Inquiry-Based Approach in Teaching Science on the Learners' Creativity and Cognitive Ability

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***Abstract*—*This study aimed to determine the relationship between Inquiry-Based Approach in teaching science and learners' creativity, as well as its effect on learners' cognitive abilities among Grade 9 Learners at Don Manuel Rivera Memorial Integrated National High School for the Academic Year 2025-2026. Specifically, it sought to examine the level of utilization of the Inquiry-Based Approach, the level of learners' creativity, and their cognitive abilities, as well as the significant relationship and effects among these variables. The study employed a descriptive-experimental research design. Data were gathered using a researcher-developed survey questionnaire and a cognitive ability test covering third quarter lessons, both of which underwent, validation and pilot testing to ensure validity and reliability. The respondents consisted of 132 Grade 9 learners selected through purposive sampling. Results presented that the level of utilization of the Inquiry-Based Approach in teaching science was high across all dimensions, including student-led questioning, process-oriented learning, scientific process, trends and investigation, data analysis, and interpretation. The level of learners' creativity was interpreted very high and high, particularly divergent thinking and scientific innovation, while scientific visualization was interpreted as high. With regard to the level of learners' cognitive ability, they demonstrated outstanding performance in knowledge retention and scientific application, very satisfactory in metacognition and satisfactory in reasoning and inquiry skills. Moreover, the study established a significant relationship between the Inquiry-Based Approach and learners' creativity. The approach also showed significant effects on selected cognitive abilities, specifically knowledge retention, metacognition, and scientific application, while having moderate effect on reasoning and inquiry skills. In conclusion, Inquiry-Based Approach is an effective teaching strategy in enhancing Grade 9 learners' creativity and cognitive abilities in science education, leading to the rejection of both null hypotheses. This implies that consistently using inquiry-based science instruction strengthens higher-order thinking skills and promotes learners actively engaged in deeper learning. The study's findings recommend the curriculum planners and teachers prioritize inquiry-based approach to enhance learners' creativity and cognitive abilities, supported by administrators through continuous professional development and resources. Learners should actively engage in inquiry skills and future researchers should examine other factors including the long-term impacts of inquiry-based learning.*

***Keywords*—** *inquiry-based approach, science education, learners' creativity, cognitive abilities, grade 9*

I. INTRODUCTION

The Inquiry-Based Approach in teaching science helps learners explore scientific concepts following significant scientific processes such as questioning, hypothesizing, performing experimentations, and drawing evidenced-based conclusions. This approach is proven to be one of the most effective methods for enhancing learners' critical thinking, creative-problem solving, and comprehensive understanding of various ideas in science as stated by Mediana et al. (2025). Through these hands-on learning experiences, science learning becomes more relevant, meaningful, and engaging.

In line with this, the Inquiry-Based Approach also fosters the meaningful development of learners' creativity. Creativity in science learning involves generating unique scientific ideas and processes, creating mental representations to comprehend lessons, visualizing comprehensive and complex concepts, and formulating valuable solutions and innovations scientific problems. Meriyati et al. (2025) demonstrated science learning environment promotes creativity by allowing learners to generate their own unique questions, boosting their curiosity about scientific concepts, designing unique innovations, and encouraging them to interpret scientific investigations.

In addition, the implementation of Inquiry-Based Approach in teaching science helps improve learners' cognitive ability. Cognitive Ability in science learning is the mental capacity that enable learners to acquire knowledge, develop metacognitive awareness, engage in analytical reasoning and investigative skills, and apply practical application of scientific concepts in practice. Antonio et al. (2024) proved that this approach significantly further strengthens learners' cognitive ability, allowing them to not just to absorb information but also to formulate more thorough understanding through evidence-based reasoning and problem-solving. Also, Arifin et al, (2025) stated that inquiry-based approach in teaching science significantly contributes to learners' critical thinking which is becoming more important in today's science classrooms. Moreover, Syahgiah et al. (2023) further explained that effective utilization of inquiry-based approach by teachers in teaching science is a helpful strategy to help learners consistently develop and strengthen their higher-order thinking skills.

Overall, the Inquiry-Based Approach in science teaching not only motivates learners through hands-on and active learning but also helps them develop their creativity and cognitive abilities. Consequently, this approach promotes meaningful science learning and allows learners to continuously develop their 21st century skills.

Therefore, this study seeks to address the gap by examining the relationship between Inquiry-Based Approach in teaching science and learners' creativity, as well as its effect on learners' cognitive ability.

1.1 Statement of the Problem

Problem/s which were addressed by the research

The study seeks to determine how the Inquiry-Based Approach in teaching science relates to learners' creativity and affects their cognitive ability.

Specifically sought to answer the following questions:

1. What is the level of Inquiry-Based Approach in teaching Science of Science Teacher in terms of:
   1.1 Student-Led Questioning;
   1.2 Process-Oriented Learning;
   1.3 Scientific Process;
   1.4 Trends and Investigation;
   1.5 Data Analysis; and
   1.6 Interpretation?
2. What is the level of Learners' creativity in terms of:
   2.1 Scientific Visualization;
   2.2 Divergent Thinking; and
   2.3 Scientific Innovations?
3. What is the level of Learners' cognitive ability in terms of:
   3.1 Knowledge Retention;
   3.2 Metacognition;
   3.3 reasoning Skills;
   3.4 Inquiry Skills; and
   3.5 Scientific Applications?
4. Is there a significant relationship between the Inquiry-Based Approach in teaching science and the creativity of the learners?
5. Is there a significant effect on the Inquiry-Based Approach in teaching science and on the cognitive ability of the learners?

II. METHODOLOGY

The study employed a descriptive-experimental research design. Data were gathered using a researcher-developed survey questionnaire and a cognitive ability test covering third quarter lessons, both of which underwent, validation and pilot testing to ensure validity and reliability. The respondents consisted of 132 Grade 9 learners selected through purposive sampling.

III. RESULTS AND DISCUSSION

This part presents the interpretation and analysis of the data gathered in the study. The data are organized and discussed in accordance with the specific problems in order to address the main objective of the research. The results are presented using appropriate statistical tools and are interpreted to provide a clear and comprehensive understanding of the findings of the study. These findings are further examined to highlight patterns, relationships, and implications.

Level of Using Inquiry-Based Approach of Science Teacher

In this study, the level of using the Inquiry-Based Approach in teaching science refers to the extent to which the science teacher implements inquiry-based strategies in the classroom. These strategies include student-led questioning, process-oriented learning, scientific process, trends and investigation, data analysis, and interpretation.

The level of using the inquiry-based approach is presented in the following tables. Each table shows the statements, computed mean, standard deviation, remarks, and verbal interpretation in order to determine how frequently the inquiry-based strategies are utilized during science instruction.

Table 1 presents the level of using the inquiry-based approach of the science teacher in terms of student-led questioning. The table describes how the teacher encourages learners to recall prior knowledge, formulate their own questions, explore scientific ideas, and analyze science concepts through questioning during classroom instruction.

Table 1. Level of Using Inquiry-Based Approach of Science Teacher in terms of Student-Led Questioning

Statements Through student-led questioning, my science teacher…	**Mean**	**SD**	**Remarks**
…engages me to recall prior knowledge by asking questions about science lessons	4.64	0.54	Strongly Agree
…supports me to explain and clarify my understanding through student-generated questions	4.48	0.57	Strongly Agree
…allows me to formulate my own unique questions to arouse my curiosity	4.33	0.68	Strongly Agree
…permits me ask and explore to "what if" or "why" to investigate scientific concepts during the lesson	4.53	0.61	Strongly Agree
…motivates me to analyze and evaluate science concepts through probing questions	4.36	0.71	Strongly Agree
Weighted Mean	4.47		
SD	0.64		
Verbal Interpretation	Very High		

Among the indicators, the statement "engages me to recall prior knowledge by asking questions about science lessons" obtained the highest mean of 4.64, which signifies that the teacher frequently initiates questions that allow learners to connect previously learned concepts with new scientific ideas. Meanwhile, the statement "allows me to formulate my own unique questions to arouse my curiosity" obtained the lowest mean of 4.33, although it is still interpreted as Strongly Agree, which indicates that learners are still provided with opportunities to construct their own questions during science lessons.

As shown in the table, the overall weighted mean of 4.47 with a standard deviation of 0.64 is verbally interpreted as Very High. This indicates that the science teacher consistently integrates student-led questioning as part of the inquiry-based approach in teaching science. Learners commonly experience opportunities to express their ideas, recall previous knowledge, and engage in questioning activities that promote deeper understanding of scientific concepts.

Overall, the results imply that student-led questioning is widely practiced in the science classroom. The relatively small variation in responses indicates consistent learner experiences in participating in questioning activities during science lessons.

Furthermore, these practices signify that learners are encouraged to become active participants in the learning process rather than passive recipients of information. Such classroom interactions also imply that questioning strategies are used to stimulate curiosity, deepen understanding, and strengthen learners' engagement with scientific concepts. This

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approach may therefore contribute to improved critical thinking skills and long-term retention of scientific concepts.

Table 2 presents the level of using the inquiry-based approach of the science teacher in terms of process-oriented learning. The table describes how the teacher provides opportunities for learners to engage in hands-on activities, conduct laboratory investigations, organize science tasks, evaluate investigation procedures, and reflect on the learning process during science instruction.

Table 2. Level of Using Inquiry-Based Approach of Science Teacher in terms of Process Oriented Learning

Statements In process-oriented learning, my science teacher…	**Mean**	**SD**	**Remarks**
…provides opportunities for me to experience hands-on activities to explore and apply science concepts	4.59	0.54	Strongly Agree
…allows me to investigate scientific ideas through laboratory experiments	4.45	0.63	Strongly Agree
…gives me time to plan and organize how to conduct our science activities	4.52	0.61	Strongly Agree
…challenges me to identify and evaluate ways to improve our investigations	4.34	0.69	Strongly Agree
…helps me explain and reflect on how learning process enhances our understanding of science concepts	4.42	0.67	Strongly Agree
Weighted Mean	4.47		
SD	0.63		
Verbal Interpretation	Very High		

Among the indicators, the statement "provides opportunities for me to experience hands-on activities to explore and apply science concepts" obtained the highest mean of 4.59, which signifies that hands-on learning activities are frequently incorporated in the science classroom. Such activities allow learners to apply scientific concepts through direct experience and active participation in learning tasks. Meanwhile, the statement "challenges me to identify and evaluate ways to improve our investigations" obtained the lowest mean of 4.34, although it is still interpreted as Strongly Agree, which indicates that learners are guided to examine and improve their investigation procedures during science activities.

As shown in the table, the overall weighted mean of 4.47 with a standard deviation of 0.63 is verbally interpreted as Very High. This indicates that the science teacher consistently implements process-oriented learning strategies in science lessons. Learners commonly experience learning activities that require them to explore scientific concepts through direct engagement, experimentation, and reflection on the learning process.

Overall, the results imply that process-oriented learning is widely practiced in the science classroom. The relatively small variation in responses indicates consistent learner experiences in engaging with learning activities that involve planning, experimentation, reflection, and evaluation of scientific investigations.

Moreover, these practices signify that learners are actively involved in the learning process and are given opportunities to develop scientific thinking and problem-solving skills. Such classroom practices also imply that the teacher emphasizes meaningful learning experiences that strengthen learners' understanding of scientific concepts and processes.

Table 3 presents the level of using the inquiry-based approach of the science teacher in terms of the scientific process. The table describes how the teacher guides learners in identifying problems, formulating hypotheses, designing experiments, recording observations, examining variables, and analyzing results during scientific investigations.

Table 3. Level of Using Inquiry-Based Approach of Science Teacher in terms of Scientific Process

Statements When applying the scientific process, my science teacher…	**Mean**	**SD**	**Remarks**
…guides me to identify the problem and formulate hypothesis in our scientific investigation	4.48	0.59	Strongly Agree
…instructs me how to design experiments and apply my knowledge in science	4.45	0.63	Strongly Agree
…trains me to observe, record, and organize observations appropriately during investigations	4.55	0.62	Strongly Agree
…helps me distinguish and examine variables to ensure fair testing	4.28	0.68	Strongly Agree
…enables me to analyze results and revise scientific explanation based on evidence	4.43	0.64	Strongly Agree
Weighted Mean	4.44		
SD	0.64		
Verbal Interpretation	Very High		

Among the indicators, the statement "trains me to observe, record, and organize observations appropriately during investigations" obtained the highest mean of 4.55, which signifies that learners are frequently guided in properly documenting and organizing observations during scientific activities. This practice strengthens learners' ability to collect and manage scientific data in a systematic manner. Meanwhile, the statement "helps me distinguish and examine variables to ensure fair testing" obtained the lowest mean of 4.28, although it is still interpreted as Strongly Agree, which indicates that learners are also guided in identifying variables and ensuring fair testing in their investigations.

As shown in the table, the overall weighted mean of 4.44 with a standard deviation of 0.64 is verbally interpreted as Very High. This indicates that the science teacher consistently integrates the scientific process as part of inquiry-based instruction in the classroom. Learners commonly experience structured activities that require them to observe phenomena, conduct investigations, and analyze scientific evidence to understand science concepts.

Overall, the results imply that the scientific process is widely practiced in the science classroom. The relatively small variation in responses indicates consistent learner experiences in conducting scientific investigations and applying systematic procedures in learning science.

These practices signify that learners are provided opportunities to develop essential scientific skills such as observation, experimentation, and evidence-based reasoning. Such learning experiences also imply that the teacher facilitates structured inquiry activities that strengthen learners' understanding of scientific concepts and investigative processes.

Table 4 presents the level of using the inquiry-based approach of the science teacher in terms of trends and investigation. The table describes how the teacher guides learners in examining trends and patterns in scientific investigations, relating findings to real-life situations, comparing results, and validating results through repeated trials during science learning activities.

Table 4. Level of Using Inquiry-Based Approach of Science Teacher in terms of Trends and Investigation

Statements During investigations and analysis of trends, my science teacher…	Mean	SD	Remarks
…reinforces me to experience real-life problems through investigations	4.48	0.67	Strongly Agree
…directs me to study the trends and patterns found in investigations	4.35	0.62	Strongly Agree
…motivates me to apply our findings to real-life situations	4.52	0.57	Strongly Agree
…facilitates me to compare and contrast our results with other groups	4.33	0.68	Strongly Agree
…encourages me to test and validate accuracy by repeating trials	4.39	0.63	Strongly Agree
Weighted Mean	4.41		
SD	0.64		
Verbal Interpretation	Very High		

Among the indicators, the statement "motivates me to apply our findings to real-life situations" obtained the highest mean of 4.52, which signifies that learners are frequently encouraged to relate the results of their investigations to real-life contexts. This practice strengthens learners' ability to recognize the relevance of scientific concepts in everyday situations. Meanwhile, the statement "facilitates me to compare and contrast our results with other groups" obtained the lowest mean of 4.33, although it is still interpreted as Strongly Agree, which indicates that learners are also guided to examine similarities and differences in results during group investigations.

As shown in the table, the overall weighted mean of 4.41 with a standard deviation of 0.64 is verbally interpreted as Very High. This indicates that the science teacher consistently integrates activities that involve identifying trends and conducting investigations as part of inquiry-based instruction. Learners commonly experience opportunities to analyze patterns in data and connect their findings with practical situations in their environment.

Overall, the results imply that activities involving trends and investigation are widely practiced in the science classroom. The relatively small variation in responses indicates consistent learner experiences in analyzing patterns, validating results, and relating scientific findings to practical situations.

These practices signify that learners are encouraged to examine evidence critically and understand the relevance of scientific investigations. Such classroom experiences also imply that the teacher promotes meaningful learning by guiding learners to interpret patterns and apply scientific knowledge in real-world contexts. This approach further enhances self-directed thinking and strengthens learners to make connections between scientific concepts and daily existence.

Table 5 presents the level of using the inquiry-based approach of the science teacher in terms of data analysis. The table describes how the teacher guides learners in organizing gathered data, interpreting graphs, identifying patterns, explaining experimental results using data, and determining whether data support or reject a hypothesis during scientific investigations.

Table 5. Level of Using Inquiry-Based Approach of Science Teacher in terms of Data Analysis

Statements In analyzing scientific data, my science teacher…	Mean	SD	Remarks
…guides me how to represent gathered data into tables or charts	4.51	0.57	Strongly Agree
…teaches me to analyze graphs to interpret the results of our scientific investigation	4.48	0.59	Strongly Agree
…encourages me to identify trends or patterns in our data	4.30	0.66	Strongly Agree
…assists me in using data to explain why an event happened in an experiment or investigation	4.38	0.69	Strongly Agree
…emphasizes that data can support or reject a hypothesis	4.31	0.70	Strongly Agree
Weighted Mean	4.40		
SD	0.65		
Verbal Interpretation	Very High		

Among the indicators, the statement "guides me how to represent gathered data into tables or charts" obtained the highest mean of 4.51, which signifies that learners are frequently guided in organizing data using appropriate visual representations. This practice enables learners to better understand and interpret scientific information obtained from investigations. Meanwhile, the statement "encourages me to identify trends or patterns in our data" obtained the lowest mean of 4.30, although it is still interpreted as Strongly Agree, which indicates that learners are also guided in recognizing patterns and relationships within their collected data.

As shown in the table, the overall weighted mean of 4.40 with a standard deviation of 0.65 is verbally interpreted as Very High. This indicates that the science teacher consistently integrates data analysis practices as part of inquiry-based instruction in the science classroom. Learners commonly experience opportunities to interpret and analyze data gathered during scientific activities and investigations.

Overall, the results imply that data analysis practices are widely implemented in the science classroom. The relatively small variation in responses indicates consistent learner experiences in analyzing and interpreting scientific data during investigations.

These practices signify that learners are guided to develop analytical skills that allow them to examine evidence and understand relationships among scientific variables. Such learning experiences also imply that the teacher emphasizes the importance of using data to explain scientific phenomena and to support evidence-based conclusions.

Table 6 presents the level of using the inquiry-based approach of the science teacher in terms of interpretation. The table describes how the teacher guides learners in drawing conclusions from evidence, discussing and justifying findings, examining how conclusions may change with new data, relating results to scientific concepts, and evaluating the significance of investigation outcomes during science lessons.

Table 6. Level of Using Inquiry-Based Approach of Science Teacher in terms of Interpretation

Statements When interpreting results, my science teacher…	**Mean**	**SD**	**Remarks**
…allows me to draw conclusions based on evidence	4.54	0.62	Strongly Agree
…gives me an opportunity to discuss and justify my findings in the class	4.44	0.58	Strongly Agree
…aids me in recognizing that conclusions may change most especially when there are new data	4.42	0.68	Strongly Agree
…offers assistance to explain the relationship between my result and scientific concepts	4.45	0.67	Strongly Agree
…fosters my ability to critically evaluate and interpret the importance of the outcomes of our investigations	4.39	0.64	Strongly Agree
Weighted Mean	4.45		
SD	0.64		
Verbal Interpretation	Very High		

Among the indicators, the statement "allows me to draw conclusions based on evidence" obtained the highest mean of 4.54, which signifies that learners are frequently guided to base their conclusions on gathered evidence during scientific investigations. This practice improves learners' ability to make logical and data-based explanations. Meanwhile, the statement "fosters my ability to critically evaluate and interpret the importance of the outcomes of our investigations" obtained the lowest mean of 4.39, although it is still interpreted as Strongly Agree, which indicates that learners are also guided to examine the relevance and meaning of their investigation results.

As shown in the table, the overall weighted mean of 4.45 with a standard deviation of 0.64 is verbally interpreted as Very High. This indicates that the science teacher consistently incorporates interpretation activities as part of inquiry-based instruction in the science classroom. Learners often interpret their results and connect them to scientific concepts.

Overall, the results imply that interpretation activities are widely practiced in the science classroom. The relatively small variation in responses indicates consistent learner experiences in explaining results, discussing findings, and connecting investigation outcomes with scientific concepts.

These practices signify that learners are encouraged to evaluate evidence carefully and understand the meaning of scientific results. Such learning experiences also imply that the teacher promotes deeper understanding by guiding learners to interpret data and formulate evidence-based conclusions during science investigations.

Level of Learners' Creativity

In this study, the level of learners' creativity refers to the learners' ability to generate ideas, visualize scientific concepts, and develop innovative solutions during science learning. This variable is examined in terms of scientific visualization, divergent thinking, and scientific innovations.

The level of learners' creativity is presented in the following tables. Each table shows the statements, computed mean, standard deviation, remarks, and verbal interpretation to determine the extent to which learners demonstrate creativity in science learning activities.

Table 7 presents the level of learners' creativity in terms of scientific visualization. The table describes how learners visualize processes, imagine experiments, interpret charts and form ideas to understand science concepts.

Table 7. Level of Learners' Creativity in terms of Scientific Visualization

Statements By visualizing scientific concepts and processes, I can…	**Mean**	**SD**	**Remarks**
…visualize and describe how scientific processes happen in the real-world situations	4.55	0.61	Strongly Agree
…imagine and predict the processes of a laboratory experiment before demonstrating it	4.35	0.67	Strongly Agree
…use and understand charts, graphs, or models to discuss science concepts during discussion	4.42	0.68	Strongly Agree
…create mental pictures and models to fully understand science lesson accurately	4.47	0.65	Strongly Agree
…envision and explore the invisible processes happening in nature	4.47	0.65	Strongly Agree
Weighted Mean	4.16		
SD	0.75		
Verbal Interpretation	High		

Among the indicators, the statement "visualize and describe how scientific processes happen in real-world situations" obtained the highest mean of 4.55, which signifies that learners are able to imagine and relate scientific processes to real-life contexts. This ability allows learners to better understand how scientific concepts operate beyond the classroom. Meanwhile, the statement "imagine and predict the processes of a laboratory experiment before demonstrating it" obtained the lowest mean of 4.35, although it is still interpreted as Strongly Agree, which indicates that learners are also capable of mentally predicting experimental procedures prior to conducting laboratory activities.

As shown in the table, the overall weighted mean of 4.16 with a standard deviation of 0.75 is verbally interpreted as High. This indicates that learners demonstrate a high level of creativity in terms of visualizing scientific concepts and processes during science learning. Learners commonly use mental representations, diagrams, and models to understand and explain scientific phenomena.

Overall, the results imply that learners commonly use visualization skills when learning scientific concepts and processes. The variation in responses indicates that learners possess different levels of ability in mentally representing scientific ideas and interpreting visual information.

These practices signify that visualization plays an important role in helping learners understand abstract scientific concepts and processes. Such abilities also imply that learners rely on mental imagery, diagrams, and models to strengthen their comprehension of science lessons.

Table 8 presents the level of learners' creativity in terms of divergent thinking. The table describes how learners generate multiple ideas, explore different solutions to scientific problems, combine concepts to form new ideas, and present unique perspectives during science learning activities.

Table 8. Level of Learners' Creativity in terms of Divergent Thinking

Statements In generating creative ideas and solutions, I can…	**Mean**	**SD**	**Remarks**
…enjoy exploring and discovering new ways of applying science in daily life	4.61	0.59	Strongly Agree
…combine different concepts to create new ideas	4.38	0.72	Strongly Agree
…provide more than one answer to a question	4.36	0.70	Strongly Agree
…present unique ideas in science different from my classmates	4.25	0.71	Strongly Agree
…brainstorm answers that cannot be found in the books but are still related to science	4.37	0.71	Strongly Agree
Weighted Mean	4.40		
SD	0.70		
Verbal Interpretation	Very High		

Among the indicators, the statement "enjoy exploring and discovering new ways of applying science in daily life" obtained the highest mean of 4.61, which signifies that learners show strong interest in connecting scientific knowledge with practical applications in their everyday experiences. This ability enables learners to recognize the relevance of science in solving real-life problems. Meanwhile, the statement "present unique ideas in science different from my classmates" obtained the lowest mean of 4.25, although it is still interpreted as Strongly Agree, which indicates that learners are also capable of expressing ideas that differ from those of their peers during science discussions.

As shown in the table, the overall weighted mean of 4.40 with a standard deviation of 0.70 is verbally interpreted as Very High. This indicates that learners demonstrate a very high level of creativity in generating diverse ideas and solutions related to scientific concepts. Learners commonly explore different ways of applying science in daily life and actively participate in activities that require creative thinking and idea generation.

Overall, the results imply that learners actively engage in generating diverse ideas and exploring different solutions to scientific questions. The variation in responses indicates that learners demonstrate different levels of confidence in expressing unique ideas and perspectives.

These practices signify that divergent thinking is evident in the science classroom as learners attempt to expand their ideas beyond conventional responses. Such learning experiences also imply that learners are encouraged to think creatively and develop multiple approaches in understanding and applying scientific concepts.

Table 9 presents the level of learners' creativity in terms of scientific innovations. The table describes how learners apply scientific knowledge to design projects, propose science-related activities, use technology in solving problems, connect science concepts with modern technologies, and develop innovative ways of using materials during science learning activities.

Table 9. Level of Learners' Creativity in terms of Scientific Innovations

Statements When applying science to create new ideas and projects, I can…	**Mean**	**SD**	**Remarks**
…design science projects that are unusual	4.45	0.65	Strongly Agree
…suggest possible science activities that could improve our classroom	4.26	0.67	Strongly Agree
…use of technology and think of scientific solutions to particular problems	4.42	0.69	Strongly Agree
…connect science lesson with modern technologies to present new projects.	4.31	0.61	Strongly Agree
…enjoy creating new and innovative ways to recycle materials in science experiments	4.55	0.60	Strongly Agree
Weighted Mean	4.40		
SD	0.65		
Verbal Interpretation	Very High		

Among the indicators, the statement "enjoy creating new and innovative ways to recycle materials in science experiments" obtained the highest mean of 4.55, which signifies that learners actively explore creative ways of using materials in scientific activities. This ability enables learners to apply scientific concepts while promoting resourcefulness and innovation in conducting experiments. Meanwhile, the statement "suggest possible science activities that could improve our classroom" obtained the lowest mean of 4.26, although it is still interpreted as Strongly Agree, which indicates that learners are also capable of proposing ideas that contribute to improving science learning activities.

As shown in the table, the overall weighted mean of 4.40 with a standard deviation of 0.65 is verbally interpreted as Very High. This indicates that learners demonstrate a very high level of creativity in developing innovative ideas and projects related to science. Learners commonly engage in activities that require them to apply scientific knowledge and skills in producing new ideas and practical solutions to scientific problems.

Overall, the results imply that learners demonstrate strong abilities in applying scientific knowledge to produce innovative ideas and projects. The variation in responses indicates that learners possess different levels of confidence in expressing and developing innovative solutions in science learning.

These practices signify that innovation is evident in the classroom as learners attempt to apply scientific concepts in creative and practical ways. Such learning experiences also imply that learners are encouraged to develop new ideas, integrate technology, and explore innovative approaches in science activities.

Level of Learners' Cognitive Ability

In this study, level of Learners' Cognitive Ability refers to Knowledge Retention; Metacognition; Reasoning Skills; Inquiry Skills; and Scientific Applications. The level of Learners' Cognitive Ability is revealed in the following table, which shows the raw score, frequency, percentage, mean, standard deviation, and verbal interpretation.

Table 10 presents the level of learners' cognitive ability in terms of knowledge retention. The table shows the distribution of learners according to their scores in recalling previously learned scientific concepts based on the results of the cognitive ability test.

Table 10. Level of Learners' Cognitive Ability in terms of Knowledge Retention

Score	Frequency (f)	Percentage (%)	Verbal Interpretation
9-10	102	77.27 %	Outstanding
7-8	30	22.73 %	Very Satisfactory
5-6	0	0 %	Satisfactory
3-4	0	0 %	Fair
1-2	0	0 %	Needs Improvement
Total	N = 132	100 %	
Weighted Mean		9.01	
SD		0.74	
Verbal Interpretation		Outstanding	

As shown in the table, the majority of the learners obtained scores within the 9–10 score range, with a frequency of 102 learners or 77.27 percent, which is verbally interpreted as Outstanding. Meanwhile, 30 learners or 22.73 percent obtained scores within the 7–8 score range, which is interpreted as Very Satisfactory. No learners obtained scores within the remaining score intervals of 5–6, 3–4, and 1–2, which correspond to Satisfactory, Fair, and Needs Improvement, respectively.

The overall weighted mean of 9.01 with a standard deviation of 0.74 is verbally interpreted as Outstanding. This indicates that learners demonstrate a very high level of ability in recalling and recognizing previously learned scientific concepts. The results signify that learners are able to retain important scientific information and apply previously acquired knowledge during hands-on activities.

Overall, the results imply that learners possess strong knowledge retention in science. The concentration of scores within the highest score interval indicates that most learners are able to recall scientific concepts accurately and consistently.

Additionally, this pattern signifies that learners demonstrate a stable ability to remember previously learned concepts, which supports their understanding of new scientific ideas and learning experiences. This retention allows to build connections between previous and new learning.

Table 11 presents the level of learners' cognitive ability in terms of metacognition. The table shows the distribution of learners according to their scores in monitoring, evaluating, and regulating their thinking processes during science learning as measured through the cognitive ability test.

Table 11. Level of Learners' Cognitive Ability in terms of Metacognition

Score	Frequency (f)	Percentage (%)	Verbal Interpretation
9-10	97	73.48 %	Outstanding
7-8	35	26.52 %	Very Satisfactory
5-6	0	0 %	Satisfactory
3-4	0	0 %	Fair
1-2	0	0 %	Needs Improvement
Total	N = 132	100 %	
Weighted Mean			8.95
SD			0.73
Verbal Interpretation			Very Satisfactory

As shown in the table, the majority of the learners obtained scores within the 9–10 score range, with a frequency of 97 learners or 73.48 percent, which is verbally interpreted as Outstanding. Meanwhile, 35 learners or 26.52 percent obtained scores within the 7–8 score range, which is interpreted as Very Satisfactory. No learners obtained scores within the remaining score intervals of 5–6, 3–4, and 1–2, which correspond to Satisfactory, Fair, and Needs Improvement, respectively.

The overall weighted mean of 8.95 with a standard deviation of 0.73 is verbally interpreted as Very Satisfactory. This indicates that learners demonstrate a high level of ability in monitoring and regulating their thinking processes during science learning activities. The results signify that learners are capable of reflecting on their understanding and evaluating their approaches in solving scientific problems.

Overall, the results imply that learners possess well-developed metacognitive abilities in science learning. The distribution of scores within the higher score intervals indicates that most learners are able to examine their thinking processes and adjust their strategies when learning scientific concepts. This shows that learners are aware of how they learn, improving their understanding and application of science.

Table 12 presents the level of learners' cognitive ability in terms of reasoning skills. The table shows the distribution of learners according to their scores in applying logical thinking, analyzing information, and drawing conclusions based on scientific evidence during the cognitive ability test.

Table 12. Level of Learners' Cognitive Ability in terms of Reasoning Skills

Score	Frequency (f)	Percentage (%)	Verbal Interpretation
9-10	13	9.85 %	Outstanding
7-8	62	46.97%	Very Satisfactory
5-6	31	23.48 %	Satisfactory
3-4	24	18.18 %	Fair
1-2	2	1.52 %	Needs Improvement
Total	N = 132	100 %	
Weighted Mean		6.41	
SD		1.78	
Verbal Interpretation		Satisfactory	

As shown in the table, 62 learners or 46.97 percent obtained scores within the 7–8 score range, which is verbally interpreted as Very Satisfactory. This group represents the largest proportion of the respondents. Meanwhile, 31 learners or 23.48 percent obtained scores within the 5–6 score range, which is interpreted as Satisfactory. In addition, 24 learners or 18.18 percent obtained scores within the 3–4 score range, which corresponds to Fair. Furthermore, 13 learners or 9.85 percent obtained scores within the 9–10 score range, interpreted as Outstanding, while 2 learners or 1.52 percent obtained scores within the 1–2 score range, interpreted as Needs Improvement.

The overall weighted mean of 6.41 with a standard deviation of 1.78 is verbally interpreted as Satisfactory. This indicates that learners demonstrate an adequate level of ability in applying reasoning skills when analyzing scientific information and drawing conclusions. The results signify that while many learners are able to apply logical thinking in science tasks, there are also learners who still experience difficulty in reasoning through scientific problems.

Overall, the results imply that learners demonstrate varying levels of reasoning skills in science learning. The distribution of scores across several score intervals indicates differences in learners' ability to analyze information and form logical conclusions.

In addition, this pattern signifies that while a considerable number of learners demonstrate satisfactory reasoning ability, further development of analytical and logical thinking skills may strengthen learners' understanding and application of scientific concepts. Providing intended activities and guided practice could help bridge the gaps and promote higher-order thinking skills among all learners.

Table 13 presents the level of learners' cognitive ability in terms of inquiry skills. The table shows the distribution of learners according to their scores in asking questions, investigating scientific problems, gathering information, and interpreting evidence during the cognitive ability test.

Table 13. Level of Learners' Cognitive Ability in terms of Inquiry Skills

Score	Frequency (f)	Percentage (%)	Verbal Interpretation
9-10	13	9.85 %	Outstanding
7-8	60	45.45 %	Very Satisfactory
5-6	32	24.24 %	Satisfactory
3-4	24	18.18 %	Fair
1-2	3	2.27 %	Needs Improvement
Total	N = 132	100 %	
Weighted Mean		6.37	
SD		1.83	
Verbal Interpretation		Satisfactory	

As shown in the table, 60 learners or 45.45 percent obtained scores within the 7–8 score range, which is verbally interpreted as Very Satisfactory. This group represents the largest proportion of the respondents. Meanwhile, 32 learners or 24.24 percent obtained scores within the 5–6 score range, which is interpreted as Satisfactory. In addition, 24 learners or 18.18 percent obtained scores within the 3–4 score range, which corresponds to Fair. Furthermore, 13 learners or 9.85 percent obtained scores within the 9–10 score range, interpreted as Outstanding, while 3 learners or 2.27 percent obtained scores within the 0–2 score range, interpreted as Needs Improvement.

The overall weighted mean of 6.37 with a standard deviation of 1.83 is verbally interpreted as Satisfactory. This indicates that learners demonstrate an adequate level of ability in applying inquiry skills when investigating scientific questions and interpreting results. The results signify that while many learners are able to engage in inquiry-based tasks, some learners still experience difficulty in applying systematic investigation processes.

Overall, the results imply that learners demonstrate varying levels of inquiry skills in science learning. The distribution of scores across several score intervals indicates differences in learners' ability to explore questions, gather information, and interpret findings.

Moreover, this pattern signifies that strengthening inquiry practices may further improve learners' investigative abilities and deepen their understanding of scientific concepts. This leads to more purposeful and long-term learning outcomes.

Table 14 presents the level of learners' cognitive ability in terms of scientific application. The table shows the distribution of learners according to their scores in applying scientific concepts and principles to practical situations as measured through the cognitive ability test.

Table 14. Level of Learners' Cognitive Ability in terms of Scientific Applications

Score	Frequency (f)	Percentage (%)	Verbal Interpretation
9-10	108	81.82 %	Outstanding
7-8	24	18.18 %	Very Satisfactory
5-6	0	0 %	Satisfactory
3-4	0	0 %	Fair
1-2	0	0 %	Needs Improvement
Total	N = 132	100 %	
Weighted Mean		9.01	
SD		0.64	
Verbal Interpretation		Outstanding	

As shown in the table, 108 learners or 81.82 percent obtained scores within the 9-10 score range, which is verbally interpreted as Outstanding. This group represents the largest proportion of the respondents. Meanwhile, 24 learners or 18-18 percent obtained scores within the 7-8 score range, which is interpreted as Very Satisfactory.

The overall weighted mean of 9.01 with a standard deviation of 0.64 is verbally interpreted as Outstanding. This indicates that learners demonstrate a very high level of ability in applying scientific concepts to practical situations and problem-solving activities. The results signify that learners are capable of utilizing their knowledge of science in explaining phenomena and addressing real-life situations.

Overall, the results imply that learners are able to apply scientific knowledge and concepts in various learning situations. The distribution of scores across the score intervals indicates differences in learners' ability to translate theoretical knowledge into practical application.

This pattern signifies that strengthening opportunities for applying scientific concepts may further enhance learners' ability to use science knowledge effectively in real-world contexts.

Significant Relationship between the Inquiry-Based Approach in Teaching Science and the Learners' Creativity

Table 15 shows the Significant Relationship between using the Inquiry-Based Approach of Science Teacher refers to Student-Led Questioning; Process Oriented Learning; Scientific Process; Trends and Investigation; Data Analysis; and Interpretation while the Learners' Creativity refers to Scientific Visualization, Divergent Thinking, and Scientific Innovations.

The significant relationship between the Inquiry-Based Approach in teaching science and the learners' creativity is presented in the following table, which shows the Pearson Product Moment Correlation Coefficient (Pearson r), p-value, and number of respondents.

As shown in the table, student-led questioning has a moderate positive relationship with learners' creativity. The

Pearson correlation values of 0.465 for scientific visualization, 0.436 for divergent thinking, and 0.383 for scientific innovations with p-values of 0.000 indicate that the relationships are statistically significant. This indicates that when teachers encourage learners to ask questions and express curiosity, learners demonstrate stronger abilities in visualizing scientific concepts, generating different ideas, and producing innovative outputs in science learning.

Table 15. Relationship between the Inquiry-Based Approach in Teaching Science and the Learners' Creativity

Inquiry-Based Approach in Teaching Science		Learners' Creativity		
		Scientific Visualization	Divergent Thinking	Scientific Innovations
Student-Led Questioning	Pearson Correlation	0.465*	0.436*	0.383*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	132	132	132
Process Oriented Learning	Pearson Correlation	0.406*	0.348*	0.376*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	132	132	132
Scientific Process	Pearson Correlation	0.552*	0.435*	0.407*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	132	132	132
Trends and Investigation	Pearson Correlation	0.541*	0.397*	0.486*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	132	132	132
Data Analysis	Pearson Correlation	0.423*	0.397*	0.502*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	132	132	132
Interpretation	Pearson Correlation	0.600*	0.452*	0.408*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	132	132	132

In terms of process-oriented learning, the Pearson correlation coefficients of 0.406 for scientific visualization, 0.348 for divergent thinking, and 0.376 for scientific innovations with p-values of 0.000 indicate a significant positive relationship with learners' creativity. These results signify that when learners are actively engaged in hands-on activities and structured learning processes, their ability to develop creative scientific ideas and solutions becomes more evident.

Similarly, the scientific process shows a significant positive relationship with learners' creativity, with correlation values of 0.552 for scientific visualization, 0.435 for divergent thinking, and 0.407 for scientific innovations, all with p-values of 0.000. This indicates that guiding learners through scientific investigations, observations, and experimentation strengthens their ability to visualize scientific concepts and generate creative solutions.

For trends and investigation, the correlation coefficients of 0.541 for scientific visualization, 0.397 for divergent thinking, and 0.486 for scientific innovations with p-values of 0.000 indicate a significant positive relationship with learners' creativity. These findings signify that examining patterns and conducting investigations allows learners to develop deeper understanding and creative interpretations of scientific concepts.

Meanwhile, data analysis also demonstrates a significant positive relationship with learners' creativity, with correlation values of 0.423 for scientific visualization, 0.397 for divergent thinking, and 0.502 for scientific innovations, all with p-values of 0.000. This indicates that analyzing scientific data supports learners in generating new ideas, identifying patterns, and producing innovative explanations based on evidence.

Lastly, interpretation shows the highest correlation with scientific visualization at 0.600, while its relationship with divergent thinking (0.452) and scientific innovations (0.408) is also significant, with p-values of 0.000. These results signify that when learners are guided to interpret results and explain scientific findings, their creative abilities in visualizing and developing ideas become more evident.

Overall, the results indicate that the inquiry-based approach in teaching science has a significant positive relationship with learners' creativity across all dimensions. Since the p-values are less than the alpha value of 0.05, the null hypothesis stating that there is no significant relationship between the inquiry-based approach in teaching science and learners' creativity is rejected. It can be concluded that the use of inquiry-based teaching practices such as questioning, investigation, analysis, and interpretation contributes to the development of learners' creativity in science learning.

Significant Effect of the Inquiry-Based Approach in Teaching Science on Learners' Creativity

Table 16 presents the significant effect of the inquiry-based approach in teaching science on learners' cognitive ability in terms of knowledge retention, metacognition, reasoning skills, inquiry skills, and scientific application. The table shows the computed t-values and significance values which determine whether the inquiry-based approach significantly affects the learners' cognitive abilities.

As shown in the table, student-led questioning has a significant effect on knowledge retention, metacognition, and scientific application with t-values of 4.922, 5.720, and 4.485 and have p-values of 0.000, respectively. These values indicate statistical significance since the p-values are less than the alpha value of 0.05. However, the effect of student-led questioning on reasoning skills with p-values of 0.272 and inquiry skills with p-values of 0.065 are not significant since the p-values are greater than 0.05.

In terms of process-oriented learning, the results show a significant effect on knowledge retention with t-values of 3.957, metacognition with t-value of 4.738, and scientific application with t-value of 5.645 and p-values of 0.000, in that order. It also shows a significant effect on inquiry skills with t-value of -2.117 and p-value of 0.036 since the p-values are less than 0.05. However, the effect on reasoning skills with p-value of 0.100 is not significant.

Table 16. Effect between the Inquiry-Based Approach in Teaching Science and the Learners' Cognitive Ability

Inquiry-Based Approach in Teaching Science		Learners' Cognitive Ability				
		Knowledge Retention	Metacognition;	Reasoning Skills	Inquiry Skills	Scientific Applications
Student-Led Questioning	t-value	4.922*	5.720*	-1.103	-1.863	4.485*
	Sig. (2-tailed)	0.000	0.000	0.272	0.065	0.000
	N	132	132	132	132	132
Process Oriented Learning	t-value	3.957*	4.738*	-1.658	-2.117*	5.645*
	Sig. (2-tailed)	0.000	0.000	0.100	0.036	0.000
	N	132	132	132	132	132
Scientific Process	t-value	5.460*	5.945*	-0.782	-1.557	4.647*
	Sig. (2-tailed)	0.000	0.000	0.436	0.122	0.000
	N	132	132	132	132	132
Trends and Investigation	t-value	5.055*	6.927*	-0.903	-1.813	5.194*
	Sig. (2-tailed)	0.000	0.000	0.368	0.072	0.000
	N	132	132	132	132	132
Data Analysis	t-value	4.708*	5.537*	-2.189*	-2.982*	5.049*
	Sig. (2-tailed)	0.000	0.000	0.030	0.003	0.000
	N	132	132	132	132	132
Interpretation	t-value	4.713*	7.019*	-1.218	-1.506	4.716*
	Sig. (2-tailed)	0.000	0.000	0.225	0.135	0.000
	N	132	132	132	132	132

Constant=1.978

For the scientific process, the results show a significant effect on knowledge retention with t-value 5.460, metacognition with t-value of 5.945, and scientific application with t-value of 4.647 and had similarities in p-values of 0.000. However, its effect on reasoning skills with p-value of 0.436 and inquiry skills with p-value of 0.122 is not significant since the p-values are greater than 0.05.

Similarly, trends and investigation show a significant effect on knowledge retention with t-value of 5.055, metacognition with t-value of 6.927, and scientific application with t-value of 5.194 with all corresponding p-values at 0.000, respectively. However, the effects on reasoning skills with p-value of 0.368 and inquiry skills with p-value of 0.072 are not significant.

Meanwhile, data analysis shows a significant effect on knowledge retention with t-value of 4.708, metacognition with t-value of 5.537, and scientific application with the t-value of 5.049, and also has p-values of 0.000 among these three dimensions. It also shows a significant effect on reasoning skills with t-value of 2.189 and p-value of 0.030 and inquiry skills with t-value of -2.982 and p-value of 0.003 since the p-values are less than 0.05.

Lastly, interpretation shows a significant effect on knowledge retention with t-value of 4.713, metacognition with t-value of 7.019, and scientific application with t-value of 4.716 with all p-values equal to 0.000. However, the results show no significant effect on reasoning skills with p-value of = 0.225 as well as inquiry skills with p-value of 0.135 since the p-values are greater than the alpha value of 0.05.

Overall, the results indicate that several components of the inquiry-based approach in teaching science significantly affect the learners' cognitive ability, particularly in terms of knowledge retention, metacognition, and scientific application. Since most of the p-values are less than the alpha value of 0.05, the null hypothesis stating that there is no significant effect between the inquiry-based approach in teaching science and the learners' cognitive ability is rejected. It can be concluded that the implementation of inquiry-based teaching practices contributes to the development of learners' cognitive abilities in science learning, particularly in strengthening their knowledge retention, metacognitive skills, scientific applications.

IV. Conclusion and Recommendations

The study revealed significant findings regarding the positive relationship between inquiry-based approach and learners 'creativity, leading to the rejection of the first hypothesis because the computed p-values were less than the alpha level of 0.05. This demonstrates that the use of inquiry-based approach effectively enhances learners' creativity in science education.

Furthermore, statistical test also presents significant finding regarding the positive effect of inquiry-based approach on learners' cognitive abilities, leading to the rejection of second hypothesis because the computed p-values were less than the alpha level of 0.05. This affirms that while learners demonstrate a strong grasp of knowledge retention, metacognition, and scientific applications, their ability in reasoning and inquiry skills remain at moderate level.

Overall, Inquiry-Based Approach is an effective teaching strategy in enhancing both learners' creativity and cognitive abilities. However, there is stills a critical need to strengthen its utilization to further improve learner's reasoning and inquiry skills.

Based on the conclusions, the following recommendations are advised:

Curriculum planners should integrate inquiry-based learning across the science curriculum, emphasizing student-led questioning, process-oriented learning, scientific process, trends and investigation, data analysis, and interpretation, while gradually transitioning from guided to open-ended tasks. Activities should enhance creativity through scientific visualization, divergent thinking, and scientific innovations, and support cognitive development including knowledge retention, metacognition, scientific application, while placing greater emphasis on reasoning and inquiry skills, through scaffolded interventions and reflective hands-on activities.

School Administrators are advised to enhance their support for Inquiry-Based teaching by offering continuous professional development programs, relevant seminars and workshops, and sufficient instructional resources, including updated learning materials and laboratory apparatus. Teachers will be able to effectively implement innovative and learnercentered teaching approaches by establishing a supportive environment.

Faculty/Teachers are encouraged to develop activities that enhance learners' reasoning and inquiry skills and to consistently implement inquiry-based teaching methods in the field of science. The creativity and cognitive development of learners can be enhanced by incorporating problem-solving tasks, critical thinking activities, and hands-on investigations.

Learners are encouraged to participate in experiments, generate unique questions, and analyze results in order to actively engage in inquiry-based learning. Learners can further improve their creativity and cognitive abilities by cultivating critical thinking skills, independence, and curiosity.

Future researchers are encouraged to conduct similar studies in diverse contexts and incorporate supplementary variables, including academic performance, learning approaches, and motivation. Additionally, investigating the long-term consequences of inquiry-based learning may offer more profound insights and contribute to the validation and extension of the results of this investigation.

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