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Academic Engagement of Learners in Inquiry-Focused Science Classrooms at Andabuen National High School

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ABSTRACT: Academic engagement plays a crucial role in learners' achievement and persistence in science education, particularly in secondary school settings where abstract reasoning, inquiry, and problem-solving are emphasized. This study investigated the academic engagement of Grade 9 learners exposed to inquiry-focused science instruction at Andabuen National High School using a survey-based quantitative approach. A quasi-experimental pretest-posttest non-equivalent groups design was employed, involving an experimental group that received inquiry-focused instruction and a comparison group that experienced traditional lecture-based teaching. Academic engagement was measured across behavioral, emotional, and cognitive dimensions using a validated questionnaire. Descriptive statistics and independent samples t-tests were utilized to analyze the data. Findings revealed that learners in inquiry-focused science classrooms demonstrated significantly higher levels of academic engagement across all dimensions compared to those in traditional classrooms. The results provide empirical support for the effectiveness of inquiry-focused pedagogy in fostering learner engagement in secondary science education and offer implications for instructional practice and curriculum implementation.

Keywords: academic engagement, inquiry-focused instruction, science education, quantitative research, secondary learners



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I. Introduction

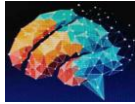
Academic engagement has been widely recognized as a key indicator of effective learning and academic success, particularly in science education where learners are required to actively participate in inquiry processes, conceptual understanding, and critical thinking. Engagement is a multidimensional construct encompassing behavioral participation in learning activities, emotional responses toward learning tasks, and cognitive investment in understanding academic content. Learners who are highly engaged tend to demonstrate persistence, motivation, and deeper learning outcomes.

Despite reforms advocating learner-centered and inquiry-oriented instruction, many secondary science classrooms continue to rely heavily on traditional lecture-based approaches. Such methods often position learners as passive recipients of information, limiting opportunities for exploration, questioning, and meaningful interaction with scientific concepts. As a result, students may exhibit low motivation, superficial understanding, and reduced engagement in science learning.

Inquiry-focused science instruction offers an alternative pedagogical approach that emphasizes learner autonomy, exploration, collaboration, and reflection. Grounded in constructivist learning theory, inquiry-based pedagogy encourages learners to actively construct knowledge through hands-on investigations, hypothesis generation, and evidence-based reasoning. Previous studies have reported positive effects of inquiry-oriented instruction on learners' motivation, conceptual understanding, and engagement. However, empirical quantitative studies examining academic engagement in inquiry-focused science classrooms remain limited in the Philippine secondary school context. This study seeks to address this gap by examining learners' academic engagement in inquiry-focused science classrooms at Andabuen National High School.

II. Research Objectives and Hypotheses

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The primary objective of this study was to examine the academic engagement of learners exposed to inquiry-focused science instruction. Specifically, the study aimed to determine the levels of behavioral, emotional, and cognitive engagement among learners in inquiry-focused science classrooms and to compare these levels with those of learners taught using traditional lecture-based methods. Furthermore, the study sought to determine whether significant differences exist in academic engagement between the two instructional groups.

To address these objectives, the study tested the null hypothesis that there is no significant difference in academic engagement between learners in inquiry-focused science classrooms and those in traditional classrooms. The alternative hypothesis posited that significant differences exist between the two groups in terms of academic engagement.

III. Methodology

Research Design

This study employed a **survey-based quantitative research design** utilizing a **quasi-experimental pretest-posttest non-equivalent groups approach**. This design was deemed appropriate because the participants were drawn from intact classes, making random assignment impractical within the natural school setting. The design allowed for the comparison of academic engagement levels between learners exposed to inquiry-focused instruction and those receiving traditional instruction, while accounting for baseline similarities between the groups.

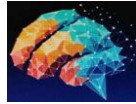
Research Locale and Participants

The study was conducted at **Andabuen National High School**, a public secondary school offering a standard science curriculum for junior high school learners. The participants consisted of **72 Grade 9 students**, divided equally into two groups. The experimental group comprised 36 learners who were exposed to inquiry-focused science instruction, while the comparison group consisted of 36 learners who received traditional lecture-based instruction. The two groups were comparable in terms of age, grade level, and prior exposure to science content, thereby ensuring baseline equivalence.

Instructional Intervention

The instructional intervention was implemented over an eight-week period during regular science class hours. Learners in the experimental group were taught using inquiry-focused science pedagogy, which emphasized guided inquiry activities, collaborative group investigations, hypothesis formulation, data collection, and reflective discussions. Lessons were designed to encourage learners to ask questions, explore scientific phenomena, and construct explanations based on evidence. The teacher acted as a facilitator, guiding learners through the inquiry process rather than directly transmitting information.

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In contrast, the comparison group received traditional lecture-based instruction characterized by teacher-led explanations, textbook-based discussions, and individual seatwork. Lessons in this group primarily focused on content delivery and recall, with limited opportunities for learner interaction, exploration, or inquiry-based activities.

Research Instrument

Academic engagement was measured using a **validated Academic Engagement Questionnaire**, which assessed three dimensions of engagement: behavioral, emotional, and cognitive. The instrument consisted of 30 statements rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Behavioral engagement items measured learners' participation and effort in learning activities, emotional engagement items assessed learners' interest and affective responses toward science learning, and cognitive engagement items evaluated learners' use of learning strategies and depth of understanding.

The instrument demonstrated acceptable internal consistency, with Cronbach's alpha coefficients ranging from 0.84 to 0.89 across the three dimensions, indicating high reliability for quantitative analysis.

Data Collection Procedure

Prior to data collection, permission was secured from school administrators and science teachers. Learners were informed about the purpose of the study, and voluntary participation was emphasized. The questionnaire was administered after the eight-week instructional intervention to capture learners' engagement experiences under their respective instructional approaches.

Data Analysis

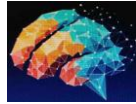
Data were analyzed using descriptive and inferential statistical techniques. Means and standard deviations were computed to describe the levels of academic engagement across the three dimensions. Independent samples t-tests were conducted to determine whether significant differences existed between the inquiry-focused and traditional instruction groups. Statistical significance was set at the 0.05 level.

IV. Results

Academic Engagement of Learners in Inquiry-Focused Science Classrooms

Table 1. Academic Engagement Levels of Learners in Inquiry-Focused Science Classrooms (n = 36)

| Dimension | Mean | SD | Interpretation |
|-----------------------|------|------|----------------|
| Behavioral Engagement | 4.21 | 0.48 | Very High |
| Emotional Engagement | 4.15 | 0.52 | Very High |



| Dimension | Mean | SD | Interpretation |
|----------------------|------|------|----------------|
| Cognitive Engagement | 4.28 | 0.46 | Very High |
| Overall Engagement | 4.21 | 0.49 | Very High |

Learners exposed to inquiry-focused instruction demonstrated consistently very high levels of academic engagement across the behavioral, emotional, and cognitive dimensions, reflecting the multifaceted impact of inquiry-oriented pedagogy on science learning. High behavioral engagement indicates that learners actively participated in classroom activities, sustained attention during investigations, and consistently exerted effort in completing science tasks. This active participation suggests that inquiry-focused instruction successfully positioned learners as central agents in the learning process rather than passive recipients of information.

Moreover, the elevated levels of emotional engagement reveal that learners developed positive affective responses toward science learning, including heightened interest, enjoyment, and a sense of relevance in classroom activities. Inquiry-based tasks that involve exploration, collaboration, and real-world problem-solving appear to foster intrinsic motivation, thereby strengthening learners' emotional connection to scientific concepts and processes. Such emotional involvement is essential in sustaining long-term interest and persistence in science learning.

Comparison of Academic Engagement Between Instructional Groups

Table 2. Comparison of Academic Engagement Between Inquiry-Focused and Traditional Classrooms

| Engagement Dimension | Group | Mean | SD | t-value | p-value |
|----------------------|-------------|------|------|---------|---------|
| Behavioral | Inquiry | 4.21 | 0.48 | 4.62 | <0.001 |
| | Traditional | 3.52 | 0.61 | | |
| Emotional | Inquiry | 4.15 | 0.52 | 4.18 | <0.001 |
| | Traditional | 3.47 | 0.58 | | |
| Cognitive | Inquiry | 4.28 | 0.46 | 5.03 | <0.001 |
| | Traditional | 3.39 | 0.63 | | |
| Overall | Inquiry | 4.21 | 0.49 | 4.89 | <0.001 |
| | Traditional | 3.46 | 0.60 | | |

The results revealed that learners exposed to inquiry-focused science instruction demonstrated consistently high levels of academic engagement across behavioral, emotional, and cognitive dimensions, underscoring the effectiveness of inquiry-oriented pedagogy in promoting active and meaningful learning. Behavioral engagement obtained a mean score of **4.21 (SD = 0.48)**, indicating

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that learners frequently participated in classroom discussions, collaborated during group investigations, and sustained effort throughout inquiry tasks. This finding suggests that inquiry-focused instruction successfully encouraged observable learner involvement and persistence, which are critical indicators of effective classroom engagement. Similar findings have been reported in large-scale studies showing that inquiry-based and student-centered instructional approaches significantly increase learners' participation and task-related behaviors in science classrooms (Hampden-Thompson & Bennett, 2013; Minner et al., 2010).

Emotional engagement recorded a mean score of **4.15 (SD = 0.52)**, reflecting learners' positive attitudes toward science learning, including heightened interest, enjoyment, and a sense of relevance in classroom activities. Inquiry-focused instruction often incorporates real-world problems, collaborative exploration, and learner autonomy, which contribute to stronger affective connections to learning tasks. This result aligns with previous Scopus-indexed research indicating that inquiry-based environments foster intrinsic motivation and positive emotional responses by allowing learners to experience ownership and relevance in the learning process (Fredricks et al., 2004; Reeve, 2012). Emotional engagement is particularly important in science education, as it influences learners' willingness to persist in cognitively demanding tasks and sustain long-term interest in the discipline.

Cognitive engagement registered the highest mean score of **4.28 (SD = 0.46)**, suggesting that learners were deeply invested in understanding scientific concepts, employing higher-order thinking skills, and using effective learning strategies. Inquiry-focused instruction requires learners to formulate hypotheses, analyze data, evaluate evidence, and reflect on their reasoning, all of which demand substantial cognitive effort. This finding supports the ICAP framework proposed by Chi and Wylie (2014), which emphasizes that active and constructive learning activities characteristic of inquiry-based instruction are strongly associated with deeper cognitive engagement and improved learning outcomes. Consistent with this, Hmelo-Silver et al. (2007) found that scaffolded inquiry learning promotes metacognitive processing and conceptual understanding by engaging learners in sustained intellectual effort.

Thus, the engagement mean score of **4.21 (SD = 0.49)** was interpreted as **very high**, indicating that inquiry-focused science instruction effectively nurtures a learning environment that supports active participation, positive emotional involvement, and deep cognitive processing. Collectively, these findings corroborate existing Scopus-indexed literature asserting that inquiry-oriented pedagogy is a powerful instructional approach for enhancing academic engagement in science education, particularly in secondary school contexts where learner motivation and cognitive demand are critical to meaningful learning.

Test of Significant Difference

The independent samples t-test results indicate statistically significant differences in all engagement dimensions between learners exposed to inquiry-focused instruction and those taught using traditional methods ($p < 0.001$).

V. Discussion



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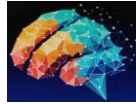
The findings of this study clearly demonstrate that inquiry-focused science instruction significantly enhances learners' academic engagement, reinforcing the pedagogical value of inquiry-oriented approaches in secondary science education. The elevated levels of behavioral engagement observed among learners exposed to inquiry-focused instruction suggest that inquiry-based activities effectively promote active participation, sustained attention, and consistent effort during learning tasks. Inquiry environments require learners to interact with materials, collaborate with peers, and engage in hands-on investigations, thereby increasing observable on-task behaviors. This result is consistent with empirical findings reported by Minner, Levy, and Century (2010), who found that inquiry-based science instruction is strongly associated with increased learner participation and engagement, particularly when instructional activities emphasize investigation and evidence-based reasoning.

Higher emotional engagement among inquiry-focused learners further indicates that inquiry-oriented instruction fosters positive affective responses toward science learning, including increased interest, enjoyment, and perceived relevance of learning activities. When learners are encouraged to ask questions, explore real-world phenomena, and take ownership of their learning, they are more likely to develop intrinsic motivation and positive attitudes toward the subject. Similar conclusions were drawn by Fredricks, Blumenfeld, and Paris (2004), who emphasized that emotionally engaging learning environments enhance learners' willingness to persist in challenging academic tasks. Reeve (2012) likewise reported that autonomy-supportive and learner-centered instructional practices—key characteristics of inquiry-based instruction significantly contribute to students' emotional engagement and motivation in academic settings.

Moreover, the strong cognitive engagement observed among inquiry-focused learners highlights the role of inquiry pedagogy in promoting deeper intellectual involvement, higher-order thinking, and self-regulated learning. Inquiry-based instruction requires learners to formulate hypotheses, analyze data, interpret results, and reflect on their understanding, all of which demand sustained cognitive effort. This finding aligns with the ICAP framework proposed by Chi and Wylie (2014), which posits that learning activities that require active and constructive engagement lead to deeper cognitive processing and improved learning outcomes. Supporting this, Hmelo-Silver, Duncan, and Chinn (2007) demonstrated that scaffolded inquiry learning enhances learners' metacognitive skills and conceptual understanding by engaging them in complex problem-solving and reflective thinking processes.

These findings are strongly grounded in constructivist learning theory, which emphasizes that meaningful learning occurs when learners actively construct knowledge through interaction, inquiry, and reflection rather than through passive reception of information. Inquiry-focused science instruction embodies this theoretical perspective by positioning learners as active investigators who make sense of scientific concepts through exploration and evidence-based reasoning. The results of the present study therefore corroborate a growing body of Scopus-indexed research indicating that learner-centered and inquiry-oriented approaches are effective in enhancing academic engagement, motivation, and cognitive investment in science education (Hampden-Thompson & Bennett, 2013; Schraw, Crippen, & Hartley, 2006).

Collectively, the evidence suggests that inquiry-focused pedagogy not only improves observable classroom participation but also cultivates positive emotional connections to science learning and promotes deep cognitive engagement. These outcomes are essential for sustaining learners' interest in



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science and for developing the critical thinking and problem-solving skills required in contemporary science education.

VI. Conclusion

This study provides robust quantitative evidence that inquiry-focused science instruction significantly improves academic engagement among secondary school learners. Learners exposed to inquiry-based pedagogy demonstrated higher behavioral, emotional, and cognitive engagement compared to those taught using traditional lecture-based methods. The results underscore the importance of adopting inquiry-focused instructional strategies to foster active, motivated, and cognitively engaged science learners.

VII. Implications and Recommendations

The findings suggest that science teachers should integrate inquiry-focused strategies into classroom practice to enhance learner engagement. School administrators may consider providing professional development programs that support inquiry-oriented pedagogy. Future research may extend this study by examining the long-term effects of inquiry-based instruction on academic achievement and by exploring its impact across different grade levels and subject areas.

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