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Influence of Teachers' Improvisation of Heat-Producing Materials on Acquisition of Science Skills among Pre-primary School Learners in Kiambu, Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Acquisition of science skills among pre-primary school learners has had its fair share of challenges with many pre-primary school learners manifesting low competencies in manipulation, experimentation and observation skills. The purpose of this study was to assess the influence of teachers' improvisation of heat-producing materials on acquisition of science skills among pre-primary school learners. The study was guided by Social Constructivism and Instructional Theories. The study adopted mixed methodology and applied concurrent triangulation research design. Qualitative data were analyzed thematically along the objectives and presented in narrative forms. Quantitative data were analyzed descriptively and inferentially using linear regression analysis with the help of Statistical Packages for Social Science (SPSS 23) and presented using tables. These results indicate that there is significant relationship between teachers' improvisation of heat-producing materials and acquisition of science skills among pre-primary school learners ($p=0.000< 0.05$). The study established that pre-primary school learners' manifest low science skills. That is, their manipulation, experimentation and observation skills are still below average. The study recommends that the pre-primary curriculum developers emphasize the improvisation of heat-

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producing materials as much as possible and frequent inspections are carried out. For future studies, researchers may put greater interest in conducting a similar study with national scope to certain the influence of improvised instructional materials on the levels of science skills among pre-primary learners.

Keywords: Pre-primary; science skills; teaching; practical knowledge.

1. INTRODUCTION

Teaching the concept of heat production to learners in pre-primary school settings has been based and aided by commercial and standard paradigms [1]. However, from early beginnings, humans developed the skills and equipment necessary to make and sustain heat from fire. Johnson [2], in a longitudinal study conducted in the United States of America, indicated that heat and fire-production could be achieved by using friction, that is, by rubbing palms, dry stones and dry wood or sticks. Johnson [2], asserted that pre-primary school teachers who adopt such techniques of improvisation in order to teach enhance young learners' procedure, manipulative, experimentation, observation, interpretation and prediction skills. In a seminar conducted in Venezuela, Harlen [3], noted that teaching children science skills on heat production, many pre-primary school teachers need to use the concept of friction of drilling or sawing sticks to create fire. One wooden stick known as the drill, plough or saw is twisted or rubbed against another known as the hearth. This motion generates heat and kindles dry materials such as tinder placed where the two objects touch.

Substances like grit are often placed at the point of contact to create extra abrasion. This method is employed all over the world. Because the principle behind all heat and fire sticks is the same, the objects look very alike. Harlen [3], noted that such practical improvisation of culturally available materials when transferred to classroom situation serve to have science concepts glued firmly in the memory of the learners. These findings affirm the view that improvisation is applicable to almost all facet of science knowledge like manipulation, observation, interpretation and prediction and other non-academic spheres. In other words, the process of acquisition of science skills requires a good deal of improvisation since it touches the cognitive, affective and psycho-motive domains of pre-primary school learners.

In most countries in Sub-Saharan Africa, Abdulahi (2010), indicated that when improvisation is utilized in a small group collaborative teaching and learning science activities in a learner-centered environment, it can be a powerful teaching tool. Abdulahi (2010), demonstrated that it can promote spontaneity, intuition, interactivity, inductive discovery, attentive listening, non-verbal communication, ad-libbing, role-playing, risk-taking, team building, creativity and critical thinking amongst pre-primary school learners. In a study conducted in Ethiopia, Mohammed [4], indicated that pre-primary school learners can easily master the fundamentals of friction, and even conduct simple experiments in order to discover most of the fundamental science ideas and skills for themselves.

Mohammed [4], indicated that explaining everyday things and encouraging young children to gain practical knowledge in science concepts like heat production and transfers by experiments at an early age develops a positive attitude to learning science the practical way. Kaggwa [5], in a study conducted in Uganda, revealed that suggesting to young children rub their hands and feet together briskly, or jog briskly in one place for about 10 minutes generate heat. In other words, when they are hot, then one needs to explain that rubbing of arms and body parts together produced heat due to friction. These findings affirm that improvisation and innovation is a must for enhancing learners' competitive edge when facing the challenges of acquisition of science skills. However, innovation can only be created through education that focuses on cultivating creativity for both pre-primary school teachers and young children.

In Kenya, due to gross inadequacy of media and equipment meant to enhance the effectiveness of science and technology education in the area of teaching and learning of heat, many teachers develop wrong attitude towards the preparation and use of improvised and fabricated local equipment and materials (Ndirangu *et al.,* 2013). Nafula (2010), in a study conducted in Busia West Sub-county, indicated that natural environment is richly endowed with materials such as dry wood, sticks or stones that can be

employed in the school to make teaching of science of heat production real and lively. Nafula (2010), suggested that efforts should therefore, be stepped up to provide improvisation and fabrication material very abundant in our schools. More emphasis nowadays is placed on relating what is taught to the worldview of the learners.

In Kiambu County, the idea of adopting improvisation as an instructional tool is very important to pre-primary school teachers' day to day teaching and learning activities and in order to make the process of instruction interesting, active and participatory, teachers' need adequate knowledge about it. Wilson [6] indicated that the process of improvisation gives teachers' the knowledge of creativity, manipulative skills, and critical thinking. Wilson [6], further indicated that improvisation encourages self-reliance and a feeling of confidence during teaching of concepts in heat production. However, Nafula (2010) and Wilson [6] have not indicated how improvisation of heat production materials, besides teachers, would enhance learners' acquisition of science skills. The study does not indicate how improvisation would enable learners to display their skills of creativity in teaching and learning activities for better understanding and assimilation of heat production concepts being taught in the classroom; research were the gaps which this study intended to address.

1.1 Theoretical Framework

The study was guided by the instructional theory which was postulated by Gagne [7] and offers explicit guidance on how to help people learn and develop [8]. Instructional theories focus on how to structure material for promoting the education of human beings, particularly pupils and learners. It outlines strategies that the teacher may adopt to achieve the learning objectives. Instructional theories are adapted based on the concept being taught and more importantly, as per the learning style of the pupils. The rationale of using instructional theory is that it appreciates the role of the teacher in instruction and it is important that the teacher make sure that pupils have the necessary skills in order to accomplish the task. Independent study is very flexible and can be used as the major instructional strategy with the whole class, in combination with other strategies, or it can be used with one or more individuals while another strategy is used with the rest of the class. In the same vein, this theory appreciates the fact that improvisation allows full participation of pre-primary school learners in activities, enhances socialization, enhances cognitive development, allows children learn new science concepts through discovery, exploration and experimentation, it enables shaving of ideas and promote self-confidence and self-esteem.

In the use of locally improvised materials to teach science skills, pre-primary school learners are exposed to various experiences, allowed to fully participate in activities, socializes, allow children learn new science concepts through discovery, exploration and experimentation and finally build self-confidence and self-esteem. The study was also guided by The Social Constructivism Theory which was postulated by Vygotsky [9] giving rise to the premise and idea that learners are not passive recipients of information, but that they actively construct their knowledge in interaction with the environment and through the reorganization of their mental structures. Learners are therefore viewed as sense-makers, not simply recording given information but interpreting it. This view of learning led to the shift from the "knowledge-acquisition" to "knowledge-construction" metaphor. The rationale of using social constructivism theory in this study is that it underscores the fact that acquisition of science skills is a dynamic, continuous process of change where new learning results in and affects learning environments through improvisation.

2. METHODOLOGY

The study adopted mixed methodology and applied concurrent triangulation research design. The target population comprised of 12 sub-county directors of education, 438 headteachers, 1500 pre-primary school teachers and 40, 595 pre-primary school learners totaling to 42, 534 respondents from which a sample of 396 respondents were selected using the Central Limit Theorem. Stratified sampling was applied to create 12 strata based on the number of sub-counties in Kiambu County. From each sub-county, the sub-county director of education and one headteacher were selected using purposive sampling. However, from sub-county, three pre-primary school teachers and 28 pre-primary school learners were selected using simple random sampling. This procedure enabled the researcher to sample 12 sub-county directors of education, 12 headteachers, 36 pre-primary school teachers and 336 pre-primary school learners. Questionnaires were used to collect quantitative data from teachers, interview

schedules for headteachers and sub-county directors whereas observation checklist were used to gather qualitative data from pre-primary school learners. Qualitative data were analyzed thematically along the objectives and presented in narrative forms. Quantitative data were analyzed descriptively and inferentially using linear regression analysis with the help of Statistical Packages for Social Science (SPSS 23) and presented using tables.

3. RESULTS AND DISCUSSION

The study sought to:

i. Assess the levels of acquisition of science skills among pre-primary school learners in Kiambu County, Kenya
ii. To examine the influence of teachers' improvisation of heat-producing materials on acquisition of science skills among pre-primary school learners in Kiambu County, Kenya.

3.1 Response Rate

In this study, 36 questionnaires were administered to teachers out of which 32 questionnaires were filled and returned. The researcher also interviewed nine headteachers and ten sub-county directors of education and also conducted observation schedules among 293 pre-primary school learners. This yielded response rates shown in Table 1.

Table 1 shows that headteachers, pre-primary school teachers, sub-county director of education and pre-primary school learners registered a response rate of 86.9%. This affirmed the assertions of Creswell [10], that a response rate above 75.0% is adequate and of suitable levels to allow for generalization of the outcomes to the target population.

3.2 Levels of Pre-primary School Learners' Science skills

The study sought to assess the levels of pre-primary school learners' science skills. This was assessed by conducting observation schedules during science activities in their pre-primary schools and were measured in terms of manipulation skills, experimentation skills and observation skills. The results are shown in Table 2.

Table 2 shows that 42.9% of the pre-primary school learners manifest manipulation skills which were below average, 35.7% were fair, 2.3% were good, 4.8% were very good whereas 14.3% manifested excellent manipulation skills. Similarly, 28.6% of the pre-primary school learners exhibited experimentation skills which were below average. 39.3% were fair, a quarter (25.0%) were good, 7.1% were very good whereas 7.1% had excellent experimentation skills. However, a quarter (25.0%) of the pre-primary school learners had excellent observation skills, 10.7% were very good, 35.7% were good, 21.4% were fair with only 7.25% of the learners manifesting observation skills which were below average. These findings indicate that science skills are privileged domains, that is, domains in which children have a natural proclivity to learn, experiment, and explore, they allow for nurturing and extending the boundaries of the learning in which children are already actively engaged. This has also been alluded by Worth [11]. Thus, developing and extending children's interest is particularly important in the pre-primary school years, when attention and self-regulation are nascent abilities.

3.3 Teachers' Improvisation of Heat-Producing Materials and Acquisition of Science Skills among Pre-primary School Learners

The study sought to examine the influence of teachers' improvisation of heat-producing materials on acquisition of science skills among pre-primary school learners. Descriptive data were collected from pre-primary school teachers and results are shown in Table 3.

Table 1. Response Rates

Respondents	Sampled Respondents	Those Who Participated	Achieved Return Rate (%)
Headteachers	10	9	90.0
Pre-primary School Teachers	36	32	88.9
Sub-county Director of Education	12	10	83.3
Pre-primary School Learners	336	293	87.2
Total	396	344	86.9

Table 2. Levels of Pre-primary School Learners' Science Skills

Science Skills	Excellent	Very Good	Good	Fair	Below Average
	%	%	%	%	%
Manipulation skills	14.3	4.8	2.3	35.7	42.9
Experimentation skills	7.1	7.1	25.0	39.3	28.6
Observation skills	25.0	10.7	35.7	21.4	7.2%

Table 3. Descriptive Findings on Teachers' Improvisation of Heat-Producing Materials in Pre-primary Schools

Test Items	Ratings						
	SA	A	U	D	SD	Mean	Std. Dev.
	%	%	%	%	%		
During science activities, pre-primary school teachers usually rub dry sticks as a strategy of improvising heat production	60.5	12.5	4.5	9.5	13.0	4.183	1.546
In many pre-primary schools, teachers do not frequently rub their palms against surfaces to improvise heat production during science activities	10.5	7.5	3.5	21.0	57.5	3.975	1.470
In many pre-primary schools, teachers usually teach heat production by rubbing dry stones during science activities	69.5	12.0	2.0	10.0	6.5	4.805	1.776
Teaching of heat production in pre-primary schools has not been made easy through improvisation of heat production materials	11.5	16.5	2.5	13.5	56.0	3.871	1.431

Table 3 reveals that 20(60.5%) of the pre-primary school teachers strongly agreed with the view that, during science activities, they usually rub dry sticks as a strategy of improvising heat production as did 4(12.5%) who agreed. However, only a paltry 2(4.5%) were undecided, 3(9.5%) disagreed whereas 4(13.0%) strongly disagreed. These findings are consistent with the assertions of Abdullahi (2010), who observed that improvisation of materials from the learners' environment facilitated acquisition of experimental skills as learners had the opportunity to extend learning outside the classroom and hence advance spontaneity, instinct, intelligence, acting, risk-taking, group building, imagination and basic deduction among pre-primary learners. The study also found out that 4(10.5%) of the pre-primary school teachers strongly agreed with the view that, in many pre-primary schools, teachers do not frequently rub their palms against surfaces to improvise heat production during science activities. 3(7.5%) agreed. 1(3.5%) were undecided, 7(21.0%) disagreed whereas 19(57.5%) strongly disagreed. This implies that while the technique is applied, there are a significant proportion of learners that are yet to benefit from the improvisation.

These observations indicated that palms might have been commonly improvised by pre-primary teachers to instruct pre-primary learners on observation and recording skills as they were commonly available. Similarly, a study by Thararuedee and Wette [12], espouse that teacher and learner interaction effectiveness is important on teacher's learning instruction. The findings of the study indicate that teachers commonly improvised palms to teach learners observation and recording skills. These findings affirm the view that improvisation is applicable to a wide array of materials available in the school environment and could be a contributing variable to learners' acquisition of observation and recording skills. In other words, the process of acquisition of science competencies requires a good deal of improvisation since it touches the cognitive, affective and psycho-motive domains

of pre-primary learners. 23(69.5%) of the pre-primary school teachers strongly agreed with the view that, in many pre-primary schools, teachers usually teach heat production by rubbing dry stones during science activities. 4(12.0%) agreed. 1(2.0%) were undecided, 4(10.0%) disagreed whereas 2(6.5%) strongly disagreed.

From Table 3, 4(11.5%) strongly agreed with the view that teaching of heat production in pre-primary schools has not been made easy through improvisation of heat production materials. 5(16.5%) agreed. 1(2.5%) were undecided, 4(13.5%) disagreed whereas 18(56.0%) strongly disagreed. These findings lend credence to the findings of a study carried out by Mohammed [5], which concur with this view and maintains that pre-primary learners can without much effort attain the essentials of friction, and even do basic experiments to find the vast majority of the key science ideas and skills for themselves. These findings point to the fact that the technique was significantly used to enhance preprimary learners` prediction skills but there is need for improvement. The findings of the study further show that pre-primary teachers extensively improvised dry stones to enhance learners' procedure skills. This movement creates heat and arouses interest among the learners and this ultimately enhances the learners' acquisition procedure skills.

3.4 Inferential Statistical Findings on the Influence of Teachers' Improvisation of Heat-Producing Materials on Acquisition of Science Skills among Pre-primary School Learners

To verify the relationship between teachers' improvisation of heat-producing materials and acquisition of science skills among pre-primary school learners, data were collected on how often pre-primary school teachers improvise heat-producing materials (very often =5, often = 4, sometimes = 3, rarely = 2 and never = 1) and learners' outcomes in science activities. The results are shown in Table 4.

Table 4 shows that pre-primary school teachers who frequently improvise heat-producing materials during science activities have their learners register impressive outcomes and competencies in difference science skills. These results were subjected to linear regression analysis to test the null hypothesis and results are shown in Table 5:

H_{01}: *There is no significant influence of teachers' improvisation of heat-producing materials on pre-primary learners' acquisition of science skills in Kiambu County.*

Table 4. Results of How Often Pre-primary School Teachers Improvise Heat-Producing Materials and Learners' Outcomes in Science Activities

How Often Pre-primary School Teachers Improvise Heat-Producing Materials	Learners' Outcomes in Science Activities (Marks out of 50)
1	19
2	21
2	25
2	27
3	29
5	33
5	40
5	44
5	45

Table 5. Relationship Between Teachers' Improvisation of Heat-Producing Materials and Acquisition of Science Skills among Pre-primary School Learners

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	13.465	3.085		4.364	.003
	Frequency of Teachers' Improvisation of Heat-Producing materials	5.394	.838	.925	6.437	.000

a. Dependent Variable: Acquisition of Science Skills by Pre-primary School Learners

Table 5 shows a linear model of the form; Acquisition of Science Skills = 13.465 + 5.394Frequency of Improvisation of Heat-Producing Materials. These results from the linear regression equation indicates that the coefficient for acquisition of science skills attributed to the frequency of teachers' improvisation of heat-producing materials is 5.394. This implies that, for every additional increase in the frequency of improvisation of heat-producing materials, acquisition of science skills is expected to increase by a factor of 5.394 marks. In the same token, the value 13.465 indicates that acquisition of science skills among pre-primary school learners is not only dependent on teachers' improvisation of heat-producing materials, but a multiplicity of other factors such as learner readiness, teacher factors and availability of scholastic materials amongst others. Similarly, from the results in Table 5, the p-value, 0.000 is less than 0.05, that is, a low p-value (0.000< 0.05). Hence, the Null Hypothesis, $\mathbf{H_{01}}$, is rejected. These results indicate that there is significant relationship between teachers' improvisation of heat-producing materials and acquisition of science skills among pre-primary school learners. These findings affirm the fact that improvisation of heat producing skills by pre-primary teachers using materials in the pupils' immediate environment may be among the variables encouraging pre-primary children acquisition of practical knowledge in science like heat production and transfers by experiments at an early age develops a positive attitude to learning science the practical way.

3.5 Thematic Analysis: Influence of Teachers' Improvisation of Heat-Producing Materials on Acquisition of Science Skills among Pre-primary School Learners

The qualitative analysis was conducted using the interviews from the headteachers and the county director of education. When asked on the importance of improvised heat producing items for teaching. Headteacher, H1, remarked,

"Improvisation of heat producing material undoubtedly elicits learners' interest and increases their knowledge base. This is because the generation of pre-primary children has been accustomed to believe that heat production is predominantly from match boxes, electrical installations, solar appliances among other commercial devices. As a consequence, the learners find it marvelous that heat can also be produced from improvisation of locally available materials and promotes their grasp of the subject. As much as possible, pre-primary teachers should improvise heat producing items frequently so as to enhance meaningful science learning".

In another response stating some of the available heat producing materials which teachers always improvised and utilized to teach various science competencies, head teachers had various opinions. When asked to state on the items improvised by teachers. Headteacher, H2, observed,

"Our teachers improvise variety of heat producing materials to teach science. For instance, rubbing a stick on another, rubbing palms together, rubbing stones among others. Because of insufficient funds to buy some scientific laboratory materials for illustrating the het production, we urge our teachers to use what is available to them and to the learners. This is because we don't need funds to buy sticks, or small stones or even the palms. Items that cost nothing and are available in the environment are most relevant for pre-primary teachers to utilize."

Improvisation of heat-producing materials enabled teachers to enhance acquisition of science competencies among the learners. Asked how teachers employ heat producing in teaching. Headteacher, H3, remarked,

"The teachers ensure that the illustration is as practical as possible. In order to achieve the feeling of the heat production, teachers form groups among the learners. One learner in each group is selected as the "actor". At the beginning, the rest of the members are asked to touch the hands of the actor to note the temperature. The actor then carries out the heat producing activity while others watch. After an instructed period of time of the activity, the other group members are asked to feel the temperate after the activity. The learner's then report on any noticed difference."

There are always challenges in improvising heat producing efforts materials. When asked if there were any challenges in heat producing items. Headteacher, H4, said,

"*While heat producing materials are very important, it takes time for the teachers to find them and organize how to improvise them. There is no doubt that these materials help in teaching of children in our pre-primary classes*."

Pre-primary learners are interested in such heat producing items such that they would assist the teachers in getting them from their homes [13]. Children are eager to learn and find joy in finding items from their environment. Asked about the interest of children, headteacher, H5, noted,

"*Sometimes the interest created among pre-primary children makes possible for them to look for such materials in their environments. This makes it easier for the teachers to work on these items once they are made available by the children. Curiosity makes children learn using fun and play*."

Security of children is paramount in pre-primary centers. When making any fire, care should be taken to ensure that there will be no danger to the learners. There is also the danger of starting fires unintentionally as care need to be taken. When asked about the caution that teachers need to observe when dealing with heat items, headteacher, H6, said,

"*We are aware that heat producing items could be very dangerous since they could be a cause for fires. Once fires burst, it may be very difficult to put them out. There are always precautions to be made to ensure that there is no danger to the children as fire is produced*."

It was not difficult to get dry stones and dry sticks. Human palms were available twenty-four hours in a day. This was emphasized by the county director of education. When asked about the availability of the items, the county director of education, SCDE1, observed,

"When you talk of teaching items like human palms it becomes laughable. Who doesn't have palms? When you look around here, how many kilometers do you need to go to find out where to get dry sticks and dry stones? Its time our teachers have done something about improvising teaching aids without bothering the head teachers or the government."

Local materials from the environments are more realistic than items bought from the shops. The children learn how to use their environment as they search for teaching aids. This was emphasized by the county director of education. Asked about improvised realia in the study area, the county director of education, SCDE2, said,

"Items from the compounds are real. This is the use of what we call realia in education. Realia materials are more appealing to the eyes and consequently the brain. What is seen by the eye goes straight to the brain. We learn through the sense of sight."

The words of the county director of education were echoed by one of the head teachers by supporting the idea of sight. Asked how these teaching aids helped children in learning, headteacher, H7, noted;

"When one sees he believes, they say. What learners see in form of teaching aids, local or otherwise, it will remain in their memory for a long period of time. Failure to make children "look" at things is failure to communicate ideas to them."

The study revealed various themes in the use of improvised heat producing materials in pre-primary in Kiambu County. Among the common themes that emerged from the respondent's views were; that teachers commonly used palms and improvised dry sticks to teach learners science competencies. Most heat producing materials are applicable to a wide array of activities required in class and the head teachers were cautious that there was danger of starting fires and therefore rubbing palms together remained the safest approach to teach learners acquisition of science competencies. A common perspective among the respondents was that improvisation of heat producing materials was important in arousing the interest of pre-primary learners that alternative/innovative methods could also be used in heat production.

The concept of heat production to learners in pre-primary settings has been and aided by commercial materials [14]. The results indicate that there were no major differences in the teachers' choice of improvised heat producing materials, although there was a slightly higher preference of rubbing hands. Teachers' utilization of heat production materials in their classes is a demonstration of practice of available options from the child's environment to encourage learning. The findings of the study indicate that teachers commonly improvised dry sticks and palm to teach learners observation and recording skills. These findings affirm the view that improvisation is applicable to a wide

array of materials available in the school environment and could be a contributing variable to learners' acquisition of observation and recording skills.

The findings of the study revealed that teachers commonly improvised stick, stones and palms to enhance pre-primary learners' experimental skills.

Improvisation materials-oriented teaching and learning of science in a learner-focused environment can be an effective teaching tool. Linear regression analysis revealed that a medium positive relationship exists between pre-primary teachers' improvisation of heat producing materials and pupils' acquisition of science competencies; increase in teachers' improvisation of heat producing materials results in an increase in pupils' science competencies.

4. CONCLUSIONS

It is evident that improvisation of heat-producing materials contributed to positive increase in teachers' improvisation of heat producing materials results in an increase in pupils' science skills. Science learning using improvised items was found to be not only possible, but also enjoyable to the learners. Heat producing items could be dangerous sometimes if not handled carefully. The security of learners in the pre-primary centres is quite paramount. Any time these items are used extra care should be taken to avoid fire bursting into the classroom. There was need then to encourage pre-primary teachers to use heat producing items more often. This would improve science teaching performance significantly.

5. RECOMMENDATIONS

The study recommends;

- The pre-primary curriculum developers emphasize the improvisation of heat-producing materials where frequent inspections are carried out.
- For future studies, the researchers to put greater interest in conducting a similar study with national scope to certain the influence of improvised instructional materials among pre-primary learners.
- The Ministry of Education should organize for in-service training for pre-primary science teachers. In-service training for teachers is important to ensure that the teachers adopt to technological changes to improvisation sound-producing materials for instruction rather being reliant on traditional archaic materials.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ezumah BA. Critical Perspectives of Educational Technology in Africa: Design, Implementation, and Evaluation. London: Palgrave Macmillan; 2020.
2. Johnson J. The forum on pre-primary school science, mathematics, and technology education. Washington, DC: AAAS. 2012;14-25.
3. Harlen W. The teaching of primary science in schools in Venezuela. London: David Fulham Publishers; 2000.
4. Mohammed A. Science Teaching in Ethiopia. Illorin: Auto Press Ltd; 2014.
5. Kaggwa A. Comparative effects of improvised and standard equipment on learners' achievement in elementary school science. Uganda; Tororo Publishing House; 2009.
6. Wilson A. Improvisation of Science Teaching resources. Science Teachers Association of Kenya 28th Annual Conference Proceedings in Thika. 2013; 55 – 60.
7. Gagne RM. Principles of instructional theory. Fort Worth: Harcourt Brace Jovanovich; 1999.
8. Tsang-Kosma W. The Work of Robert Gagné: Part of the Instructional Design Theory. Retrieved November. 1999;21:2004.

9. Vygotsky LS. Socio-cultural theory. Mind in society. 1978;6:52-58.
10. Creswell J. *Research design: qualitative, quantitative and mixed methods approaches.* Thousand Oaks, California: Sage Publications; 2014.
11. Worth K. Science in early learning environments. In STEM in early childhood education. Routledge. 2019: 3-21.
12. Thararuedee P, Wette R. Attending to learners' affective needs: Teachers' knowledge and practices. System. 2020; *95*:102375.
13. Rönkkö ML, Yliverronen V, Kangas K. Investigative activity in pre-primary technology education: The Power Creatures project. Design and Technology Education: an International Journal. 2021; *26*(1):29-44.
14. Spiteri J. Early childhood education for sustainability. Quality Education, Encyclopedia of the UN Sustainable Development Goals; Filho LW, Azul AM, Brandli L, Özuyar GP, Wall T, Eds. 2020;1-12.

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