noted that, use of computer based software had helped pupils develop higher levels of geometric thinking and to learn geometric concepts and skills. They also showed that sixth grade learners who were taught concepts of area and volume using a computer-based program improved overall performance than eighth grade learners taught traditionally. According to this study, only one type of teaching aid was focused on, that is, computer software loaded with teaching programs. In addition, the population under study was grade six learners as compared to grade one learners, the target population of this study. This study focused on the influence of utilization of all MIM on acquisition of mathematical competencies among grade one learners.

Guloba, Wokadala & Bategeka (2010) in Uganda found out that inadequate teaching resources resulted to teacher-centered approaches of teaching. This contributed to low quality of education. The findings also showed that availability of instructional materials provided motivating conditions for teaching and learning thus promoting better outcomes. However, the study was carried out in Uganda among grade three and grade six learners in their performance in literacy and numeracy. This study was carried out among grade one learners. In addition, the study employed the baseline survey conducted between July and August in the districts under study. All these studies were carried out in areas outside Kenya. There was therefore a need to focus on Kenya and find out the influence of instructional materials on acquisition of mathematics competencies.

In Kenya, most studies carried out on relationship between IM and acquisition of mathematics competences show that IM have great impact on mathematics performance. For example, a study done in Masaba by Nyamongo, Sang, Nyaoga & Matoke (2014) on the relationship between school based factors and students' performance showed that inadequate resources and irregular training led to poor student performance. They added that textbooks are a major input for performance in examinations. Inadequate teaching and learning materials led to teachers using other methods of teaching leading to inactive learners. This study was carried out at secondary school level unlike this study which focused on primary school level of education particularly grade one learners. In addition, their study was based on overall performance in the final secondary school examination unlike this study which focused on acquisition of mathematical competencies among grade one learners.

A study conducted in Bondo by Otieno (2010) reported that, IM strengthened learning. He also noted that, academic achievements were realized through appropriate use of IM. He found out that, IM helps teachers to enjoy the process of teaching while learners find it exciting. This encourages exploration and manipulation which in turn bring forth improved performance in mathematics. Although Otieno's study focused on the effects of teaching/learning resources on mathematics performance, his target population was senior four learners, teachers and head teachers in secondary school.

This study focused on grade one learners and teachers and the influence of instructional materials on acquisition of mathematics competencies.

In yet another study carried out in Nakuru North Sub County, Gichohi (2014) found out that 53% of the teachers agreed that inadequate TLR affects teaching and learning processes as well as the concentration of pupils. Njenga (2014) agrees with Gichohi's findings by confirming that 78.6% of teachers indicated inadequacy of TLM. Their studies established that inadequate IM affected performance of primary national examination because TLM promoted better understanding of concepts thus better performance in examination. Nevertheless, Gichohi's purpose was to investigate the institutional factors affecting pupils' retention in public primary schools as compared to the purpose of this study which was to find out the influence of instructional materials on acquisition of mathematical competencies among grade one learners. In addition, the study adopted a survey research design owing to its versatility and generalization as contrasted to correlation research design which this study adopted. As Gichohi's study focused on secondary school final national examinations, this study focused on grade one acquisition of mathematical competencies. Therefore, there was a gap to be filled in Nakuru East Sub County to find out whether utilization of instructional materials influenced acquisition of mathematics competencies.

1.1 Purpose of the Study

The purpose of this study was to investigate the influence of different types of mathematics instructional materials on acquisition of mathematics competencies among grade one learners.

2. Research Methodology

This study adopted correlation research design. This design was appropriate because it allowed testing the relationship variables and making predictions. Thus the design allowed the researcher to check the relationship between influences of instructional materials on acquisition of mathematics competencies. This was through an observation between a checklist before and after the utilization of instructional materials among grade one learners.

The targeted population was grade one learners in both private and public primary schools. There are 62 public primary schools and 72 private primary schools in Nakuru East Sub County. Public primary schools had 3630 grade one learners while private primary schools had 3721 learners. Since most of lower primary school teachers teach all the activity areas, all the grade one teachers were targeted. Nakuru East Sub County has 66 teachers in public primary schools and 74 teachers in private primary schools.

This study used three sampling techniques; purposive, stratified sampling and random sampling technique. Nakuru County and Nakuru East Sub County were purposively selected owing to the previous information about poor performance of mathematics (Uwezo, 2011). Stratified and random sampling was used to sample the

schools. Therefore, public and private schools formed the two strata. Randomly, a proportional sample size was drawn from both the private and public primary schools. For schools with more than a stream, random sampling was used to select a class. Teachers in the selected grade one classes were automatically part of the sampled population.

2.1 Instrumentation

Data was gathered using a classroom observation schedule, interview schedule and an observation checklist. These instruments were considered the most appropriate in collecting data which enabled investigation of influence of IM on acquisition of mathematical competencies among grade one learners. The instruments were pre-tested to allow for necessary adjustments and corrections. Piloting also enhanced the validity and reliability of the instruments for accurate data collection. Validity was tested using content validity for comprehensive coverage of study purpose while reliability was measured using test-retest. Pearson product moment correlation coefficient was used to correlate the repeated tests and obtained a coefficient of 0.77 and hence the tools were deemed reliable.

3. Findings and Discussions

This study sought to establish the influence of instructional materials on development of mathematics competencies. To achieve this objective, a learners' competency checklist was prepared during piloting. With the help of the teachers in the piloted schools and grade one curriculum design, different skills were included in the learners' competency checklist including rote counting, number recognition, geometry/shape recognition among others. The checklist prepared during piloting was used in the sampled schools during the first visit to schools to check learners' competency at the beginning of the study. To establish whether there was development of mathematics competencies, a similar competency checklist with little alterations was prepared and used to check learners' competency three weeks after the first one. Table 1 below presents the results of learners' competency during the first visit to the sampled schools.

Table 1: Learners' Mathematics Competency Checklist at the Beginning of the Study

Math Skill	School Category		Those Capable				Not Capable			
			Public		Private		Public		Private	
	F	%	F	%	F	%	F	%		
Rote counting	489	89	513	91	56	11	46	9		
Geometry/Shape recognition	462	83	492	88	83	17	67	12		
Number arrangement	412	76	463	83	133	24	96	17		
Addition	401	74	441	79	144	26	118	21		
Subtraction	345	63	445	80	200	37	114	20		
Recognition of Kenyan Currency	413	76	485	87	132	24	74	13		
Recognition of Numbers	382	70	474	85	163	30	85	15		
Filling-in missing numbers	361	66	478	86	184	34	81	14		

Putting together objects	404	74	494	88	141	26	65	12
Counting shaded parts	410	75	503	90	135	25	56	10

Table 1 above was a learners' checklist prepared during piloting by the researcher with the help of teachers in the piloted schools. The skills included in the competency checklist were derived from grade one curriculum design. The results in this competency checklist were compared with the results in a similar competency checklist done by grade one learners three weeks later. The skills in the latter competency checklist were similar to those in the first one but with little alterations.

Table 2: Learners' Second Mathematic Checklist Results

Math Skill	School Category		Those Capable				Not Capable			
			Public		Private		Public		Private	
	F	%	F	%	F	%	F	%		
Rote counting	513	94	532	95	32	6	27	5		
Geometry/Shape recognition	506	93	519	93	39	7	40	7		
Number arrangement	422	77	515	92	123	23	44	8		
Addition	479	88	509	91	66	12	50	9		
Subtraction	424	78	499	89	121	22	60	11		
Recognition of Kenyan Currency	482	88	517	92	63	12	42	8		
Recognition of Numbers	459	84	515	92	86	16	86	8		
Filling-in missing numbers	420	77	524	94	125	23	35	6		
Putting together objects	492	90	537	96	53	10	22	4		
Counting shaded parts	471	86	539	96	74	14	20	4		

Table 2 presents results of a learners' competency checklist carried out three weeks after the first one. Capability in the skill was measured using points the learner got correctly. If a learner was capable of scoring six points and above, he was considered having acquired mathematics competence. Another way in which acquisition of mathematics competencies were measured was by comparing the number of learners who are capable of performing skills in both competency checklists. The results, as it can be seen from Table 1 and Table 2 showed that, the number of learners capable in the latter competency checklist was bigger than the number of learners in the first competency checklist. The results were shown by comparing the scores of learners in both competency checklists. Pearson's product moment co-efficient was used to tabulate the correlation between utilization of instructional materials and development of mathematics skills. Table 3 below presents the results.

Table 4.9: Mean, Standard Deviation and Correlation Coefficient of Mathematics Competencies

Mean in the first checklist (N)	443.4
Mean in the second checklist (N)	488.7
Standard deviation from mean of first checklist	28.9
Standard deviation from mean of second checklist	23.7
Correlation Coefficient	+0.77

Table 3 presents the relationship between utilization of instructional materials and development of mathematics skills. The results show that there was increased mean in the second competency checklist. This implied that learners in the second competency checklist improved in the scores. The results also showed a positive correlation coefficient of +0.77 which implied that there was a relationship between utilization of instructional materials and development of mathematics skills.

The findings of this study agreed with findings of a study in Germany by Mischo & Maab (2013) that revealed that teaching and learning materials improved development of mathematical skills that led to acquisition of mathematics competencies. The findings of this study also confirmed the findings by Leone et al (2010) in USA who found out that, instructional materials created a favorable learning condition and a classroom climate that engaged learners in their learning. Their study revealed that a favorable classroom climate correlates to a positive attitude towards what is being engaged in, thus, positive results.

This study also revealed that there are learners with low scores and these learners added very few points in the latter competency checklist. This could have been as a result of inadequate instructional materials in the classroom which could lead to inappropriate teaching methods. These findings agree with Yeboah's (2011) findings in Ghana in a report that student teachers, upon being released in the field for teaching practice, never found any of the experienced teachers teaching with any teaching and learning materials. This shows that scoring good points in any form of assessment correlates with proper and appropriate teaching method. Njenga's (2014) findings in Nakuru North Sub County confirmed that, private primary schools had higher scores than public primary schools that could have led to better academic performance in private schools. Njenga's findings conclude that, utilization of instructional materials during teaching and learning correlates with development of mathematics skills which promotes acquisition of mathematics competencies.

4. Conclusion

It was evident from the study findings that instructional materials influenced development of mathematical skills. This was revealed by the increase of the mean score in the second competency checklist after the treatment period. Therefore, it can be concluded that instructional materials influence acquisition of mathematics competencies.

4.1 Recommendations

The government, through the Ministry of Education, should ensure early disbursement of funds meant for the provision of instructional materials in public primary schools. This would ensure purchase of enough instructional materials and avail them to learners as early as the term begins. In addition, the Ministry of Education, through the District Quality Assurance Officers (DQASO) should ensure that the head teachers buy the right and adequate textbooks.

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Nzii Priscilla Mueni is a professional early childhood educator with over ten years experience in early childhood education programs. She has taught preschoolers both inside and outside classroom environment and boasts of a wide experience in use of instructional materials to teach different preschool subject areas. Nzii is currently a lecturer and instructional coach at a private early childhood education teachers training college.

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