

Influence of Learning Materials on Preprimary Children's Performance in Science in Tharaka Nithi County, Kenya

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Cite this article in APA

Mugambi, M. M., Ngaruiya, B., & Kahiga, R. (2026). Influence of learning materials on preprimary children's performance in science in Tharaka Nithi County, Kenya. *Journal of education and learning*, 5(1), 16-31. <https://doi.org/10.51317/jel.v5i1.904>



A publication of Editon Consortium Publishing (online)

Article history

Received: 2025-12-25

Accepted: 2026-01-15

Published: 2026-02-23

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Abstract

The purpose of this study was to examine how the use of learning materials influences pre-primary children's performance in science in Tharaka Nithi County. Although early science education is widely acknowledged as a foundation for later academic success, questions remain about the sufficiency and proper use of instructional resources in pre-primary classrooms. The research was framed using Brown's Situated Learning Theory and employed a descriptive survey design. The study population included 240 preschools, 505 teachers, and 5,326 PP2 learners from Meru South, Maara, and Tharaka sub-counties. Stratified sampling was used to select 36 preschools based on geographic location, and purposive sampling was used to select 211 teachers. Data were collected using teacher questionnaires, documentary analysis, and an observation checklist for learners. Instruments were piloted in five preschools outside the study sample. Quantitative data were summarised using frequencies and percentages, and Pearson's correlation, along with linear regression, was employed to assess the relationship between learning resources and learner achievement. The findings indicated that the use of learning materials had a statistically significant, positive influence on children's performance in science activities compared with other instructional management practices examined. The study concluded that appropriate selection and effective utilisation of learning materials substantially enhance science learning outcomes in pre-primary education. It recommends increased support from the Ministry of Education to ensure adequate provision and proper use of instructional resources, thereby strengthening early science education and improving long-term academic achievement.

Key terms: Learning materials, pre-primary education, science performance, instructional resources.

INTRODUCTION

Science is viewed as one of the most significant subjects children can learn, as it is very relevant to our lives. The science subject also provides learners with the capacity to apply the crucial skills to everyday activities. Science is a discipline that deals with observation, calculations, and measurements in efforts to solve problems, answer puzzling questions, and understand the natural world (Buyuktaskapu, 2011). There is a need for better science education in pre-primary schools to assist today's learners in developing the new knowledge, reasoning abilities, and problem-solving skills required for the rapidly technological world (Johnson & Adams, 2011).

Adequate instructional materials have been identified as a contributor to the quality of learning and overall performance of learners in science-related subjects (Musau & Abere, 2015). However, some of the teachers lag behind in utilising the said instructional materials. Some schools lack the materials; others have the materials but are inadequate; others lack the specialised personnel to handle them; and others lack the required infrastructure to support them (Nyamai, 2015). How effectively teachers utilise the instructional materials in teaching science is as important as having the materials themselves.

Although the challenges in learning science skills in pre-primary schools in Kenya continue to hamper the education system, the Ministry of Education, Science and Technology (MoEST) regularly addresses curriculum and instructional issues. This has led to the introduction of the competency-based curriculum in primary schools to address the gaps in the current curriculum. Further, the county governments have taken the initiative to provide teaching materials and employ teachers for the pre-primary schools; however, despite these interventions, they seem not to address instructional management in classrooms. Despite these efforts, learners' dismal performance in science has been reported in preschools in Tharaka Nithi County (Mugure, 2018; Nkirote & Thinguri, 2020). Studies have examined contextual and teacher factors affecting the teaching of science in primary schools, but little has been done on the approach to teaching science in pre-primary schools. It is not clear how instructional management methods, independently and collectively, affect children's performance in

science at the preschool level in Tharaka Nithi County and Kenya at large. This is because Tharaka Nithi County reported low performance of pupils in science in KCPE, and thus the study aims to establish if the problem stems from the preschool level. Thus, this study sought to establish the influence of learning materials on pre-primary children's performance in science in Tharaka Nithi County.

LITERATURE REVIEW

Incorporating teaching and learning materials enables children to grasp abstract concepts, enhance problem-solving abilities, and cultivate critical thinking skills. They teach the concept of number (building blocks). Instructional materials also encourage collaboration in solving problems by having children work in groups to discuss and solve problems together. Children are also able to interact with others, adapt to new technology and think logically (Dong, 2016). The availability of varied instructional materials and equipment is crucial for science learning, play, and child development. Teachers should regularly provide children with materials such as pencils, glue, scissors, sticks, tape, and rulers. Providing materials such as corn, flour, clay, and water enables children to engage in skill-building activities and enhances their creativity and imagination. Young children should be encouraged to interact with teaching and learning materials regularly (Monda, 2012). The availability and use of these resources depend on the teacher's ability to acquire and use them in the teaching process. If the teacher cannot access the resources, learners are disadvantaged, as they cannot benefit from them. As such, this study intends to establish how the materials can be applied in the teaching of science at the preschool level.

A conducive classroom environment is essential for effective classroom interaction (Dörnyei & Muir, 2019). Classroom interaction encompasses a broad range of factors that contribute to a good classroom atmosphere, including educational concepts, the physical setting, the psychological environment created through social contexts, and numerous instructional components related to teaching characteristics and behaviours. The classroom environment affects the motivation and attitudes of students who interact; both the physical space and the dynamics of routines, activities, and people within the

classroom impact performance and behaviour (Franklin & Harrington, 2019). A teacher also plays an important role in the classroom by creating an interactive environment. Learners often replicate their teacher's actions. Therefore, a teacher-created, cheerful and welcoming environment can encourage students to feel happy. A teacher's environment can be either positive or negative. If students sense the teacher is angry, they may react negatively, which can impair learning. Teachers oversee and influence their students' social conduct; therefore, this behaviour primarily reflects the teachers' actions and the environment they create.

Reading materials, textbooks and teaching aids should be adequate and available in all preschools and for each and every preschooler (Andiema, 2016). The way the books are presented and typed can also affect learners' learning. The concepts presented in the texts should be further supported by examples and illustrations, and these examples should serve as cognitive support for learners. The examples and illustrations should be relevant and help learners connect what is written with what is illustrated, as well as with their personal real-life experiences. This implies that it's not only the materials that are important, but also their form and content. For preschoolers, the availability of well-designed materials has been found to positively influence their performance. This study aims to examine how the use of learning materials affects children's performance in science.

The use of adequate and varied instructional resources in preschool classes stimulates learners' attention and maintains their curiosity (Yıldırım & Akamca, 2017). This enables learners to stay focused and motivated in their science learning. Adequate, well-formatted instructional resources pique learners' interest in learning the sciences. In science classrooms, the instructional resources should be plentiful and sufficient for all learners to interact with. This ensures that at no point in a classroom is any learner idle due to a lack of resources, so learning occurs simultaneously for all learners. The adequacy of the teaching resources is the result of the combined efforts of the county government and the preschool management. Whether the resources are available, appropriate, and adequate depends on the commitment of the two.

Bewa (2016) identified factors affecting learners' poor performance in science, including a lack of learning materials and teachers, a poor attitude towards the subject, and poor teaching methods. The study concluded that teachers' lack of pedagogical skills is affecting learning. Whether it is a lack of teaching competence or the difficulty of the science subject itself that contributes to poor academic performance, reports have shown that academic achievement is related to teaching practices (Blazar, 2016; Johnson, 2017). School curricula were recalibrated to adjust and improve the way science is taught, in the belief that this would improve academic outcomes.

Tety (2016) indicated that the shortage of instructional resources hindered effective utilisation. This is supported by Usman (2016), in a study on factors affecting the availability, acquisition, and utilisation of resources in the teaching of English in selected secondary schools in Kenya, which found that the unavailability of educational resources hinders effective utilisation. However, Awuor (2015) noted that schools with abundant resources may not always utilise them efficiently and, consequently, fail to raise learners' performance levels. On the other hand, schools with limited resources may utilise what they have efficiently, which may boost learning; thus, learners should maximise available resources to adequately achieve educational objectives. The utilisation of available resources is more important than the quantity. This is supported by Usman (2016), who points out that it is not making resources available to schools that matters, but getting those resources utilised by teachers and learners to learn academic content.

Heo and Toomey (2020) emphasised that the availability of relevant educational resources contributes to academic achievement, and that unattractive school buildings, crowded classrooms, the absence of playing grounds, and surroundings lacking aesthetic beauty can contribute to poor academic achievement. In a study examining educational resources and student performance in Kenya, Kalkan et al. (2020) found a significant positive relationship: better-resourced schools performed better academically. Similarly, Babalola (2011) reported that private schools outperformed public schools due to more adequate teaching and learning materials.

Onasanya and Omosewo (2010) investigated the impact of using both standard and improvised instructional materials on the academic achievement of secondary school students in Physics in Ilorin, Nigeria. The sample consisted of selected Secondary Schools in Ilorin Metropolis of Kwara State. The research employed a quasi-experimental pretest-posttest non-randomised control group design. Two hypotheses were evaluated at the 0.05 significance level. The study found that (1) students instructed with standard materials performed significantly better than those using improvised materials ($t = 4.09$, $df = 14$, $p = 0.05$), and (2) no significant difference was found between the experimental and control groups' posttest scores. This shows that the improvised instructional materials did not differ in academic ability between the male experimental and control groups ($t = 1.23$, $df = 7$, $p = 0.05$). The implications of improvised instructional materials were discussed. Recommendations for improving standard and improvised instructional Aids in the teaching of physics, and suggestions for further studies, were made.

Instructional materials are very important throughout the teaching and learning process for any subject. They make learning more pleasant for learners by offering a sense of reality, which stimulates self-activity and imagination. According to Jayawardena et al. (2020), instructional materials support conceptual thinking and reduce learners' irrelevant responses. Likewise, Ajoke (2017) emphasised that such materials facilitate teaching and learning by providing information essential for skill and knowledge acquisition. Ajoke (2017) outlined that, apart from teachers, instructional materials are the most important resources needed at the classroom level. If the curriculum is to succeed, the preparation and production of instructional materials must be handled with utmost care.

The Ministry of Education and Vocational Training is responsible for establishing criteria for evaluating and ensuring that only high-quality instructional materials are selected to support teaching and learning in the classroom. It is expected that quality instructional materials shall correspond to the curricula and syllabi, be piloted in pilot schools, promote competences intended for learners, be sufficient, adequate,

interesting, and learner-friendly, especially for learners with special needs. Textual Materials include printed materials such as textbooks, syllabi, modules and manuals, reference books, charts and maps, newspapers, journals and encyclopedias, texts in Braille, posters, fliers, photographs, booklets and brochures. On the other hand, non-textual materials include laboratory apparatus, prototypes, Braille machines, writing boards, weather stations, and samples of actual materials; ICT resources such as computers, internet connectivity, photocopying machines, printers, and scanners.

Isola (2019) investigated the effects of improvised and conventional instructional materials on pupils' academic achievements and attitude to Basic Science. The study adopted an experimental design incorporating both pretests and posttests. Random sampling was used to select 3 of the 10 co-educational primary schools in the Wase Supervisory Zone of Wase LGA, Plateau State. The sample of 120 primary 5 pupils was selected using a table of random numbers. The selected schools were randomly assigned to experimental group I, experimental group II and control group. The experimental group I was exposed to improvised materials, and the experimental group II was taught with conventional instructional materials.

Learners in the control group were taught using lectures as the primary instructional strategy. The instruments used for data collection were the Basic Science Achievement Test (BSAT) and the Basic Science Attitude Questionnaire (BSAQ), with reliability coefficients of 0.73 and 0.83, respectively. The study tested three hypotheses at the 0.05 significance level using analysis of variance (ANOVA), t-tests, and the Wilcoxon Signed-Rank Test. The findings showed that pupils taught with improvised and conventional materials had no significant difference in their mean scores, but did show a significant difference compared with the control group. In addition, no significant difference in pupils' attitude before and after exposure to improvised materials compared with those exposed to conventional instructional materials. Based on this finding, it was recommended that Basic Science teachers should be trained through workshops on how to effectively design and use improvised materials in teaching Basic Science.

Usman and Saminu (2017) conducted a study on the effects of using an improvised weighing balance on the solution of linear equation problems and learners' attitudes towards mathematics in junior secondary schools in Niger State, Nigeria. The study sought to determine the effects of using improvised instructional material (a weighing balance) in solving linear equations and learners' attitudes toward mathematics in Junior Secondary Schools in Niger State. The study adopted a pre-test, post-test, control-group quasi-experimental design. Six of 224 junior secondary schools in the state were sampled across the state's three educational zones. Two hundred and ten learners were used for the study. Linear Equation Performance Test (LEPT) and Learner Mathematics Attitude Scale Test (SMASST) are used as instruments for the research. T-test, group mean, and percentage mean scores were used for data analyses. The findings established positive effects of using a weighing balance in solving linear equations and learners' attitudes towards mathematics.

Finally, some recommendations such as Mathematics teachers especially those teaching in Junior Secondary Schools should link theories with practical, to enable the learners get proper concepts of mathematics and discourage rote learning and cramming of procedures of obtaining solutions without proper understanding and Government should sponsor teachers for workshop, seminars and further studies to make them be mathematics teachers who can think mathematically as well as develop improved skills and competencies for effective teaching of the subject and in-turn, be able to foster mathematics mindedness in the learners.

Obodo et al. (2020) on the comparative effect of using an improvised free-fall apparatus and bomb calorimeter in teaching the concept of enthalpy in Nigerian Senior Secondary Schools Chemistry. This study aimed to determine how effective an improvised free-fall apparatus and a bomb calorimeter are in teaching enthalpy. The study was in response to Call 23, which called for the deployment of materials within learners' immediate environment as a means of addressing the persistent shortage of learning resources for the teaching of Chemistry in Nigerian secondary schools. The study involved 93 Senior Secondary Two (SS2) chemistry students. This sample

comprised 48 females and 45 males from four secondary schools in the Calabar Educational Zone of Cross River State, Nigeria. A pretest-posttest control group design was used for the study. Data were analysed using ANCOVA, which revealed that the improvised free-fall apparatus enhanced learners' chemistry performance more effectively than the bomb calorimeter. The result also showed no significant difference in performance between male and female learners when taught the concept of enthalpy using a free-fall apparatus.

Achor (2011) investigated the relative efficacy of improvised and manufactured analogue voltmeters in secondary school physics. A pre-test/post-test control-group quasi-experimental design was used. This is because learners were not randomly selected; rather, an intact class was used. Senior Secondary (SS) two classes were selected for use, being the most stable class, quite unlike the SS1, which is newly introduced to the subject or SS3, which is preparing for external examination. The (standardised) improvised and manufactured equipment was used to teach experimental group 1 and 2 learners on how to take measurements of voltage, respectively, while the control group was taught using an alternative to practical (i.e. conventional method). Data collection was conducted using the PATVM, and analysis was performed with ANCOVA. A significant difference existed between learners taught voltage measurements using a manufactured voltmeter, an improvised voltmeter and the conventional method. The Scheffe tests carried out to determine the direction of significance showed that the difference in learners' achievement between those taught using manufactured and conventional methods, as well as those taught using improvised analogue voltmeters and conventional methods, was significant. However, the mean difference between the two experimental groups was not statistically significant.

One of the key recommendations of the study was that teachers should provide students with hands-on experiences and utilise improvised models when commercially manufactured ones are unavailable for teaching physics. The aspect of standardisation of the improvised instructional resources was completed and reported elsewhere. Based on the finding that improvised resources compare favourably with the

manufactured ones, the present study assumed the usability of the improvised instructional materials.

Adeyemi and Olaleye (2010) investigated the effect of learners' involvement in the production of instructional materials on their academic performance in Biology. A pre-test post-test control group quasi-experiment design was used. An intact class of one hundred and twenty (120) learners of the SS2 class was used. A sample of sixty (60) learners, constituting the experimental group, were taught using produced models, while the control group of sixty (60) learners used already prepared pieces of bones. Data was collected using the Biology Achievement Test for Instructional Materials (BATIM) and were analyzed using ANCOVA.

A significant difference existed between learners taught Biology using produced models and those taught Biology using already prepared bones. The Scheffe tests carried out to determine the direction of significance showed that the difference in learners' achievement between those taught Biology using produced models and those taught using already prepared bones was significant. The need for teachers to provide practical experience in teaching Biology was the study's major recommendation. Based on the finding that learners' involvement in the production of instructional materials impacted their academic performance in Biology, the present study assumed the usability of the improvised instructional materials. This study is related to the present learner in terms of the independent variables, but differs in the subject area used for study and location.

Mupa and Chinooneka (2015) explained that an effective science lesson is characterised by the use of resources available to accomplish the purpose of the lesson (Bukoye, 2019), and other stakeholders are even advocating for the use of high-quality teaching and learning resources for achieving the purpose of science education (Bybee & Chopyak, 2017). In using (real) objects, teaching becomes effective when learners interact in small groups. Such instruction makes learners work cooperatively, share their learning and pool their knowledge (Adu-Gyamfi et al., 2020). Hence, for teachers to be effective, they need to provide learners with enough learning experiences. Rosenshine (2012) reported that teachers use

instruction to help learners efficiently acquire, rehearse and connect background knowledge. In such instructions, teachers provide support by modelling, guiding learner practice, helping learners to overcome their errors, providing scaffolds for difficult tasks and providing enough practice and review. According to Bakar (2017), teachers use technology in the form of a management system to reduce their workload and to support monitoring and tracking the progress of learners. Hence, education leaders are looking for resources to support learners to make meaning of the world as to how the scientists see it (Bybee & Chopyak, 2017).

Kodriyah et al. (2020) note that, historically, teachers have often relied heavily on verbal explanations to communicate ideas in the classroom, a practice known as the 'chalk-talk' method. With modern technological advancements, it is now possible to create instructional materials and devices that reduce excessive teacher talk while making lessons clearer, more engaging, and easier for learners to comprehend. According to Rahmar et al. (2020), graphics include charts, posters, sketches, cartoons, graphs and drawings. Graphics communicate facts and ideas clearly through a combination of drawings, words and pictures. The use of graphics in teaching adds clarity to the materials being studied. They help to visualise the whole concept learned and its relationships with one another.

Researchers provide proof that even the learners who were very behind in science instruction, the provision of adequate and good learning resources led to an improvement in their performance in the sciences (Engle et al., 2011). Interventions such as the provision of learning materials have proven effective in predicting the outcomes of the learners in sciences and other subjects as well. Andiema (2016) stated that for preschool learners to adequately grasp science concepts, they must be provided with adequate teaching materials to improve their level of learning, as well as enable them to recognise symbols, numbers, shapes and the values of the numbers. Despite the fact that classroom interaction plays a significant role in the understanding of science concepts, there is a lack of consensus on the best methods of instructional management for science in preschools. An empirical study aimed at establishing the effectiveness of

instructional management methods applied by preschool teachers in teaching sciences at a preschool level would fill the knowledge gap.

FINDINGS AND DISCUSSION

The respondents were required to indicate their level of agreement to a 5-point Likert scale where S.A= Strongly Agree, A=Agree, U = Undecided, D=Disagree, S.D=Strongly Disagree. The findings from the analysis are shown in Table 1.

Table 1: Teachers' Opinion on how the Use of Learning Materials affects the Performance of learners in Science

Statements	SA 5	A 4	U 3	D 2	SD 1	WA
In my class, the science teaching materials are adequate for all the learners in the classroom	11.1	19.4	2.8	57.8	25.0	2.499
The availability of the learning materials has eased the process of teaching science skills to the learners	33.3	52.8	5.6	5.6	2.8	4.085
The teaching materials available are congruent with the requirements of the competency-based curriculum	19.4	52.8	5.6	19.4	2.8	3.804
The teachers are able to handle the teaching materials that are in the classrooms	38.9	47.2	0	6.9	6.9	4.04
The available teaching materials are adequate for science curriculum delivery in the classrooms	16.7	50.0	5.6	19.4	8.3	3.474
The use of learning materials has led to improvement of learner's performance	55.6	25.0	5.6	2.8	11.1	4.115
The preschools have received the recommended books and reading materials from the ministry of education	8.3	55.6	8.3	16.7	11.1	3.333

A weighted average score ranging from 4.20 to 5.00 meant that the respondents strongly agreed with the statement, a weighted average of 3.40 to 4.19 meant that the respondents agreed. A weighted average score ranging from 2.60 to 3.39 meant that the respondents were undecided about the statement. A weighted average score ranging from 1.80 to 2.59 meant that the respondents disagreed with the statement. Respondents with a weighted average between 1.00 and 1.79 were considered to strongly disagree.

The study established that the majority (57.8%) of the respondents disagreed that the classrooms had science teaching materials that were adequate for all the learners in the classroom. The implication is that the science instruction materials were not adequate, as was revealed by a low weighted average of 2.499 that was obtained. These findings agree with Musau and Abere (2015), who opined that adequate

instructional materials have been identified as a contributor to the quality of learning and overall performance of learners in science-related subjects. However, some of the teachers lag behind in the utilisation of the said instructional materials.

The study further established that the availability of the learning materials has eased the process of teaching science skills to the learners, as was indicated by 52.8 per cent of the respondents who agreed. These findings imply that the teaching and learning materials that are available in the classrooms have made it easy for the teachers to teach English, as was revealed by a high weighted average of 4.085 that was obtained. The study agrees with the sentiments of Nyamai (2015), who stated that some schools lack the materials, others have the materials but are inadequate, and other schools lack the specialised personnel to handle the materials, while others lack the required infrastructure to support the materials.

How effectively the teachers utilise the instructional materials in teaching science is as important as having the materials.

The study further established that the teaching materials available in the classrooms are congruent with the requirements of the competency-based curriculum, as was revealed by 52.8 per cent of the respondents who agreed. The implication is that the materials currently in use in preprimary schools in Kenya are valid as per the curriculum, as was indicated by a high weighted average of 3.804 that was obtained. These findings agree with the sentiments of Monda (2012), who opined that young children should be encouraged to interact with teaching and learning materials regularly. The availability and use of these resources depend on the teacher's ability to acquire and use them in the teaching process. If the teacher cannot acquire or access the resources, the learners are disadvantaged, as they cannot reap the benefits.

The study further established that the teachers were able to handle the teaching materials that are in the classrooms, as was revealed by 38.9 per cent and 47.2 per cent of the respondents who strongly agreed and agreed, respectively. The implication is that the teachers in preprimary schools were able to use the available instructional materials effectively, to ease learning, as was revealed by a high weighted average of 4.040 that was obtained. The findings agree with the sentiments of Andiema (2016), who was of the opinion that reading materials, textbooks and teaching aids should be adequate and available in all preschools and for each and every preschooler. The manner in which the books are presented and typed can also affect the learners' learning. The concepts projected in the texts should be further supported by examples and illustrations, and the examples should be the cognitive support for the learners. The examples and illustrations should be of relevance and should help the learners connect what is written and what is illustrated in the examples, as well as their personal real-life experiences.

The study further established that the majority (52.8%) of the respondents agreed that the available teaching materials are adequate for science curriculum delivery in the classrooms. These findings implied that most of the schools had adequate teaching materials for the

learners to use in learning science, as was revealed by a weighted mean of 3.474 that was obtained. The findings agree with the opinion of Bewa (2016), who indicated the factors affecting the poor performance of learners in science, such as a lack of learning materials and teachers, a poor attitude of learners towards the subject, and poor teaching methods. The study concluded that the lack of pedagogical skills of teachers affects learning. Whether it is the lack of teaching competence or the hard nature of the science subject itself that contributes to poor academic performance, reports have shown that academic achievement has something to do with teaching practices (Blazar, 2016; Johnson, 2017). Recalibration of school curricula was made to adjust and improve the way science is taught, in the belief that it will improve academic outcomes.

The study also established that the majority (55.6%) of the respondents strongly agreed that the use of learning materials has led to improvement in learners' performance. These findings are further supported by the sentiments of Andiema (2016), who stated that for preschool learners to adequately grasp science concepts, they must be provided with adequate teaching materials to improve their level of learning, as well as enable them to recognise symbols, numbers, shapes and the values of the numbers. Despite the fact that classroom interaction plays a significant role in the understanding of science concepts, there is a lack of consensus on the best methods of instructional management for science in preschools. The relationship between teachers and learners should be based on affection and love on the one hand, and on the other hand, it is based on authority and order (Talebi et al., 2015). In a well-coordinated classroom environment, teachers and managers can make the best educational decisions in a disciplined way.

The study further established that 55.6 per cent of the respondents agreed that the preschools have received the recommended books and reading materials from the Ministry of Education. These findings are further revealed by a weighted average of 3.33 that was obtained. These findings agree with the sentiments of Tety (2016), who indicated that the shortage of instructional resources hindered effective utilisation. This is supported by Usman (2016) in a study on factors affecting the availability, acquisition, and

utilisation of resources in the teaching of English in selected secondary schools in Kenya, who found that the unavailability of educational resources hinders effective utilisation. However, Awuor (2015) noted that schools with abundant resources may not always utilise them efficiently and consequently fail to raise learners' level of performance. On the other hand, schools with limited resources may utilise what they have efficiently, and this may boost learning; thus,

learners should be able to maximise and utilise available resources so as to adequately achieve educational objectives. The utilisation of available resources is more important than the quantity. This is supported by Usman (2016), who points out that it is not making resources available to schools that matters, but getting those resources utilised by teachers and learners to learn academic content learned.

Table 2: Observation Data on Use of Learning Materials and Performance of Learners in Science

Variable	Rating of Teacher Effectiveness in: Use of Learning Materials					Weighted Mean
	VP 1	P 2	A 3	G 4	VG 5	
Content in the material						
Adherence to the curriculum	0	13.9	5.6	63.9	16.7	3.837
Legibility of the materials	0	0	25.0	19.4	55.6	4.306
Ease of use by learners	5.6	11.1	11.1	61.1	11.1	3.610
Adequacy of the materials						
Material sharing	8.3	13.9	16.7	52.8	8.3	3.389
Accessibility to the learning resource	11.1	16.7	16.7	41.7	13.9	3.309
Clarity of the resources	0	2.8	22.2	25.0	50.0	4.222
Teachers' ability to use resources						
Teacher training on resource use	5.6	8.3	13.9	44.4	27.8	3.805
Teacher understanding of the resource	8.3	11.1	8.3	52.8	19.4	3.606
Teacher attitude towards the resource	5.6	13.9	13.9	38.9	27.8	3.697

A weighted average score ranging from 4.20 to 5.00 meant that the rating was very good; a weighted average of 3.40 to 4.19 meant that the rating was good. A weighted average score ranging from 2.60 to 3.39 meant that the rating was average. A weighted average score ranging from 1.80 to 2.59 meant that the rating was poor. A weighted average of 1.00 to 1.79 meant that the rating was very poor.

The researcher established that on the content materials, most (63.9%) of the schools adhered to the stipulated curriculum, as guided by the Kenya Institute of Curriculum Development. Only 13.9 per cent of the schools did not strictly adhere to the curriculum. These findings further reveal that a weighted average of 3.837 was obtained, and this implies that the teachers

were rated as 'good' in adherence to the curriculum. These results support Heo and Toomey's (2020) assertion that access to relevant educational resources enhances academic achievement, while poorly maintained school facilities, overcrowded classrooms, lack of playgrounds, and aesthetically unappealing surroundings can negatively affect student performance. Further, Kalkan et al. (2020) observed that in Kenyan schools, the presence of instructional resources was strongly and positively associated with students' academic outcomes. According to him, schools with more resources performed better than those with fewer resources. This aligns with Babalola (2011), who found that private schools performed better than public schools

because they had more sufficient instructional resources.

The study further established that most (55.6%) of the schools had reading materials that were very legible. The study further established that 61.1 per cent of the schools had reading materials that were easy to use by the learners in the preschools, in learning science. The findings further posted a weighted average of 4.306, thus implying that most of the classrooms were rated as 'very good' on legibility of the reading materials. These findings agree with the findings of a study carried out by Onasanya and Omosewo (2010) on the effect of using standard instructional materials and improvised instructional materials on Secondary School Learners' Academic Performance in Physics in Ilorin, Nigeria. The sample consisted of selected Secondary Schools in Ilorin Metropolis of Kwara State. The research employed a quasi-experimental design of the pretest-posttest non-randomised control group design. Two hypotheses were designed and tested at a 0.05 level of significance. The analysis revealed the following: (1) learners taught using standard instructional materials scored significantly higher on the posttest than those taught with improvised materials ($t = 4.09$, $df = 14$, $p = 0.05$); (2) no significant difference was observed between the posttest scores of the experimental and control groups. This shows that the improvised instructional materials did not differ in academic ability between the male experimental and control groups ($t = 1.23$, $df = 7$, $p = 0.05$). The implications of improvised instructional materials were discussed. Recommendations for the improvement of standard instructional and improvised instructional Aids in the teaching of physics and suggestions for further studies were made.

On the adequacy of the reading materials, the researcher established that 52.8 per cent of the schools shared the reading materials, which meant that they were not adequate. The overall implication is that the teaching and learning materials available in the classrooms were rated average, as was revealed by a weighted mean of 3.389 that was obtained. Instructional materials are very important in the whole process of teaching and learning any subject. By providing real-life experiences, instructional materials make learning more engaging, promote self-activity and imagination, and help students develop

conceptual understanding while minimising irrelevant responses (Jayawardena et al., 2020). Ajoke (2017) also highlighted that these materials facilitate the teaching-learning process by delivering the necessary information for acquiring knowledge and skills.

Ajoke (2017) outlined that, apart from teachers, instructional materials are the most important resources needed at the classroom level. If the curriculum is to succeed, the preparation and production of instructional materials must be handled with utmost care. The Ministry of Education and Vocational Training is responsible for putting in place criteria for evaluating and ensuring that only quality instructional materials are selected to support teaching and learning in the classroom. It is expected that quality instructional materials shall correspond to the curricula and syllabi, be piloted or tried out in pilot schools, promote competences intended for the learners, be adequate, interesting and learner-friendly, especially for the learners with special needs. Textual Materials include printed materials such as textbooks, syllabi, modules and manuals, reference books, charts and maps, newspapers, journals and encyclopedias, texts in Braille, posters, fliers, photographs, booklets and brochures. On the other hand, non-textual materials include laboratory apparatus, prototypes, Braille machines, writing boards, weather stations and samples of actual materials, ICT resources such as computers, internet connectivity, photocopying machines, printers and scanners.

The study further established that in 41.7 per cent of the schools, the learning resources in the schools were accessible to the learners during the science instruction lessons. A weighted average of 3.309 reveals that the rating of the accessibility of learning resources in the schools was average. Similarly, Isola (2019) investigated the effects of improvised and conventional instructional materials on pupils' academic achievements and attitude to Basic Science. The study employed an experimental design with pretest and posttest measures. Three schools were randomly selected from the ten co-educational primary schools in the Wase Supervisory Zone of Wase LGA, Plateau State. The sample of 120 primary 5 pupils was selected through the use of a table of random numbers. The selected schools were randomly assigned to experimental group I, experimental group

II and control group. The experimental group I was exposed to improvised materials, and the experimental group II was taught with conventional instructional materials. The control group received instruction through the lecture method. The instruments used for data collection were the Basic Science Achievement Test (BSAT) and the Basic Science Attitude Questionnaire (BSAQ), with reliability coefficients of 0.73 and 0.83, respectively.

Three hypotheses were tested at the $P < 0.05$ significance level using Analysis of Variance (ANOVA), t-tests, and the Wilcoxon Signed Rank Test. The findings showed that pupils taught with improvised and conventional materials have no significant difference in their mean scores, but showed a significant difference from the control group. In addition, no significant difference in the pupils' attitude before and after exposure to improvised and those exposed to conventional instructional materials. Based on this finding, it was recommended that Basic Science teachers should be trained through workshops on how to effectively design and use improvised materials in teaching Basic Science.

The study further established that in most of the classrooms, the science instructional materials were clear, as was established in 50 per cent of the classrooms that were found to be very good and 25 per cent that were found to be good. These findings are further exemplified by a weighted average of 4.222 that was obtained, implying that the materials were very good. A similar study by Usman and Saminu (2017) carried out a study on the effects of using an improvised weighing balance in solving linear equation problems and the attitude of learners towards mathematics in junior secondary school in Niger State, Nigeria. The study sought to determine the effects of using improvised instructional material (a weighing balance) in solving linear equations and learners' attitudes toward mathematics in Junior Secondary Schools in Niger State. The study adopted a pre-test, post-test, control-group quasi-experimental design. Six of 224 junior secondary schools in the state were sampled across the state's three educational zones. Two hundred and ten learners were used for the study. Linear Equation Performance Test (LEPT) and Learner Mathematics Attitude Scale Test (SMASST) are used as instruments for the research. T-test, group

mean, and percentage mean scores were used for data analyses. The findings established positive effects of using a weighing balance in solving linear equations and learners' attitudes towards mathematics.

Finally, some recommendations such as Mathematics teachers especially those teaching in Junior Secondary Schools should link theories with practical, to enable the learners get proper concepts of mathematics and be discourage rote learning and cramming of procedures of obtaining solutions without proper understanding and Government should sponsor teachers for workshop, seminars and further studies to make them be mathematics teachers who can think mathematically as well as develop improved skills and competencies for effective teaching of the subject and in-turn, be able to foster mathematics mindedness in the learners.

The study revealed that most teachers (44.4%) had been trained in utilising instructional materials, achieving a "good" competency rating, whereas 27.8 per cent were considered "very good." The teachers were rated as 'good' in their training on the use of the instructional materials, as was revealed by a weighted average of 3.805 that was obtained. Another similar study by Obodo et al. (2020) on the comparative effect of using an improvised free-fall apparatus and bomb calorimeter in teaching the concept of enthalpy in Nigerian Senior Secondary Schools Chemistry. The study aimed to assess the effectiveness of employing an improvised free-fall apparatus and a bomb calorimeter in teaching the concept of enthalpy. The study was in response to Call 23, which called for the deployment of materials within learners' immediate environment as a means of addressing the persistent shortage of learning resources for the teaching of Chemistry in Nigerian secondary schools. A total of 93 SS2 chemistry learners participated in the study. This sample comprised 48 females and 45 males from four secondary schools in the Calabar Educational Zone of Cross River State, Nigeria. A pretest-posttest control group design was used for the study. Using ANCOVA, the study found that learners taught with an improvised free-fall apparatus performed better in chemistry than those taught with a bomb calorimeter in enthalpy instruction. The result also showed no significant difference in performance between male

and female learners when taught the concept of enthalpy using a free-fall apparatus.

The study further established that 52.8 per cent of the teachers had a good understanding of the resources used for science instruction, while 19.4 per cent were very good. The data further yielded a weighted average of 3.606, which thus implies that the overall rating of the teachers on their understanding of the learning materials was good. These findings agree with Achor (2011), who investigated the relative efficacy of improvised and manufactured analogue voltmeters in secondary school physics. A pre-test/post-test control-group quasi-experimental design was used. This is because learners were not randomly selected; rather, an intact class was used. Senior Secondary (SS) two classes were selected for use, being the most stable class, quite unlike the SS1, which is newly introduced to the subject or SS3, which is preparing for external examination. The (standardised) improvised and manufactured equipment was used to teach experimental group 1 and 2 learners on how to take measurements of voltage, respectively, while the control group was taught using an alternative to practical (i.e. conventional method). Data were gathered using the Physics Achievement Test on Voltage Measurements (PATVM) and analysed using ANCOVA. A significant difference existed between learners taught voltage measurements using a manufactured voltmeter, an improvised voltmeter and the conventional method. The Scheffe tests carried out to determine the direction of significance showed that the difference in learners' achievement between those taught using manufactured and conventional methods, as well as those taught using improvised analogue voltmeters and conventional methods, was significant. However, the mean difference between the two experimental groups was not statistically significant. One of the main recommendations was that educators facilitate practical learning and adopt improvised instructional models whenever manufactured apparatuses are lacking. The aspect of standardisation of the improvised instructional resources was completed and reported elsewhere. Based on the finding that improvised resources compare favourably with the manufactured ones, the present study assumed the usability of the improvised instructional materials.

The study further established that 39.8 per cent of the teachers had a good attitude towards the available teaching resources, while 27.8 per cent had a very good attitude towards the same. These findings are further exemplified by a weighted average of 3.697 that was obtained, thus implying that the majority of the teachers were observed to have a good attitude towards the use of teaching materials. The findings also agree with Adeyemi and Olaleye (2010), who investigated the effect of learners' involvement in the production of instructional materials on their academic performance in Biology. A pre-test post-test control group quasi-experiment design was used. An intact class of one hundred and twenty (120) learners of the SS2 class was used.

A sample of sixty (60) learners constituting the experimental Group were taught using produced models, while the control group of sixty (60) learners used already prepared pieces of bones. Data were gathered using the Biology Achievement Test for Instructional Materials (BATIM) and analysed through Analysis of Covariance (ANCOVA). A significant difference existed between learners taught Biology using produced models and those taught Biology using already prepared bones. The Scheffe tests carried out to determine the direction of significance showed that the difference in learners' achievement between those taught Biology using produced models and those taught using already prepared bones was significant. The need for teachers to provide practical experience in teaching Biology was the study's major recommendation. Based on the finding that learners' involvement in the production of instructional materials impacted their academic performance in Biology, the present study assumed the usability of the improvised instructional materials. This study is related to the present learner in terms of the independent variables, but differs in the subject area used for study and location.

The researcher sought to test the third hypothesis: Use of learning materials has no statistically significant influence on the performance of children in science in preprimary schools in Tharaka Nithi County. Pearson product-moment and linear regression analysis were applied for hypothesis testing. The findings obtained are thus presented in the following subsections. The researcher conducted Pearson's correlation analysis

between the use of learning materials (as the third independent variable) and the performance of children in science in preprimary schools (as the dependent variable). The model summary obtained is presented in Table 3.

Table 3: Model Summary on Use of Learning Materials and Performance of Learners in Science

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.903 ^a	.815	.819	.124

a. Predictors: (Constant): Use of learning materials

Table 3 shows a strong positive relationship between the use of learning materials and children's performance in pre-primary school science. This was revealed by a positive Coefficient R (0.903). The R-squared is 0.815 (or 81.5%), which implies that an improvement in the preschool use of learning materials can predict 81.5% increase in the learner's performance in science in preschools.

The researcher further conducted a linear regression test between the use of learning materials and the performance of children in the sciences. The learners' average test scores were regressed against the researcher's rating of the use of learning materials. The findings from the analysis are shown in Table 4.

Table 4: Regression analysis on Use of Learning Materials and Performance of Learners in Science

Model	Unstandardised Coefficients		Standardised Coefficients	T	P-Value
	B	Std. Error	Beta		
(Constant)	.197	.142		4.405	.003
Use of learning materials	.784	.120	.779	7.272	.000

Dependent Variable: Performance of children in science

A regression analysis at a 95 per cent level of confidence ($\alpha = 0.05$) was applied to test this hypothesis. In the analysis, the independent variable, Use of learning materials, was regressed against the Performance of children in sciences. From the findings, the P value for the constant was 0.003, which is < 0.05 , thus making the influence of the constant significant. Further, the study established that the P value for the independent variable was 0.00, which is < 0.005 , indicating that the relationship between the independent and dependent variables is statistically significant. This implies that the null hypothesis (Use of learning materials has no statistically significant influence on performance of children in science in preprimary schools in Tharaka Nithi County) was rejected, and thus the alternative hypothesis, Use of learning materials has a significant influence on performance of children in science in preprimary schools in Tharaka Nithi County, was accepted. These findings agree with the finding of Mupa and Chinooneka (2015) who explained that an effective science lesson is characterized by the use of resources

available to accomplish the purpose of the lesson (Bukoye, 2019) and other stakeholders are even advocating for the use of high-quality teaching and learning resources for achieving the purpose of science education (Bybee & Chopyak, 2017). In using (real) objects, teaching becomes effective when learners interact in small groups. Such instruction makes learners work cooperatively, share their learning and pool their knowledge (Adu-Gyamfi et al., 2020). Hence, for teachers to be effective, they need to provide learners with enough learning experiences. Rosenshine (2012) reported that teachers use instruction to help learners efficiently acquire, rehearse and connect background knowledge. In such instructions, teachers provide support by modelling, guiding learner practice, helping learners to overcome their errors, providing scaffolds for difficult tasks and providing enough practice and review. According to Bakar (2017), teachers use technology in the form of a management system to reduce their workload and to support monitoring and tracking the progress of learners. Hence, education leaders are looking for

resources to support learners to make meaning of the world as to how the scientists see it (Bybee & Chopyak, 2017). The study further established the beta coefficient of 0.784 to model the level of association between the independent and the dependent variable. To predict the level of relationship between the use of learning materials and the performance of children in the sciences, the researcher had this regression equation.

$$\text{Performance of children in sciences} = 0.197 (\text{Constant}) + 0.784 (\text{Use of learning materials}).$$

From this, the implication is that the improvement in performance of science in preschools can be caused by a 0.414 (Use of learning materials) and a constant value of 0.319 (these include all other factors not included in this test). These findings align with the sentiments of Kodriyah et al. (2020), who assert that experience over the years has shown that teachers have relied on excessive word use to express and convey ideas or facts in the teaching-learning process. This approach is commonly referred to as the 'chalk-talk' method. With modern technological advancements, it is now possible to create instructional materials and devices that reduce excessive teacher talk while making lessons clearer, more engaging, and easier for students to understand. According to Rahmar et al. (2020), graphics include

charts, posters, sketches, cartoons, graphs and drawings. Graphics communicate facts and ideas clearly through a combination of drawings, words and pictures. The use of graphics in teaching adds clarity to the materials being studied. They help to visualise the whole concept learned and its relationships with one another.

CONCLUSION AND RECOMMENDATION

Conclusion: This study concludes that the use of learning materials had the greatest influence on the performance of learners in science activities. The teacher's ability to use the instructional materials, as well as the availability of instructional materials, influenced the frequency of use of materials. The study concludes that teachers' instructional coordination also influenced the learners' performance in the sciences. The study further concludes that some teachers were not very effective in instructional coordination, and this affected the learners' performance.

Recommendation: The Ministry of Education should allocate funds to the head teachers of preschools to acquire the required instructional resources. Further, the government should provide the approved teaching resources to the teachers in the preschools and train them on how to use them effectively.

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