International Journal of Sustainability and Advanced Integrated Research
Volume 2, Issue 2 (April-June 2026) | ISSN: 3107-7854
DOI: https://doi.org/10.65339/ijsair.V2.I2.308

Effects of Hands-On Experiments in Science on the Academic Performance of Grade Four Pupils

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Publication history: Received: April 12, 2026; Revised: April 16, 2026; Accepted: April 26, 2026
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Abstract

This study examined the effects of hands-on experiments in Science on the academic performance of Grade Four pupils in public elementary schools in District II-A, City Schools Division Office of Antipolo for School Year 2025–2026. Specifically, it investigated how experiential learning activities influence pupils' focus and concentration, motivation to learn, critical thinking, and classroom engagement and collaboration, as well as their relationship with academic performance in Science.The study employed a descriptive survey research design complemented by documentary analysis. A total of 20 Grade Four Science teachers and 346 pupils participated as respondents, with the pupil sample determined using Slovin's formula. Data were gathered through a researcher-made questionnaire-checklist and analyzed alongside pupils' first and second quarter grades in Science.Findings revealed that most teacher-respondents were middle-aged, female, married, and experienced educators, many of whom were pursuing graduate studies and had attended various in-service trainings. The pupil-respondents were predominantly 10 years old, female, and came from small families with modest income levels. Both teachers and pupils perceived that hands-on experiments have a high positive effect on pupils' focus, motivation, critical thinking, and classroom engagement.However, significant differences were found between teachers' and pupils' perceptions in terms of focus and concentration, and class engagement and collaboration, while no significant differences were observed in motivation and critical thinking. Results further showed that demographic profiles of both teachers and pupils did not significantly influence their perceptions. Pupils' academic performance in Science was rated as Very Satisfactory, yet no significant relationship was found between perceived effects of hands-on experiments and academic performance.The study concludes that while hands-on experiments are perceived as highly beneficial for enhancing learning experiences, they do not directly correlate with academic grades. It recommends strengthening inquiry-based instruction, improving instructional resources, and enhancing home-school collaboration to maximize the benefits of experiential learning.

Keywords: Hands-On Experiments, Academic Performance, Science Education, Experiential Learning, Grade Four Pupils, Inquiry-Based Learning

Introduction

Education is a continuous process of acquiring knowledge, skills, and values through both formal instruction and lived experiences. It plays a vital role in the holistic development of individuals by enhancing intellectual, moral, physical, and social growth. Through education, learners develop essential competencies such as critical thinking, decision-making, and problem-solving skills that are necessary for personal development and active participation in society.

In the Philippines, the importance of education is enshrined in Article XIV, Section 1 of the 1987 Philippine Constitution, which mandates the State to provide quality, accessible, and relevant education for all. In support of this mandate, the Department of Education promotes instructional innovations that enhance learning outcomes, particularly in Science education.

One of the most effective instructional approaches in Science is the use of hands-on experiments. Hands-on experiments are experiential learning activities where learners actively engage in observing, exploring, and investigating scientific concepts through practical tasks. This approach allows pupils to apply theoretical knowledge in real-life contexts, making learning more meaningful, engaging, and relevant. It also enhances critical thinking, curiosity, collaboration, and conceptual understanding among learners.

Aligned with this, DepEd Order No. 10, s. 2024 or the MATATAG Curriculum emphasizes inquiry-based and experiential learning approaches that encourage active learner participation. This policy supports the integration of hands-on activities in Science to develop scientific literacy and 21st-century skills among learners.

Globally, science education increasingly promotes "learning by doing" as an effective pedagogical approach. This method enables learners to construct knowledge through direct experience, improving retention and understanding of scientific concepts. It also fosters engagement, motivation, and the development of higher-order thinking skills.

Despite its benefits, challenges persist in implementing hands-on experiments in Science classrooms. Observations reveal that limited laboratory equipment, materials, and resources hinder the effective delivery of experiential learning. This results in reduced opportunities for pupils to engage in meaningful scientific exploration, thereby affecting their conceptual understanding and skill development.

Foreign studies consistently affirm the effectiveness of hands-on learning. Trevisan et al. (2023) and Kaneza et al. (2023) found that students exposed to laboratory-based and hands-on instruction perform better academically compared to those taught through traditional methods. Kapici et al. (2022) further emphasized that inquiry-based and hands-on approaches enhance conceptual understanding and inquiry skills. Similarly, Nwankwo et al. (2024) confirmed that hands-on activities significantly improve students' academic performance in Science.

Local studies support these findings. Arnado et al. (2021) highlighted teachers' positive attitudes toward laboratory-based instruction, while Benong et al. (2024) found that interactive and localized experiments improve student performance. Zabala and Dayaganon (2023) emphasized the importance of laboratory environments in developing science skills, while Nuevo (2024) identified resource limitations as a key challenge in implementing effective hands-on instruction. Balaoro (2024) further confirmed that active learning strategies enhance student engagement and understanding in Science.

Although existing studies recognize the effectiveness of hands-on learning, most focus on secondary or higher education levels and often include additional variables such as virtual laboratories or teacher competency. There is limited research focusing on Grade Four pupils in the Philippine elementary context, particularly on how hands-on experiments affect multiple learning dimensions and academic performance in Science. This gap underscores the need for the present study, which aims to examine the effects of hands-on experiments on the academic performance of Grade Four pupils in Science.

Material and methods

2.1 Research Design

The study applied the descriptive research method utilizing a researcher-made questionnaire checklist in gathering the needed data.

2.2 Locale of the Study

The study was conducted in public elementary schools in District II-A, City Schools Division Office of Antipolo. These schools include Dalig Elementary School, Kaila Elementary School, Knights of Columbus Elementary School, Juan Sumulong Elementary School, Lores Elementary School and Nazarene Ville Elementary School. These schools offer complete elementary education from kindergarten level to grade six level

2.3 Respondents of the Study

The study involved two groups of respondents. The first group consisted of the total population of 20 Grade Four Science teachers from public elementary schools in District II-A, City Schools Division Office of Antipolo. These teachers were described in terms of age, sex, civil status, educational attainment, length of service, position title, and in-service trainings attended. The second group consisted of 346 Grade Four pupils from the same schools, who were described in terms of age, sex, sibling position, number of children in the family, parents' educational attainment, parents' occupation, and monthly family income.

2.4 Sample and Sampling Procedure

The teacher-respondents were selected through total enumeration, involving all 20 Grade Four Science teachers in the identified schools. For the pupil-respondents, the sample size was determined using Slovin's formula ($n = N / (1 + Ne^2)$), resulting in 346 pupils out of a total population of 2,554 Grade Four learners. The pupils were selected using simple random sampling to ensure equal opportunity of inclusion and to avoid bias.

2.5 Research Instrument

This study utilized a researcher-made questionnaire-checklist as the main data-gathering instrument. The questionnaire was composed of two parts. Part I gathered the profile of the respondents, including teachers' age, sex, civil status, educational attainment, length of service, position title, and in-service trainings attended, as well as pupils' age, sex, sibling position, number of children in the family, parents' educational attainment, parents' occupation, and monthly family income. Part II measured the extent of effects of hands-on experiments in Science on Grade Four pupils' performance in terms of focus and concentration, motivation to learn, critical thinking, and class engagement and collaboration, with 10 items per

indicator or a total of 40 items. Responses were rated using a five-point Likert scale ranging from 1 (Never/Very Low Effect) to 5 (Always/Very High Effect). In addition, documentary analysis was used to determine pupils' academic performance in Science based on their first and second quarter grades, interpreted using the DepEd grading scale ranging from Did Not Meet Expectations to Outstanding. The instrument was content-validated by experts in research and education, including the thesis adviser, statistician, school principal, master teachers, dean of graduate studies, and professorial lecturers. Their suggestions and recommendations were incorporated before the final administration of the instrument to the respondents.

2.6 Data Gathering Procedure

The researcher followed the Gantt Chart of Activities in the conduct of the study. This includes the formulation of research problem up to the revision of the manuscript and submission of the final copy. After the validation of the instrument, permission to conduct the study was obtained from the office of the Schools Division Superintendent. The questionnaire-checklist was administered to the respondents. Gathering of the needed information was guided by the Data Privacy Act of 2012. After the retrieval, the data were encoded and processed through the Statistical Package for Social Sciences (SPSS). Data were analyzed and interpreted based on the sub problems. Based on the interpreted data, summary of findings, conclusions and recommendations were formulated. After the oral defense, the manuscript was revised considering the comments and suggestions of the Oral Examination Committee. It was also subjected to anti plagiarism test. After finalization, hard bound copies were submitted to the office of the Graduate Studies Program and other offices

2.7 Data Analysis Techniques

To analyze and interpret the data, appropriate statistical tools were employed. Frequency, percentage, and rank distribution were used to describe the profile of the two groups of respondents in terms of selected variables. The weighted mean was used to determine the extent of effects of hands-on experiments in Science on Grade Four pupils' performance as perceived by both teachers and pupils in terms of focus and concentration, motivation to learn, critical thinking, and class engagement and collaboration. To test the significant difference between the perceptions of the two groups of respondents, an independent samples t-test was applied. One-way Analysis of Variance (ANOVA) was used to determine significant differences in perceptions when respondents were grouped according to their profile variables.Furthermore, the level of academic performance in Science of Grade Four pupils, based on their first and second quarter grades, was analyzed using frequency, percentage, mean, and standard deviation. Finally, correlation analysis was used to determine the significant relationship between the perceived effects of hands-on experiments in Science and the pupils' academic performance.

2.8 Ethical Considerations

This study strictly adhered to ethical standards in the conduct of research. Prior to data collection, permission was sought from the school authorities and concerned officials to ensure proper coordination and approval. The respondents were informed about the purpose of the study, and their participation was entirely voluntary. Informed consent was obtained, assuring them that they could withdraw from the study at any time without any consequences. Confidentiality and anonymity of the respondents were strictly maintained by not disclosing their identities and ensuring that all collected data were used solely for academic purposes. Additionally, the researcher ensured that no harm, discomfort, or bias would affect the participants throughout the process. All information gathered was treated with utmost respect and integrity, and results were presented honestly and objectively.

Results and Discussion

3.1 Profile of the Respondents in Terms of the Selected Variables

As reflected in the table, out of 20 teachers -respondents, 8 or 40.0% are 41-50 years old and 6 or 30.0% are 31-40 years old. The rest are 21-30 years old and 51 years old and above. Most of them are females with 13 or 65.0% while only 7 or 35.0% are males. With regard to their civil status, most of them are married with 18 or 90.0% and only two (2) or 10.0% are single. As to their length of service, most of them are teaching for 16-20 years with 8 o or 40.0% and 5 or 25.0% are in the service for 6-10 years. As regard to their educational attainment, most of them are with MA Units with 11 or 55.0%; followed by Bachelor's Degree with 5 or 25. %; while 3 or 15.0% are MA with Doctorate Units and only one (1) or 5.0% are Masters' degree holders. With regard to their position title, 9 or 45.0% are Teacher 6, 8 or 40.0% are Teacher 3 while 2 or 10.0% are Master Teacher I and the only 1 or 5.0% are Teacher 7. In terms of in-service trainings attended, 85 % have attended in the Division level, 10% in the district level and 5.0% have attended in school level.

Table 1.1
Frequency, Percentage and Rank Distribution of the Teacher-Respondents in Terms of the Selected Variables

Profile	f	%	Rank
Age			
51 years old and above	4	20.0	3
41-50 years old	8	40.0	1
31-40 years old	6	30.0	2
21-30 years old	2	10.0	4
Total	**20**	**100.0**	
Sex			
Male	7	35.0	2
Female	13	65.0	1
Total	**20**	**100.0**	
Civil Status			
Single	2	10.0	2
Married	18	90.0	1
Total	**20**	**100.0**	
Length of Service			
26 years and above	4	20.0	3
21-25 years	2	10.0	4
16-20 years	8	40.0	1
11-15 years	1	5.0	5
6-10 years	5	25.0	2
Total	**20**	**100.0**	
Educational Attainment			
MA with Doctorate Units	3	15.0	3
Master's Degree	1	5.0	4
With MA Units	11	55.0	1
Bachelor's Degree	5	25.0	2
Total	**20**	**100.0**	
Position Title			
Master Teacher 1	2	10.0	3
Teacher VII	1	5.0	4
Teacher VI	9	45.0	1
Teacher III	8	40.0	2
Total	**20**	**100.0**	
In-Service Trainings Attended			
Division	17	85.0	1
District	2	10.0	2
School	1	5.0	3
Total	**20**	**100.0**	

The table 1.2 below shows that out of 346 pupil-respondents, 62.1 % are 10 years old and 36.1 % are 9 years old; while only 1.7% are 11 years old and above who are mostly female with 59.0%. In terms of sibling position, most of them are 3rd born and 2nd born child with 56.6% and 18.2 percent respectively. The remaining percentages are 15.0% and 10.1% who are 1st born and 4th and above. With regard to the number of children in the family, most of them belong to families with 2 children and 3 children with 54.3% and 36.4% respectively. With regard to parents' educational attainment, most of the fathers are high school graduate with 67.3% and college graduates with 25.1% while 6.9 % are college undergraduate and only .6% are elementary graduate. As for the mothers, most of them are high school graduate with 68.8% and college undergraduate with 17.3% while 13.9 percent are college graduates. As to the parents' occupation, majority of the fathers are private employee with 56.9% and OFW and Housewife/househusband both with 12.7%; while only .3% are healthcare provider. As for the mother's occupation, majority of them are housewife with 41.0% and government employee with 33.2%; while only .6% are healthcare provided. As to their monthly family income, most of the respondents have monthly family income of Php 10,000.00 – Php 14,999.00 with 40.5% and below P 10,000 with 30.6% while 26.3% with monthly income of Php 15,000.00 – Php 19,999.99 and 2.6% with Php 20,000.00 and above respectively.

Table 1.1
Frequency, Percentage and Rank Distribution of the Pupil-Respondents in Terms of the Selected Variables

Profile	f	%	Rank
Age			
11 years old and above	6	1.7	3
10 years old	215	62.1	1
9 years old	125	36.1	2
Total	**346**	**100.0**	
Sex			
Male	142	41.0	2
Female	204	59.0	1
Total	**346**	**100.0**	
Sibling Position			
1st	52	15.0	3
2nd	63	18.2	2
3rd	196	56.6	1
4th and above	35	10.1	4
Total	**346**	**100.0**	
Number of Children in the Family			
1	32	9.2	3
2	188	54.3	1
3	126	36.4	2
Total	**346**	**100.0**	

Parent's Educational Attainment	**Father**			**Mother**		
College Graduate	87	25.1	2	48	13.9	3
College Undergraduate	24	6.9	3	60	17.3	2
High School Graduate	233	67.3	1	238	68.8	1
High School Undergraduate	-	-	-	-	-	-
Elementary Graduate	2	.6	4	-	-	-
Elementary Undergraduate	-	-	-	-	-	-
Total	**346**	**100.0**		**346**	**100.0**	
Parent's Occupation	**Father**			**Mother**		
Government Employee	39	11.3	4	115	33.2	2
Private Employee	197	56.9	1	44	12.7	3
Self-Employed	2	.6	6	7	2.0	5
OFW	44	12.7	2.5	32	9.2	4
Healthcare Provider	1	.3	7	2	.6	7
Housewife/Husehusband	44	12.7	2.5	142	41.0	1
Others	19	5.5	5	4	1.2	6
Total	**346**	**100.0**		**346**	**100.0**	

Monthly Family Income			
Php 20, 000 and above	9	2.6	4
Php 15, 000 – Php 19, 999	91	26.3	3
Php 10, 000 – Php 14, 999	140	40.5	1
Below Php 10, 000	106	30.6	2
Total	**346**	**100.0**	

3.2 Extent of Effects of Hands-On Experiments in Science on the Performance of Grade Four Pupils as Perceived by the Two Groups of Respondents with Respect to the Different Aspects

Table 3 shows that both teachers and pupils perceived hands-on experiments in Science as having a High Effect on Grade Four pupils' performance, with composite weighted means of 3.79 and 3.64, respectively. Teachers rated "Class Engagement and Collaboration" highest, followed by "Critical Thinking" and "Motivation to Learn," while "Focus and Concentration" ranked lowest. Similarly, pupils rated "Critical Thinking" highest, followed by "Class Engagement and Collaboration" and "Motivation to Learn," with "Focus and Concentration" again ranked lowest and interpreted only as a

Moderate Effect. These findings suggest that hands-on experiments are most effective in enhancing pupils' engagement, collaboration, and critical thinking, but are less consistent in sustaining attention and focus. The variation in rankings between teachers and pupils further indicates a perceptual gap, where teachers emphasize instructional intent and expected outcomes, while pupils reflect their actual learning experience and cognitive readiness during activities. This is supported by Chu (2024), who emphasized that science learning is most effective through hands-on activities that promote observation, collaboration, and active participation, although their effectiveness depends on adequate resources and proper implementation. Likewise, Trevisan et al. (2023) and Kaneza et al. (2023) found that experiential and laboratory-based instruction significantly improves student engagement and academic performance compared to traditional approaches, reinforcing the value of hands-on experiments in developing scientific understanding and skills among learners.

Table 3
Extent of Effects of Hands-On Experiments in Science on the Performance of Grade Four Pupils as Perceived by the Two Groups of Respondents with Respect to the Different Aspects

Aspects	Teachers			Pupils		
	WX	VI	Rank	WX	VI	Rank
Focus and Concentration	3.53	High Effect	4	3.36	Moderate Effect	4
Motivation to Learn	3.80	High Effect	3	3.62	High Effect	3
Critical Thinking	3.87	High Effect	2	3.89	High Effect	1
Class Engagement and Collaboration	3.96	High Effect	1	3.68	High Effect	2
Composite WX	**3.79**	**High Effect**		**3.64**	**High Effect**	

3.3 Significant Difference Between the Perception of the Two Groups of Respondents on the Extent of Effects of Hands-On Experiments in Science on the Performance of Grade Four Pupils with Respect to the Different Aspects
The table shows that there is a significant difference in the perception of the two groups of respondents on the extent of effects of hands-on experiments in Science on the performance of Grade Four pupils in terms of Focus and Concentration and Class Engagement and Collaboration, as indicated by p-values less than the .05 level of significance. However, no significant differences were found in Motivation to Learn and Critical Thinking, with p-values greater than .05, leading to the acceptance of the null hypothesis for these aspects. This indicates that teachers and pupils differ in their perceptions in selected areas, particularly where teachers rated the effects higher than pupils, suggesting that educators perceive stronger instructional impact than what is actually experienced by learners in terms of attention and collaboration. In contrast, both groups share similar perceptions regarding Motivation to Learn and Critical Thinking, implying a common understanding that hands-on experiments effectively enhance curiosity and cognitive engagement among pupils. These findings imply that while hands-on activities are effective in promoting learning, their impact on sustained focus and collaborative engagement may not be fully realized by learners unless explicitly reinforced by teachers. It further suggests the need for teachers to strengthen strategies that maintain attention and make collaborative learning outcomes more visible to pupils. This finding is supported by San Gabriel and Manalastas (2025), who also reported differences in teacher and student perceptions of learning outcomes in experimental activities, although some areas showed no significant difference, reflecting both alignment and divergence in perceived effectiveness of hands-on instructional approaches.

Table 3
Significant Difference Between the Perception of the Two Groups of Respondents on the Extent of Effects of Hands-On Experiments in Science on the Performance of Grade Four Pupils with Respect to the Different Aspects

Aspects	t-value	p-value	Decision	Verbal Interpretation
Focus and Concentration	2.005	.046	Rejected	Significant
Motivation to Learn	1.321	.201	Accepted	Not Significant
Critical Thinking	.195	.847	Accepted	Not Significant
Class Engagement and Collaboration	4.446	.000	Rejected	Significant

3.4 Significant Difference on the Perception of the Two Groups of Respondents on the Extent of Effects of Hands-On Experiments in Science on the Performance of Grade Four Pupils with Respect to the Different Aspects in Terms of Their Profile

As reflected in Table 4.1, the F-test results show that all computed p-values across the different personal variables of the teacher-respondents (age, sex, civil status, length of service, educational attainment, position title, and in-service trainings attended) are greater than .05 level of significance. This leads to the acceptance of the null hypothesis, indicating that there is no significant difference on the perception of the teacher-respondents regarding the extent of effects of hands-on experiments in Science on the performance of Grade Four pupils across all aspects, namely focus and concentration, motivation to learn, critical thinking, and class engagement and collaboration. This implies that teachers' perceptions remain consistent regardless of their demographic and professional profiles, suggesting that these personal characteristics do not influence how they view the effectiveness of hands-on experiments. It further indicates that teachers generally share a common understanding that hands-on activities positively influence pupils' learning outcomes in Science. This consistency in perception suggests that experiential learning is widely recognized among teachers as an effective instructional strategy, regardless of differences in experience, training, or position. Moreover, it implies that hands-on experiments create a strong and uniform perception of educational value, as they are seen to enhance understanding, motivation, collaboration, and cognitive development among pupils, ultimately contributing to improved academic performance in Science.

Table 4.1.
Significant Difference on the Perception of the Teacher-Respondents on the Extent of Effects of Hands-On Experiments in Science on the Performance of Grade Four Pupils with Respect to the Different Aspects in Terms of Their Profile

Variables/ Aspects	F-comp	p-value	Ho	VI
Age				
Focus and Concentration	1.217	.336	Accepted	Not Significant
Motivation to Learn	2.610	.087	Accepted	Not Significant
Critical Thinking	2.107	.140	Accepted	Not Significant
Class Engagement and Collaboration	1.259	.322	Accepted	Not Significant
Sex				
Focus and Concentration	.306	.587	Accepted	Not Significant
Motivation to Learn	.414	.528	Accepted	Not Significant
Critical Thinking	1.926	.182	Accepted	Not Significant
Class Engagement and Collaboration	.001	.982	Accepted	Not Significant
Civil Status				
Focus and Concentration	1.531	.232	Accepted	Not Significant
Motivation to Learn	.466	.503	Accepted	Not Significant
Critical Thinking	.301	.590	Accepted	Not Significant
Class Engagement and Collaboration	.021	.886	Accepted	Not Significant
Length of Service				
Focus and Concentration	.539	.663	Accepted	Not Significant
Motivation to Learn	1.120	.370	Accepted	Not Significant
Critical Thinking	.316	.814	Accepted	Not Significant
Class Engagement and Collaboration	2.231	.124	Accepted	Not Significant
Educational Attainment				
Focus and Concentration	.721	.554	Accepted	Not Significant
Motivation to Learn	.251	.860	Accepted	Not Significant
Critical Thinking	.213	.886	Accepted	Not Significant
Class Engagement and Collaboration	.737	.545	Accepted	Not Significant
Position Title				
Focus and Concentration	1.780	.185	Accepted	Not Significant
Motivation to Learn	.716	.594	Accepted	Not Significant
Critical Thinking	.275	.889	Accepted	Not Significant
Class Engagement and Collaboration	1.763	.189	Accepted	Not Significant
In-service Trainings Attended				
Focus and Concentration	2.198	.142	Accepted	Not Significant
Motivation to Learn	.671	.524	Accepted	Not Significant

Critical Thinking	1.066	.366	Accepted	Not Significant
Class Engagement and Collaboration	.016	.984	Accepted	Not Significant

Table 4.2. results of the statistical analysis show that there are no significant differences in the perceptions of pupil-respondents on the effects of hands-on science experiments when grouped according to their demographic profiles, including age, sex, sibling position, number of children in the family, parents' educational attainment, parents' occupation, and monthly family income, as all p-values across Focus and Concentration, Motivation to Learn, Critical Thinking, and Class Engagement and Collaboration were greater than the .05 level of significance, leading to the acceptance of the null hypothesis. This indicates that pupils perceive the benefits of hands-on science experiments in a consistent manner regardless of their personal or family backgrounds, suggesting that experiential learning provides equal opportunities for engagement, understanding, and skill development among all learners. It implies that the interactive and activity-based nature of hands-on experiments allows pupils to equally experience improvements in learning regardless of socioeconomic or demographic differences, making it an inclusive and accessible instructional strategy. This finding is supported by Hagenimana et al. (2023), who also reported no significant differences in student performance based on demographic factors such as gender and school type, reinforcing the present study's conclusion that learner characteristics do not significantly influence the perceived effectiveness of hands-on science experiments.

Table 4.2

Significant Difference on the Perception of the Pupil-Respondents on the Extent of Effects of Hands-On Experiments in Science on the Performance of Grade Four Pupils with Respect to the Different Aspects in Terms of Their Profile

Variables/ Aspects	F-comp	p-value	Ho	VI
Age				
Focus and Concentration	.583	.559	Accepted	Not Significant
Motivation to Learn	1.778	.171	Accepted	Not Significant
Critical Thinking	.376	.687	Accepted	Not Significant
Class Engagement and Collaboration	1.956	.143	Accepted	Not Significant
Sex				
Focus and Concentration	.017	.895	Accepted	Not Significant
Motivation to Learn	1.738	.188	Accepted	Not Significant
Critical Thinking	.201	.654	Accepted	Not Significant
Class Engagement and Collaboration	.489	.485	Accepted	Not Significant
Sibling Position				
Focus and Concentration	.732	.533	Accepted	Not Significant
Motivation to Learn	.923	.430	Accepted	Not Significant
Critical Thinking	1.781	.151	Accepted	Not Significant
Class Engagement and Collaboration	1.402	.242	Accepted	Not Significant
Number of Children in the Family				
Focus and Concentration	.020	.980	Accepted	Not Significant
Motivation to Learn	.831	.436	Accepted	Not Significant
Critical Thinking	.006	.994	Accepted	Not Significant
Class Engagement and Collaboration	1.454	.235	Accepted	Not Significant
Father's Educational Attainment				
Focus and Concentration	.302	.824	Accepted	Not Significant
Motivation to Learn	1.486	.218	Accepted	Not Significant
Critical Thinking	2.118	.098	Accepted	Not Significant
Class Engagement and Collaboration	1.769	.153	Accepted	Not Significant
Father's Educational Attainment				
Focus and Concentration	.921	.399	Accepted	Not Significant
Motivation to Learn	1.391	.250	Accepted	Not Significant
Critical Thinking	1.460	.234	Accepted	Not Significant
Class Engagement and Collaboration	.063	.939	Accepted	Not Significant
Father's Occupation				
Focus and Concentration	.628	.643	Accepted	Not Significant
Motivation to Learn	.871	.482	Accepted	Not Significant

Critical Thinking	2.397	.051	Accepted	Not Significant
Class Engagement and Collaboration	1.643	.163	Accepted	Not Significant
Mother's Occupation				
Focus and Concentration	.941	.465	Accepted	Not Significant
Motivation to Learn	1.519	.171	Accepted	Not Significant
Critical Thinking	.773	.592	Accepted	Not Significant
Class Engagement and Collaboration	1.474	.073	Accepted	Not Significant
Monthly Family Income				
Focus and Concentration	.838	.541	Accepted	Not Significant
Motivation to Learn	.386	.888	Accepted	Not Significant
Critical Thinking	1.228	.291	Accepted	Not Significant
Class Engagement and Collaboration	.783	.584	Accepted	Not Significant

3.5 Level of Academic Performance in Science of the Grade Four Pupils as Revealed by Their Average Grade in the First and Second Quarters

As reflected in Table 5 the academic performance of Grade Four pupils in Science based on their first and second quarter grades shows that out of 346 pupils, 152 or 43.9% obtained an average grade of 85–89 interpreted as Very Satisfactory (rank 1), followed by 114 or 32.9% with grades of 80–84 interpreted as Satisfactory (rank 2), and 56 or 16.2% who achieved 90 and above interpreted as Outstanding (rank 3), while 24 or 7% obtained 75–79 interpreted as Fairly Satisfactory (rank 4), with no pupils falling under "Did Not Meet Expectations." The overall mean of 85.34 with a standard deviation of 4.506 indicates a Very Satisfactory level of performance in Science. These results imply that Grade Four pupils generally perform well in Science, which may be associated with the use of hands-on experiments that promote active engagement, better understanding, and improved retention of scientific concepts. This suggests that experiential learning helps pupils move beyond rote memorization by allowing them to observe, explore, and apply knowledge in meaningful ways, thereby enhancing academic performance. This finding is supported by Kırılmazkaya and Dal (2022), who found that hands-on activities using simple materials significantly improve student achievement and foster more positive attitudes toward Science compared to traditional teaching methods, reinforcing the effectiveness of experiential learning in improving academic outcomes.

Table 5

Level of Academic Performance in Science of the Grade Four Pupils as Revealed by Their Average Grade in the First and Second Quarters

Average Grade	Verbal Interpretation	Frequency	Percent	Rank
90 and above	Outstanding	56	16.2	3
85 – 89	Very Satisfactory	152	43.9	1
80 – 84	Satisfactory	114	32.9	2
75 – 79	Fairly Satisfactory	24	7	4
Below 75	Did Not Meet Expectations	-	-	-
Total		**346**	**100.0**	
Highest Rating		92		
Lowest Rating		75		
Mean		85.34 (VS)		
Std. Deviation		4.506		

3.6 Significant Relationship Between the Perceived Extent of Effects of Hands-On Experiments in Science and the Level of Academic Performance of Grade Four Pupils

The correlational analysis presented in Table 6 shows that there is no significant relationship between the perceived effects of hands-on science experiments and the level of academic performance of Grade Four pupils across all four aspects: Focus and Concentration, Motivation to Learn, Critical Thinking, and Class Engagement and Collaboration, as all p-values are greater than the .05 level of significance. This indicates that the null hypothesis is accepted, meaning that pupils' perceptions of the benefits of hands-on experiments are not statistically associated with their actual academic performance in Science. The results imply that pupils who report higher levels of engagement, motivation, or critical thinking during hands-on activities do not necessarily obtain higher academic grades compared to those with lower perceived experiences. This suggests a disconnect between perceived learning experiences and measurable academic outcomes, where positive classroom engagement does not directly translate into higher test performance. It further implies that while hands-on experiments are valuable in promoting interest, participation, and positive attitudes toward Science, they may not be

sufficient on their own to significantly improve academic achievement unless reinforced with clear instructional connections and assessment-focused teaching strategies. This finding is aligned with Zabala and Dayaganon (2024), who reported that certain instructional factors, such as teacher competency, did not significantly correlate with students' science process skills, although learning environment quality showed stronger influence, suggesting that multiple conditions must work together to affect measurable academic outcomes.

Table 6
Significant Relationship Between the Perceived Extent of Effects of Hands-On Experiments in Science and the Level of Academic Performance of Grade Four Pupils

Aspects	r-value	p-value	Decision	Verbal Interpretation
Focus and Concentration	.000	.995	Accepted	Not Significant
Motivation to Learn	.005	.931	Accepted	Not Significant
Critical Thinking	.055	.307	Accepted	Not Significant
Class Engagement and Collaboration	.062	.254	Accepted	Not Significant

Conclusions & Recommendations

Based on the findings of the study, it is concluded that teachers and pupils share similar perceptions regarding the effects of hands-on experiments in Science on Grade Four pupils' performance in terms of focus and concentration, motivation to learn, critical thinking, and class engagement and collaboration. It is further concluded that teachers' personal attributes do not significantly influence their perceptions of the effectiveness of hands-on experiments, while pupils' demographic and family-related profiles are also not significant factors affecting their perceptions. Moreover, the study concludes that there is no significant relationship between the perceived effects of hands-on science experiments and the actual academic performance of Grade Four pupils, indicating that positive perceptions of engagement and learning experiences do not necessarily translate into higher academic achievement.

In light of these findings, it is recommended that school administrators conduct professional development programs focusing on inquiry-based learning, effective classroom management during experiments, and strategies for linking hands-on activities to assessment outcomes. They are also encouraged to allocate sufficient budget and resources to ensure the availability of adequate science materials and equipment across grade levels. Teachers are encouraged to design simple and achievable experiments that promote success experiences and build pupils' confidence and interest in Science. Parents may also support learning by engaging their children in simple science-related activities at home and encouraging critical thinking through questioning and active involvement in school discussions. Pupils should be exposed to varied instructional strategies and learning materials to further enhance their academic performance in Science. The implementation of the proposed action plan is strongly recommended, and future researchers are encouraged to conduct parallel studies using other variables to further validate and expand the findings of this study.

Compliance with ethical standards

The author declares no conflict of interest. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. This study was self-funded. The authors thank the participating respondents for their contributions

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