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The relationship between classroom interaction and performance of children in Science in pre-primary schools in Tharaka Nithi County, Kenya

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Abstract

The purpose of this study was to establish if classroom interaction has any relationship with preschool learners' performance in science activity areas. A solid science foundation at an early age of children can predict their performance in sciences at a later stage of primary and secondary levels of education. From the preschool level, children's interests, attitudes, and learning outcomes are, to a large extent, determined by the teaching methods teachers apply. A descriptive research design was applied as the researcher collected data. The target population for this study was 240 preschools, 505 teachers and 5326 learners in the early childhood Classes (PP2) in the three sub-counties (Meru South, Maara and Tharaka) of Tharaka Nithi County. Data was collected using questionnaires for teachers, documentary analysis and an observation checklist for preschool children. Descriptive analysis was applied to the data from the questionnaires. The study established that the classroom interaction used by preschool teachers had an influence on the learners' performance in science activities. The ability of the teachers to identify the learners' learning needs and the teaching methods that can best handle the topic were found to be crucial in science instruction. The study recommends that the Ministry of Education, through the Kenya Institute of Curriculum Development, should review the current classroom interaction for preschools and modify them to fit specific topics. The methods should then be taught to teachers through in-service training to keep them versed in the current classroom interaction.

Key words: Classroom, interaction, performance, pre-primary, relationship, Science.



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INTRODUCTION

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

In Tharaka Nithi County, science teachers in pre-primary schools are using talk and chalk, memorisation, expository methods, and fewer inquiry methods to instruct science activities despite the curriculum emphasis on the use of more varying learning approaches. This resulted in a dismal performance in science and related subjects (Njagi, 2016). Appropriate instructional management has been found to influence the learner's participation, understanding, and performance in other subjects (Hallinger et al., 2015), and this could be the case in preschools in Tharaka Nithi County. Since other studies have attempted to solve the problem of poor performance by focusing on teachers, teaching methods, and school factors, this study aims to fill in the gap in how instructional management practices influence preschool children's performance in science.

Although the challenges facing learning science skills in pre-primary schools in Kenya continue to hamper the education system, the Ministry of Education, Science and Technology (MoEST) continues to regularly address curriculum instructional issues. This has led to the introduction of a 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 being in place, they seem not to address the management of instruction in classrooms. Despite these efforts, the dismal performance of learners in sciences has been

reported in preschools in Tharaka Nithi County (Mugure, 2018; Nkirote & Thinguri, 2020). Studies have been conducted on contextual and teacher factors influencing the teaching of science in primary schools, but little has been done in relation to the approach to teaching science in pre-primary schools. It is not clear how the instructional management practices independently and collectively affect the performance of children in science at the preschool level in Tharaka Nithi County and Kenya at large. Thus, this study sought to establish how classroom interaction relates to the performance of children in science in pre-primary schools. The study also tested the following null hypothesis at a significance level of 0.05: **H₀₁**: Classroom interaction has no statistically significant relationship with the performance of children in science in pre-primary schools.

LITERATURE REVIEW

Learning is a dynamic process that involves a child wholly. Studies carried out in the last decade established that the methods of instruction play a vital part in the overall lifelong success of children (Jackson, 2018; Friedman & Rockoff, 2014). Teachers who create effective science instructional environments contextualise instruction to appeal to learner interests and present new science concepts (Jackson, 2018). Contextualised science instruction uses learners' prior knowledge and experiences to foster understanding (Friedman & Rockoff, 2014). Guided inquiry, problem-based learning, and project-based learning are some strategies science teachers use to bring content to the science curriculum alive for learners through their own personal senses. Teachers in preschools have the autonomy to apply whichever method they deem fit for teaching particular science concepts. This implies that the teachers apply varying classroom interaction that yields different results. This study aims to establish the effectiveness of the teaching methods applied.

The methods of teaching applied by the teachers should be geared towards learner participation so as to enable the learners to enjoy learning science, acquire science process skills and apply the things they learn in their day-to-day lives. Knowledge retention actively acquired through science activities is much more potent than the knowledge the learners acquire passively. According to Ooko et al. (2018),

science learning usually takes different techniques. The participatory approach to learning science entails practical activities, demonstrations, guided discussions, field trips and projects. In the demonstration approach, the teachers usually have clear objectives they aim to achieve. In both methods, the learners ought to be involved in the instructional process. Teachers usually enhance their involvement by making observations, asking questions, recording results, and discussing the conclusions. Such teaching methods arouse the preschooler's curiosity and thirst to know and discover more. The interest they develop in science at this stage can be useful and applicable even in the later stages of learning. Thus, the application of appropriate teaching methods cannot be overemphasised in this study.

Archila (2017) asserts that, even if science teachers consider including any element of the dramatic scenes in science in the curriculum, they do so primarily to humanise science in order to foster positive attitudes towards science rather than to understand the nature of science. For many science teachers, only the development of an understanding of science concepts and the methods of science are crucial to an education in science. Walan (2016) conducted studies on the effects of the inquiry-based learning model on learners and teachers. Based on their findings, learners were found to give better responses when inquiry-based learning was used in the teaching and learning sessions. Research has also reported the positive effect of inquiry-based learning on teachers and teaching. Inquiry-based learning improves teachers' performance, understanding, science process skills and inquiry.

Multiple studies have shown that practical work confers many advantages, including scientific knowledge and developing science skills, as well as understanding science concepts and theories (Zimmerman et al., 2016). Saritepeci (2021) asserted that practical work has also been proven in some research to help improve the communication skills of learners in order to address problems in science and so become more motivated in science. In addition to this, practical work enhances and boosts learners' interest in science and promotes it as an engaging subject. As an example, when learners practice

chemical reactions, they learn that chemistry/science is an applied science and not just rules and theories.

These findings partly agree with the Case Studies in Science Education (Manzano-Sanchez et al., 2018), involving a cross-section of 11 U.S. school districts, described the conditions and needs of science, mathematics and social studies education. The authors noted that the quality of science instruction learners experienced was quite varied; while some of the observed science classes stressed important science ideas and were described as interesting to learners, most overemphasised facts and memorisation and were not seen as relevant to the learners. Science education observation studies since that time have generally either been quite small or have been conducted in the context of the evaluation of a reform initiative, in both cases limiting the generalizability of the results. The Inside the Classroom Study provides new insight into the extent to which teaching for understanding is occurring in our nation's schools. The study included observations of 180 science lessons, selected to be representative of lessons nationally and interviews with the teachers of those lessons. Lessons were documented and analysed in a number of different areas, including the quality of the science content and the extent to which the classroom culture facilitated learning. Findings about the national status of quality science instruction and the components of lessons that seem likely to promote learner understanding have important implications for science educators.

Ethiopian researchers conducted studies on the effects of inquiry-based learning models on learners' conceptual understanding, attitudes, experience and achievement (Berie et al., 2022). Some of these studies indicated that learners who learned with guided inquiry learning model lesson design were better in their achievement, attitudes and conceptual understanding of science topics than those who were taught by the conventional teaching methods (Berie et al., 2022). In another study, the instructional model had a significantly higher effect than the conventional teaching methods on enhancing conceptual understanding and minimising misconceptions (Morges, 2021). Wale and Bishaw (2020) also found out that although many teachers were aware of inquiry-based learning, they did not apply it in their classrooms.

In a similar vein, Tsakeni (2018) investigated access to effective practical work for physical sciences students in two South African high schools. The results indicated that the lack of practical examinations led to underestimating practical work in physical sciences classrooms and, therefore, marginalising learners. The study indicated that the limited access led to a social justice agenda because of the high expectations linked to studying physical sciences. The study recommended supporting practical work through the assessment processes and instructional leadership tools.

These findings agree with those of Harris and Brown (2013), who found in their study on learners' feedback that they were well aware of the public nature and accountability part of the evaluation; they tended to write superficial comments rather than articulating strengths and weaknesses. Moreover, the learners did not credit their peers as much as they trusted their teacher. Gamlem and Smith (2013), who interviewed teenage learners about how they generally regarded classroom feedback, found that the learners wanted more specific suggestions on how they could improve their work. Also, the learners questioned the often mandatory element of appraisal in feedback offered to peers since they sometimes found it difficult to find appropriate aspects to praise. Consequently, they doubted the honesty of the appraisals received.

These findings agree with the findings of a study by Hovardas et al. (2014), which found that science learners tended to stress content before skills to a greater extent than the teacher and that the learners were less likely to find scientific mistakes than the teacher. Differences between the assessment of teachers and that of peers may be influenced by the task to be assessed, the criteria and the assessor's experience. However, Tsai et al. (2022) found the differences between learners' and teachers' assessments to be connected to how they perceived the relevance of the criteria at hand. Although the above study on discrepancies between peer and teacher feedback concerns university-level education, the observation of potential inconsistencies also in lower education levels could be relevant in spite of differences in educational practices.

Zghida et al. (2022) indicated that one of the most useful solutions is to trigger learners' interest and optimise their active involvement and, therefore, their engagement in the learning process. Engagement is directly linked to academic achievement and is the result of a person's interest in content-specific activities. Interest development takes place in two phases: The triggering phase and the maintaining phase. However, studies have shown that many problems and difficulties still arise in young learners' understanding of the concept of energy (Zghida et al., 2022). These difficulties reduce their interest in the subject, and energy becomes an unattractive area of study. We must, therefore, consider whether there are teaching strategies available that might ease some of the learner's difficulties.

Friendly classroom engagement entails a teaching-learning atmosphere where learners are allowed to exercise some influence over their own learning. In this way, they are more likely to value the significance of achievement-related behaviour and demonstrate more internal motivation in their school work. Management of classroom interaction includes controlled or formalised classroom behaviour, clarified classroom or individual goals, developed subject contents and reinforced learners' behaviour. The level of complexity of the subject content also matters to the learners. Rad et al. (2018) found that interaction patterns are related to teacher efficacy and only exist to some level, which needs further clarification in this research. Eriba and Achor (2010) further add that the sex of the teachers in a particular classroom does not matter; rather, the teacher's ability to teach science concepts is key.

Hernández et al. (2019) established that recognition of the benefits that accrue to learners when instruction is more learner-centred and less teacher-directed had been widely reported. This involves developing a learning environment in which learners are encouraged to actively participate and to accept accountability for their own learning, as well as creating a learning atmosphere that focuses attention not only on the condition under which learning takes place but also on the variables that mediate the teaching-learning process. Teacher-centred interaction was said not to provide a learning environment that allows learners to actively

participate and take responsibility for their own learning rather than remaining passive throughout the teaching-learning process. To date, those employing interaction as a means of teaching have used a variety of approaches to structure learning. These varieties of approaches adapted to structure learning consist of friendly classroom interaction, cooperative classroom interaction, teachers' classroom management interaction and so on.

The influence of classroom interaction on learners' performance in science has been evaluated in research by Koedinger et al. (2013). The study established that the use of situations connected to real life in teaching scientific concepts helps the learners develop an abstract understanding of science concepts. However, preschool teachers in Kenya are not dictated to follow a particular teaching methodology for teaching a particular subject, and the teaching methods they apply vary in their level of effectiveness and efficiency. This study seeks to establish how the varying classroom interaction influences the learner's performance in science activities.

Learners at the preschool stage depend on the teacher to learn the sciences. Teachers are also responsible for interpreting the curriculum content for young learners in preschools. Thus, teachers should encourage and allow the learners to investigate, practice, explore, discuss, model, and play (Gunga & Odundo, 2013). Learners usually require actual experience since they can't think through abstract ideas. Therefore, this study will investigate the factors related to teachers that affect preschool learners' performance in science.

This study was guided by situated learning theory by Brown et al. (1989). The fundamental basis of situated learning theory is that knowledge should not be the transmission of de-contextualised facts from teacher to learner. Brown et al. (1989) have been used to model the variables of this study: The best learning occurs when learners are presented with a problem themselves and must think through and act like the experts. Problems must be realistic and relevant to the situation (this models the first variable on science instruction practices and how it influences learning). The learning environment must stimulate reflection, discussion, and evaluative thinking.

METHODOLOGY

This study employed a descriptive survey research design. A descriptive research design was applied as the researcher collected data from the preschools, using the situation as it is and without the manipulation of the variables. The target population for this study was 240 preschools, 505 teachers and 5326 learners in the early childhood Classes (PP2) in the three sub-counties (Meru South, Maara and Tharaka) of Tharaka Nithi County. The researcher used stratified random sampling to ensure that particular respondents who possess data that the researcher required are included in the sample. The sub-counties in Tharaka Nithi County were used to form the sampling strata. A sample of 15 per cent of the preschools in each of the sub-counties was sampled using stratified sampling, thus resulting in 36 preschools. The researcher obtained a list of preschools from the sub-county educational office, which served as a sampling frame. The researcher then randomly selected 15 per cent of the schools in the list by assigning an identifying number to each of the schools and then randomly selected 13 numbers for Meru South, 11 for Maara and 12 for Tharaka and picked the schools identified by the selected numbers. The teachers and the learners in the sampled schools were sampled for this study. By this, all the learners in PP2 classes, as well as their class teachers, were purposively sampled to take part in this study. The resultant sample was 36 preschools and 211 teachers.

The instruments for data collection were observation checklists for preschool children, documentary analysis, and questionnaires for teachers. Descriptive analysis was applied to the data from the questionnaires. These included frequencies and percentages of ages. The findings of the data analysis were presented using tables. Data from the documentary analysis was tallied, and class averages were computed from the teachers' ratings of the learners, which would serve as the indicator of the dependent variable of the study. As for the inferential statistics, the researcher tested the hypothesis using linear regression and the Pearson correlation coefficient. Significance was tested at 0.05 level of significance at 1 degree of freedom. The quantitative data was discussed to form the conclusions of the study, while the qualitative data was used to

reinforce the findings obtained from the quantitative data.

RESULTS AND FINDINGS

Gender of the Respondents

The study sought to establish the gender distribution of the teachers, and the findings obtained are presented in Table 1.

Table 1: Respondents Gender

Gender	Frequency	Percentage
Female	140	77.8
Male	40	22.2
Total	180	100.0

The study established that 77.8 per cent of the teachers were female while 22.2 per cent were males. This implies that the gender of the pre-primary school teachers was biased in favour of females.

Academic Qualification

The study further sought to establish the academic qualifications of the respondents, and the findings obtained are presented in Table 2.

Table 2: Academic Qualifications of the Teachers

Qualification	Frequency	Percentage
Degree (ECE)	35	19.4
Degree (Education)	15	8.3
ECE certificate	30	16.7
ECE diploma	55	30.6
Education Diploma	15	8.3
P1	30	16.7
Total	180	100

The study established that 30.6 per cent of pre-primary school teachers had a diploma level of qualification, 19.4 per cent had attained a bachelor's degree in ECE education, 16.7 per cent had a certificate level of qualification, and another 16.7 per cent had a P1 level of qualification. Only 8.3 per cent

of the teachers had a Diploma in education and a bachelor's degree in education.

Length of Service as a Teacher

The study sought to establish the length of time the respondents had served as teachers, and the findings collected are presented in Table 3.

Table 3: Length of Service as a Teacher

Time	Frequency	Percentage
Below 5 years	20	11.1
5 to 10 years	95	52.8
10 to 15 years	40	22.2
15 to 20 years	20	11.1
20 years and above	5	2.8
Total	180	100

The study established that the majority (52.8%) of the respondents had been teachers for a period of 5 – 10 years, while 22.2 per cent had served as teachers for a period of 10-15 years, 11.1 per cent had served as

teachers for a period of 15-20 years. These findings reveal that most of the teachers had served as teachers for more than 5 years and thus had accumulated experience in the teaching profession.

Preschool Children of Science Assessment Scores

The findings obtained from documentary analysis of the means of the results from the preschool learners science assessment tests are presented on Table 4.

Table 4: Descriptive Statistics of the Preschool learner’s science assessment scores

Range (Scores)	Frequency	Percentage
0-49 (Below Expectation)	9	5
50-64 (Approaching Expectation)	23	12.8
65-79 (Meeting Expectations)	44	24.4
80-100 (Exceeding Expectations)	104	57.8
Total	180	100.0

The findings from the preschool learners' science assessment tests imply that the majority (57.8%) of the preschool classes had learners scoring a mean of (81-100) in their science assessment tests, which implies that they exceeded the expectations in their assessment. This implies that their preschool learners' science assessment was above average, which is good. However, there was a challenge with the schools that had learners' means that had scored

low (below 50) on science assessment, as the test revealed.

Children's performance in science

The study further sought to establish children's performance in science of the learners. The findings obtained from documentary analysis of the means of the results from the preschool learners' science assessment tests are presented in Table 5.

Table 5: Children's Performance in Science

N Valid	180
Mean	79.2641
Median	80.2441
Mode	78.26
Std. Deviation	5.56324
Variance	44.21007
Minimum	44.00
Maximum	96.00

From Table 5, the lowest score was 44, while the highest was 96. The mean of children's performance in science scores was 79.2641 with a standard deviation of 5.56324. About 50 per cent of the subjects had scored above the mean. This implies that the learners scored high on children's performance in science tests, where most of the scores were below 80 per cent. The learners who scored below 70 per cent on the preschool learner's science assessment test score imply that, indeed, there was a challenge in the learners' children's performance in science. Thus, this study aims to

establish how it is influenced by classroom management practices.

Classroom Interaction and the Performance of Children in Science

The first objective of the study sought to establish how classroom interaction affects children's performance. The respondents were required to indicate their level of agreement on a 5-point Likert scale where S.A= Strongly Agree, A=Agree, U = Undecided, D=Disagree, S.D=Strongly Disagree. The findings collected are presented in Table 6.

Table 6: Classroom Interaction and the Performance of Children in Science

Statements	SA 5	A 4	U 3	D 2	SD 1	WA
Teachers who use individual teaching methods are very effective during science lessons.	16.7	58.3	2.8	13.9	8.3	3.612
During science lessons, a teacher who dramatises teaching situations efficiently is able to increase the learners' understanding of concepts	33.3	52.8	0	0	13.9	3.916
Instructors show understanding with other teachers efficiently during science lessons. (Exchanging ideas)	16.6	69.5	2.8	8.3	2.8	3.884
Teachers engagement of learners on real-life science issues does not influence their science acquisition	8.3	13.9	2.8	55.5	19.5	2.360
As a teacher, never apply inquiry-based learning in the classroom during science lessons.	2.8	13.9	5.5	52.8	25.0	2.167
Some teachers are not capable of choosing and applying appropriate teaching methods during science lessons	8.3	61.1	2.8	22.2	5.6	3.443

A weighted average score range from 4.20 to 5.00 meant that the respondents strongly agreed with the statement, and 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. While a weighted average of 1.00 to 1.79 meant that the respondents strongly disagreed with the statement.

The study established that the majority (58.3%) of the respondents agreed that teachers who use individual teaching methods were very effective during science lessons. These findings are further supported by a weighted average of 3.612 that was obtained. These findings agree with the sentiments of Gunawan (2017), who asserted that instructional management has been emphasised in many studies as a common factor that influences the learner's performance in sciences and related subjects. This is because effective management of instruction in a classroom prepares the learners for learning.

The study further established that during science lessons, a teacher who dramatises teaching situations efficiently is able to increase the learner's understanding of concepts, as was revealed by 52.8 per cent and 33.3 per cent of the respondents who agreed and strongly agreed, respectively. The use of dramatisation in teaching science has also been

emphasised by Archila (2017), who asserts that, even if science teachers consider including any element of the dramatic scenes in science in the curriculum, it is often solely only in terms of humanising science for the aim of fostering positive attitudes towards science, rather than for the aim of understanding the nature of science. For many science teachers, only the development of an understanding of science concepts and the methods of science are crucial to an education in science.

The study also established that the majority (69.5%) of the respondents indicated that instructors show efficiency in exchanging ideas with other teachers during science lessons. These findings are further corroborated by a weighted average of 3.884 that was obtained. These findings agree with those of Koedinger et al. (2013) research. The study established that the use of situations connected to real life in teaching scientific concepts helps the learners to develop an abstract understanding of science concepts. Another way of ensuring that learners have obtained a concrete understanding of scientific concepts is to apply figurative systems that are appropriate, giving the learners the concepts that examine their level of understanding of the concepts, as well as ensuring that the learners are actively involved in the classroom.

The study further established that teachers' engagement with learners on real-life science issues influenced their science acquisition, as revealed by a

majority (55.5%) of the respondents who disagreed, and a weighted average of 2.360 was obtained. These findings agree with the findings of Gacheri (2017). According to Gacheri (2017), teacher engagement in classroom management is the most neglected area of study in preschools. With no dictated instructional management practices set out by the Kenya Institute of Curriculum Development, the teachers use the strategies they deem most appropriate. Instructional management encompasses several activities that a teacher undertakes in the classroom to ensure that the curriculum content is transferred from the books to the learners.

The study further established that the teachers applied inquiry-based learning in the classroom during science lessons, as revealed by 52.8 per cent of the teachers who disagreed, and a weighted average of 2.167 was obtained. The findings are in line with the findings of research by Walan (2016), who conducted studies on the effects of the inquiry-based learning model on learners and teachers. Based on their findings, learners were found to give better responses when inquiry-based learning was used in the teaching and learning sessions. Research has also reported the positive effect of inquiry-based learning on teachers and teaching. Inquiry-based learning improves teachers' performance, understanding,

science process skills, and inquiry skills. A case in point is that the experimental session conducted by teachers improved.

According to Ooko et al. (2018), science learning usually takes different techniques. The participatory approach to learning science entails practical activities, demonstrations, guided discussions, field trips and projects. In the demonstration approach, the teachers usually have clear objectives they aim to achieve. In both methods, the learners ought to be involved in the instructional process. It is unfortunate that the study also established that some teachers were not capable of choosing and applying appropriate teaching methods during science lessons, as was revealed by 61.1 per cent of the respondents who agreed and a weighted average of 3.443 was obtained.

The researcher carried out observations during a science lesson in classrooms. The researcher sat in during science lessons in classrooms and obtained the following data, as guided by the observation checklist. The findings obtained regarding the objective of classroom management are presented in Table 7. Where: VP = Very Poor, P = Poor, A Average, G=Good VG = Very Good.

Table 7: Observation data on Classroom interaction and the Performance of Children in science

Variable	Rating of Teacher Effectiveness in Classroom Interaction				
	VP 1	P 2	A 3	G 4	VG 5
Problem-based learning					
Assigning a problem	2.8	11.1	5.6	27.8	52.8
Identify what needs to be known	0	44.4	11.1	41.7	0
Application of knowledge to solve a problem	16.7	2.8	0	55.6	25
Project-based learning					
Inquiry and innovation	2.8	16.7	11.1	58.3	11.1
Deriving a challenge	0	5.6	13.9	25	55.6
Obtaining feedback and revision	0	2.8	11.1	44.4	38.9
Traditional learning methods					
Tell what the learner needs to know	2.8	8.3	19.4	44.4	25
Learner memorises what has been taught	0	0	13.9	22.2	63.9
Assign a problem for application	5.6	5.6	22.2	55.6	11.1

The study established that the majority (52.8%) of the schools were found to have teachers in

preschools who were very good at assigning a problem to the learners for ease of understanding.

However, the study established that 11.1 per cent and 2.8 per cent of teachers were poor and very poor, respectively. These findings agree with the following multiple studies that have shown that practical work confers many advantages, including developing science skills and scientific knowledge, as well as comprehending science theories and concepts (Zimmerman et al., 2016). As described by Okam and Zakari (2017), practical work has been able to promote learners' positive attitudes and increase motivation for effective learning in science. Consequently, a positive attitude toward the relevance of practical work meaningfully affects learners' achievement in science.

The study further established that 41.7 per cent of the teachers were good at identifying what needs to be known in the classrooms during the science instruction lessons. However, the concern was that 44.4 per cent of the preschool teachers were poor at identifying what needed to be known. These findings partly agree with the Case Studies in Science Education (Manzano-Sanchez et al., 2018), involving a cross-section of 11 U.S. school districts, described the conditions and needs of science, mathematics and social studies education. The authors noted that the quality of science instruction learners experienced was quite varied; while some of the observed science classes stressed important science ideas and were described as interesting to learners, most overemphasised facts and memorisation and were not seen as relevant to the learners. Science education observation studies since that time have generally either been quite small or have been conducted in the context of the evaluation of a reform initiative, in both cases limiting the generalisability of the results.

The Inside the Classroom Study provides new insight into the extent to which teaching for understanding is occurring in our nation's schools. The study included observations of 180 science lessons, selected to be representative of lessons nationally, and interviews with the teachers of those lessons. Lessons were documented and analysed in a number of different areas, including the quality of the science content and the extent to which the classroom culture facilitated learning. Findings about the national status of quality science instruction and the components of lessons that seem likely to promote

learner understanding have important implications for science educators.

The study also established that the majority (55.6%) of the teachers enhanced problem-solving skills in science learning. However, a considerable number (16.7%) of the teachers were very poor in their use of science skills to solve problems. The findings are also supported by the findings of Saritepeci (2021), who asserted that practical work has also been shown in some studies to help improve the learners' communication skills so as to solve science problems and thus become more motivated in science. In addition to this, practical work encourages and increases learners' interest in science and promotes it as an engaging subject. As an example, when learners practice chemical reactions, they perceive that chemistry/science is an applied science and not just rules and theories.

Regarding project-based learning, the researcher established that 58.3 per cent of the teachers were good at inquiry and innovations during science lessons, while 16.7 per cent of the teachers were poor at it. These findings agree with the findings of Ethiopian researchers who carried out studies on the effects of inquiry-based learning models on learners' conceptual understanding, attitudes, experience and achievement (Berie et al., 2022). Some of these studies indicated that learners who learned with a guided inquiry learning model lesson design were better in their achievement, attitudes and conceptual understanding of science topics than those who were taught by the conventional teaching method (Berie et al., 2022). In another study, the instructional model had a significantly higher effect than the conventional teaching methods on enhancing conceptual understanding and minimising misconceptions (Morges, 2021). Wale and Bishaw (2020) also found out that although many teachers were aware of inquiry-based learning, they did not apply it in their classrooms.

The study further established that 55.6 per cent of the teachers were very good at deriving practical challenges during science lessons, whereas only 5.6 per cent were poor at this skill. These findings are supported by the findings of Tsakeni (2018), who explored access to effective practical work for physical sciences students in two South African high

schools. The findings revealed that the lack of practical examinations led to underestimating practical work in physical sciences classrooms and thus marginalised learners.

The study further established that most of the teachers were good at obtaining feedback and revision, which was revealed by 44.4 per cent and 38.9 per cent of the ratings observed. These findings agree with the findings of Harris and Brown (2013), who found in their study on learners' feedback that they were well informed of the public nature and accountability element of the assessment; they tended to write superficial comments rather than articulating strengths and weaknesses. Moreover, the learners did not trust their peers as they trusted their teacher. Gamlem and Smith (2013), who interviewed teenage learners on how they generally viewed classroom feedback, established that the learners wanted more specific suggestions on how they could improve their work. Also, the learners questioned the often mandatory aspect of appraisal in feedback given to peers since they sometimes discovered it difficult to find relevant aspects to praise. Consequently, they doubted the honesty of the appraisals received.

Most of the teachers were able to tell what the learner needs to know, as was revealed by 44.4 per cent of the classrooms observed as good and 25 per cent of classrooms that were observed as very good. These findings agree with the findings of a study by Hovardas et al. (2014), who found that science learners tended to emphasise content over skills to a greater extent than the teacher and that the learners were less likely to find scientific mistakes than the teacher. Differences between the assessment of teachers and that of peers may be influenced by the task to be assessed, the criteria and the assessor's experience. However, Tsai et al. (2022) found the differences between learners' and teachers' assessments to be related to how they judged the importance of the criteria at hand. Although the above study on discrepancies between teacher and

peer feedback concerns university-level education, the recognition of potential discrepancies also in lower education levels could be relevant in spite of differences in educational practices.

The study further established that the observations made implied that the learners memorised what had been taught, as was revealed by 63.9 per cent of the classes observed. These findings differ from the sentiments of Zghida et al. (2022), who indicated that one of the most useful solutions is to trigger learners' interest and optimise their active involvement and, therefore, their engagement in the learning process. Engagement is directly linked to academic achievement and is the result of a person's interest in content-specific activities. Interest development takes place in two phases: The triggering phase and the maintaining phase.

The study further established that in assigning a problem for application, 55.6 per cent of the classes observed were good. The concern was that 5.6 per cent of the classes were found to be poor. However, studies have shown that many problems and difficulties still arise in young learners' understanding of the concept of energy (Zghida et al., 2022). These difficulties reduce their interest in the subject, and energy becomes an unattractive area of study.

The researcher first sought to test the hypothesis, **H₀₁**: Classroom interaction has no statistically significant relationship with the performance of children in science in pre-primary 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 classroom interaction (as the first independent variable) and the performance of children in science in pre-primary schools (as the dependent variable). The model summary obtained is presented in Table 8.

Table 8: Model Summary of influence of Classroom interaction in preschools on performance of children in science

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.842 ^a	0.709	0.712	0.2914

a. Predictors: (Constant) Classroom interaction in preschools

From Table 6, it is revealed that there was a strong positive association between classroom interaction and the performance of children in science in pre-primary schools. This was revealed by a positive Coefficient R (0.842). The R-squared is 0.709 (or 70.9%), which implies that an improvement in the preschool classroom interaction can predict a 70.9 per cent increase in the learner's performance in

science in preschools. The researcher further conducted a linear regression test between classroom interaction and the performance of children in science. The learner's average test scores were regressed against the researcher's rating of the classroom interaction. Table 9 shows the findings obtained.

Table 9: Regression Analysis on the Influence of Classroom Interaction in Preschools on the Performance of Children in Science

Model	Unstandardised Coefficients		Standardised Coefficients	T	P- Value
	B	Std. Error	Beta		
(Constant)	0.204	0.214		5.129	0.000
Classroom interaction	0.724	0.104	0.716	15.210	0.000
a. Predictor: 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, Classroom interaction, was regressed against the performance of children in science. From the findings, the P value for the constant was 0.000, which is < 0.05 , thus making the influence of the constant to be significant. Further, the study established that the P value for the independent variable was 0.00, which is < 0.005 , thus making the level of relationship between the dependent and independent variables statistically significant. This implies that the null hypothesis (**H₀₁**: Classroom interaction has no statistically significant relationship with performance of children in science in pre-primary schools in Tharaka Nithi County) was rejected, and thus the alternative hypothesis, Classroom interaction has a significant relationship with performance of children in science in pre-primary schools in Tharaka Nithi County was thus accepted. The study further established the beta coefficient of 0.724 to model the level of association between the independent and the dependent variables. To predict the level of relationship between classroom interaction and the performance of children in sciences, the researcher used this regression equation.

Performance of children in sciences = 0.204 (Constant) + 0.724 (Classroom interaction). From this, the implication is that the improvement in the performance of science in preschools can be caused

by a 0.724 (classroom interaction) and a constant value of 0.204 (these include all other factors not included in this test). These findings agree with the findings of Hernández et al. (2019), who established that recognition of the benefits that accrue to learners when instruction is more learner-centred and less teacher-directed has been widely reported. This involves developing a learning environment in which learners are encouraged to actively participate and accept responsibility for their own learning, as well as providing a learning environment that focuses attention not only on the condition within which learning occurs but also on the factors that mediate the teaching-learning process. Teacher-centred interaction was said not to provide a learning environment that allows learners to actively participate and take responsibility for their own learning rather than remain passive during the teaching-learning process. To date, those employing interaction as a means of teaching have used a variety of approaches to structure learning. These varieties of approaches adapted to structure learning include teachers' classroom management interaction, cooperative classroom interaction, friendly classroom interaction and so on.

CONCLUSION AND RECOMMENDATIONS

Conclusion: The study established that the majority (58.3%) of the respondents agreed that teachers who use individual teaching methods were very effective during science lessons. The study also established that the majority (69.5%) of the respondents

indicated that instructors show understanding with other teachers efficiently during science lessons. 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, Classroom interaction, was regressed against the performance of children in science. From the findings, the P value for the constant was 0.000, which is < 0.05 , thus making the influence of the constant to be significant. Further, the study established that the P value for the independent variable was 0.00, which is < 0.005 , thus making the level of relationship between the dependent and independent variables statistically significant. This implies that the null hypothesis (**H₀₁**: Classroom interaction has no statistically significant relationship with the performance of children in science in pre-

primary schools in Tharaka Nithi County) was rejected. Based on the findings of this study, the researcher concludes that the classroom interaction used by preschool teachers had an influence on the learners' performance in science activities. The ability of the teachers to identify the learners' learning needs and the teaching methods that can best handle the topic were found to be crucial in science instruction.

Recommendations: The Ministry of Education, through the Kenya Institute of Curriculum Development, should review the current classroom interaction for preschools, topic by topic and modify them to fit specific topics. The methods should then be taught to teachers through in-service training to keep them versed in the current classroom interaction.

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