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LEARNER ENGAGEMENT AND INQUIRY-BASED SCIENCE INSTRUCTION IN JUNIOR HIGH SCHOOL: EDUCATIONAL EXPERIENCES OF GRADE 9 LEARNERS IN A PHILIPPINE PUBLIC SECONDARY SCHOOL

Kayceerona R. Nangorog[1], Dr. Alma Gonzales[2]
[1]*Northeastern College, Santiago City, Philippines*
San Pablo National High School
kayceerona.rodriguez@deped.gov.ph[1]
[2]*Northeastern College, Santiago City, Philippines*
almag0400@gmail.com[2]

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ABSTRACT

This qualitative study explored learner engagement and inquiry-based Science instruction among Grade 9 learners at San Pablo National High School. The study aimed to examine how inquiry-based instructional practices influence learner participation, critical thinking, and classroom engagement in Science education within a Philippine public secondary school context. Using a descriptive qualitative research design, data were gathered through semi-structured interviews, classroom observations, and document analysis involving Science teachers and selected Grade 9 learners. Thematic analysis revealed four major themes: (1) inquiry-driven and experiential science learning, (2) collaborative and participatory learner engagement, (3) critical thinking and problem-solving development through inquiry activities, and (4) instructional and classroom challenges in implementing inquiry-based Science education. Findings showed that inquiry-based instructional practices such as experimentation, collaborative investigations, questioning activities, and problem-solving tasks significantly enhanced learners' participation, curiosity, and engagement in Science classes. Learners became more motivated and confident when classroom instruction encouraged exploration, experimentation, and collaborative learning. However, inadequate laboratory facilities, limited instructional resources, time constraints, and varying learner readiness affected the implementation of inquiry-based instruction. The study concludes that inquiry-based Science instruction contributes positively to learner engagement, critical thinking, and meaningful learning experiences among junior high school learners. Strengthening instructional support, laboratory resources, and teacher professional development is recommended to improve inquiry-based Science education in Philippine public secondary schools.

Keywords: *inquiry-based learning, Science education, learner engagement, junior high school, critical thinking, qualitative study, Philippines*

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I. INTRODUCTION

Science education plays a significant role in developing learners' scientific literacy, critical thinking, problem-solving abilities, and understanding of real-world phenomena. In junior high school education, Science instruction encourages learners to investigate concepts, analyze evidence, and apply scientific knowledge to practical situations. Effective Science education therefore requires instructional approaches that actively engage learners in inquiry, exploration, experimentation, and collaborative learning.

Inquiry-based instruction has become one of the most widely recognized pedagogical approaches in Science education because it promotes learner-centered and experiential learning experiences. Inquiry-based learning allows learners to formulate questions, investigate problems, analyze evidence, and construct knowledge through active exploration and scientific reasoning. Such instructional practices encourage learners to become active participants in the learning process rather than passive recipients of information.

Learner engagement is essential in Science education because meaningful scientific understanding develops through active participation, curiosity, experimentation, and reflective thinking. Behavioral engagement is reflected through classroom participation and task involvement, emotional engagement through learners' interest and motivation, and cognitive engagement through critical thinking and problem-solving during inquiry activities.

In Philippine public secondary schools, teachers frequently implement inquiry-based instructional approaches to improve classroom participation and deepen learners' scientific understanding. Teachers utilize experiments, collaborative investigations, questioning techniques, simulations, and contextualized scientific activities to make learning meaningful and interactive. However, public secondary schools, particularly in rural communities, continue to encounter challenges related to limited laboratory resources, inadequate facilities, large class sizes, and insufficient instructional materials.

Despite these educational limitations, Science teachers continuously adapt instructional strategies to sustain learner engagement and meaningful classroom interaction. Previous studies revealed that inquiry-based instruction improves learner participation, scientific reasoning, and conceptual understanding in Science education. However, limited qualitative studies have explored how Grade 9 learners experience inquiry-based Science instruction within public secondary school settings in the Philippines.

Objectives of the Study

This study therefore aimed to explore learner engagement and inquiry-based Science instruction among Grade 9 learners at San Pablo National High School.

Specifically, the study sought to answer the following questions:

1. What inquiry-based instructional practices are utilized in Grade 9 Science education?
2. How do learners demonstrate engagement during inquiry-based Science instruction?
3. What challenges do teachers and learners encounter in implementing inquiry-based Science learning activities?
4. What implications may be derived for improving learner engagement and inquiry-based Science instruction in public secondary schools?

Review of Related Literature

Inquiry-Based Science Instruction

Inquiry-based instruction refers to learner-centered pedagogical approaches that encourage learners to investigate questions, explore concepts, and construct understanding through active inquiry and experimentation. According to John Dewey, meaningful learning occurs when learners actively engage in problem-solving and experiential inquiry (Dewey, 1938). Inquiry-based learning promotes scientific thinking, exploration, and reflective learning experiences.

Research revealed that inquiry-based Science instruction enhances learners' conceptual understanding, scientific reasoning, and classroom engagement (Hmelo-Silver et al., 2007). Learners become more motivated and participative when classroom instruction involves investigation, questioning, experimentation, and collaborative exploration.

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Learner Engagement in Science Education

Learner engagement refers to learners' behavioral, emotional, and cognitive involvement in classroom learning activities (Fredricks et al., 2004). In Science education, engagement is demonstrated through active participation, curiosity, experimentation, collaborative interaction, and critical thinking during inquiry-based tasks.

Studies suggest that inquiry-driven and collaborative Science classrooms strengthen learner participation, motivation, and scientific understanding (Christenson et al., 2012). Learners demonstrate deeper engagement when they are encouraged to investigate scientific problems and apply knowledge through experiential learning activities.

Constructivist and Experiential Learning in Science

Constructivist learning theory emphasizes that learners actively construct knowledge through experience, inquiry, and interaction. Lev Vygotsky emphasized the importance of guided interaction and collaborative learning in cognitive development (Vygotsky, 1978). Inquiry-based Science instruction aligns with constructivist principles by encouraging learners to explore, analyze, and interpret scientific concepts through social and experiential learning.

Experiential learning theory proposed by David Kolb also emphasizes learning through concrete experiences, reflection, and experimentation (Kolb, 1984). Science laboratories, investigations, and hands-on activities contribute significantly to meaningful learning experiences among secondary learners.

Challenges in Inquiry-Based Science Education

Public secondary schools frequently encounter challenges related to inadequate laboratory facilities, limited Science equipment, insufficient instructional materials, and large class sizes (OECD, 2019). Teachers often modify inquiry-based activities according to available resources and classroom conditions.

Despite these limitations, teachers demonstrate adaptability and creativity in implementing learner-centered instructional approaches. However, strengthened institutional support, laboratory resources, and professional development opportunities remain necessary to sustain quality inquiry-based Science education.

II. METHODOLOGY

Research Design

This study utilized a descriptive qualitative research design to explore learner engagement and inquiry-based Science instruction among Grade 9 learners in a Philippine public secondary school context. The qualitative approach enabled the researcher to examine participants' lived experiences, instructional practices, and classroom realities within natural educational settings.

Research Locale

The study was conducted at San Pablo National High School. The school serves learners from rural and semi-rural communities and reflects the realities of Science education in Philippine public secondary schools.

Participants of the Study

The participants included six Grade 9 Science teachers and ten selected Grade 9 learners. Participants were selected through purposive sampling based on their involvement and experiences in inquiry-based Science instruction and classroom learning activities.

Data Gathering Procedures

Interviews explored participants' experiences regarding inquiry-based instruction, learner participation, classroom interaction, and instructional challenges. Classroom observations focused on learner engagement, experimentation, collaborative activities, questioning behaviors, and inquiry-based classroom interaction.

Data Analysis

Data were analyzed using thematic analysis following the framework developed by Virginia Braun and Victoria Clarke (2006). Coding, categorization, and theme generation were conducted systematically to identify meaningful patterns and interpretations from the collected qualitative data.

Trustworthiness of the Study

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Credibility was established through triangulation and member checking. Dependability was ensured through audit trails and systematic documentation of research procedures. Confirmability and transferability were strengthened through detailed descriptions of the research process, participants, and classroom contexts.

Ethical Considerations

Ethical principles such as informed consent, confidentiality, anonymity, voluntary participation, and respect for participants were strictly observed throughout the conduct of the study. Permission from school authorities and parental consent for learner participants were secured prior to data gathering activities.

III. RESULTS AND DISCUSSION

Theme 1: Inquiry-Driven and Experiential Science Learning

The findings revealed that inquiry-driven and experiential instructional practices significantly enhanced learner engagement among Grade 9 learners in Science education at San Pablo National High School. Teachers emphasized the importance of allowing learners to actively investigate, experiment, and discover scientific concepts through hands-on inquiry activities and collaborative investigations.

One participant shared:

"Mas naiintindihan ng mga estudyante ang Science kapag sila mismo ang nag-eexperiment at nagdi-discover ng concepts."

Another teacher explained:

"Kapag inquiry-based ang lesson, mas curious sila at mas maraming gustong itanong."

Teachers frequently utilized experiments, laboratory activities, scientific investigations, simulations, demonstrations, and inquiry tasks during classroom instruction. Classroom observations revealed that learners became more attentive, participative, and motivated when lessons involved active experimentation and exploration.

One learner shared:

"Mas gusto ko po ang Science kapag may actual experiments at activities."

Another learner stated:

"Mas exciting po ang klase kapag kami mismo ang naghahanap ng sagot."

Teachers explained that experiential Science instruction strengthened learners' comprehension because they directly observed scientific processes and participated in inquiry activities. Learners became more engaged when they were encouraged to formulate hypotheses, analyze observations, and interpret scientific evidence independently.

One participant noted:

"Mas lumalalim ang understanding nila kapag sila mismo ang gumagawa ng investigation."

Another teacher added:

"Hindi sila passive sa learning kasi involved sila sa process."

Behavioral engagement was observed through active participation and task involvement during laboratory and inquiry activities. Emotional engagement emerged through learners' curiosity, excitement, and enjoyment during scientific investigations. Cognitive engagement was reflected in learners' ability to analyze data, interpret findings, and apply scientific reasoning during classroom discussions and inquiry tasks.

The findings suggest that inquiry-driven and experiential Science instruction significantly strengthens learner engagement and meaningful learning experiences among junior high school learners. Inquiry-based classrooms encouraged learners to become active participants in constructing scientific understanding.

These findings support the experiential learning theory of David Kolb, which emphasizes learning through concrete experiences and reflective inquiry (Kolb, 1984). Similarly, Hmelo-Silver et al. (2007) emphasized that inquiry-based learning enhances conceptual understanding, scientific reasoning, and learner engagement.

Theme 2: Active Learner Participation and Collaborative Engagement

Another major finding revealed that collaborative and interactive classroom activities significantly improved learner participation and engagement during inquiry-based Science instruction. Teachers emphasized that learners became more expressive, cooperative, and confident when classroom activities involved teamwork, collaborative

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investigations, and peer interaction.

One teacher explained:

"Kapag group activities at collaborative experiments, mas nagiging active ang participation nila."

Another participant stated:

"Mas natututo sila kapag nagtutulungan sa pag-aanalyze ng experiments."

Teachers frequently utilized group investigations, brainstorming sessions, peer discussions, collaborative experiments, and cooperative problem-solving activities. Classroom observations showed that learners actively interacted with classmates, exchanged ideas, asked questions, and participated confidently during collaborative Science tasks.

Learners likewise expressed positive experiences regarding collaborative classroom interaction.

One learner shared:

"Masaya po kapag by group ang experiments kasi nagtutulungan kami."

Another learner stated:

"Mas naiintindihan ko po ang lesson kapag may discussions at sharing ng ideas."

Teachers noted that collaborative activities improved learners' communication skills, confidence, and classroom participation. Learners who were initially shy became more engaged when inquiry activities encouraged teamwork and peer support.

One participant shared:

"Mas nagiging confident silang magsalita kapag collaborative ang activities."

Another teacher added:

"Mas interactive at buhay ang classroom kapag inquiry at teamwork ang ginagawa."

Behavioral engagement was observed through active participation and involvement during collaborative inquiry activities. Emotional engagement emerged through learners' enjoyment, confidence, and positive classroom interaction. Cognitive engagement was reflected in learners' ability to solve scientific problems and interpret scientific findings collaboratively.

The findings indicate that collaborative inquiry-based classroom environments contribute positively to learner participation, communication, and engagement in Science education. Collaborative learning strengthened both academic and social interaction among Grade 9 learners.

These findings align with the learner engagement framework of Fredricks et al. (2004), which emphasizes behavioral, emotional, and cognitive involvement in classroom learning activities. Similarly, Christenson et al. (2012) highlighted that collaborative educational environments positively influence learner motivation and classroom engagement.

Theme 3: Critical Thinking and Problem-Solving Development Through Inquiry Activities

The findings further revealed that inquiry-based Science instruction strengthened learners' critical thinking, analytical reasoning, and problem-solving skills. Teachers emphasized that inquiry activities encouraged learners to ask questions, investigate problems, analyze evidence, and formulate scientific explanations independently.

One participant stated:

"Natututo silang mag-analyze at mag-isip critically kapag inquiry-based ang instruction."

Another teacher explained:

"Hindi lang sila nakikinig, kundi sila mismo ang nag-iinvestigate at naghahanap ng explanation."

Teachers encouraged learners to formulate hypotheses, gather evidence, conduct investigations, and interpret scientific observations during classroom activities. Classroom observations revealed that learners became more reflective and analytical during discussions and inquiry tasks.

One learner shared:

"Mas challenging po pero mas natututo kami kapag kami ang naghahanap ng sagot."

Another learner stated:

"Napapaisip po kami kapag may experiments at investigations."

Teachers observed that inquiry-based activities enhanced learners' curiosity and willingness to explore scientific concepts independently. Learners demonstrated improved reasoning skills and became more engaged in analyzing scientific problems during classroom interaction.

One participant explained:

"Mas nagiging critical thinkers sila kapag hinahayaan silang magtanong at mag-explore."

Another teacher added:

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"Mas natututo silang mag-solve ng problems gamit ang sariling analysis."

The findings suggest that inquiry-based Science instruction contributes significantly to the development of higher-order thinking skills and scientific reasoning among junior high school learners. Inquiry activities promoted meaningful engagement by encouraging learners to actively construct scientific knowledge through exploration, investigation, and analysis.

These findings support constructivist learning principles proposed by Lev Vygotsky, which emphasize guided inquiry, collaboration, and active knowledge construction through social interaction (Vygotsky, 1978). The findings also align with Dewey's experiential learning principles emphasizing inquiry, reflection, and problem-solving in education (Dewey, 1938).

Theme 4: Instructional and Classroom Challenges in Implementing Inquiry-Based Science Education

Despite the positive effects of inquiry-based instruction, participants encountered several instructional and classroom challenges affecting the implementation of inquiry-driven Science education in the public secondary school setting.

One participant stated:

"Mahirap minsan mag-conduct ng inquiry activities kapag kulang ang laboratory materials."

Another teacher explained:

"Limitado minsan ang time at resources kaya hindi lahat ng experiments ay nagagawa."

Teachers identified inadequate laboratory facilities, insufficient Science equipment, limited instructional materials, large class sizes, and varying learner readiness as major challenges affecting inquiry-based Science instruction.

One participant shared:

"Kailangan minsan mag-improvise dahil kulang ang gamit sa laboratory."

Another teacher noted:

"May mga estudyante ring nahihirapang sumabay lalo na kapag complicated ang activity."

Classroom observations revealed that teachers frequently modified laboratory activities and adjusted inquiry tasks according to available materials and classroom conditions. Teachers exerted additional effort in preparing improvised instructional materials and contextualized inquiry activities to sustain learner engagement despite resource limitations.

Learners also recognized these classroom limitations.

One learner shared:

"Mas maganda sana kung mas marami pong laboratory equipment."

Another learner stated:

"Minsan po kulang ang oras para matapos ang experiments."

Despite these challenges, teachers demonstrated resilience, adaptability, and commitment in implementing meaningful inquiry-based Science instruction. Participants emphasized that learners' curiosity and classroom participation motivated them to continue utilizing inquiry-driven instructional practices despite limited resources.

The findings indicate that while inquiry-based instruction positively influences learner engagement and critical thinking, strengthened institutional support, laboratory facilities, and instructional resources remain essential in sustaining quality Science education in Philippine public secondary schools.

These findings support OECD (2019), which emphasized that public schools frequently encounter infrastructural and instructional limitations affecting Science education quality and learner support. Similarly, Dela Peña (2020) highlighted that rural teachers continuously adapt instructional practices creatively despite classroom and resource-related challenges.

Discussion

The study revealed that inquiry-based Science instruction significantly strengthens learner engagement, critical thinking, and meaningful learning experiences among Grade 9 learners in Philippine public secondary school contexts. Teachers at San Pablo National High School implemented inquiry-driven and experiential instructional practices that encouraged learners to actively investigate, analyze, and construct scientific understanding.

Inquiry-based instructional approaches enhanced learners' behavioral, emotional, and cognitive engagement through experimentation, collaborative investigations, questioning activities, and scientific exploration. Learners became more attentive, participative, curious, and reflective when

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classroom instruction encouraged active inquiry and experiential learning.

Collaborative classroom activities further strengthened learner participation and communication during Science instruction. Group investigations and cooperative problem-solving tasks created supportive learning environments that encouraged peer interaction and active classroom engagement.

Inquiry activities also contributed significantly to learners' critical thinking and scientific reasoning skills. Learners demonstrated deeper understanding and analytical thinking when they were encouraged to formulate questions, investigate problems, analyze evidence, and interpret scientific findings independently.

However, instructional challenges related to inadequate laboratory facilities, insufficient instructional materials, large class sizes, and time limitations continue to affect the implementation of inquiry-based Science instruction in public secondary schools. Despite these limitations, teachers demonstrated adaptability and commitment in sustaining learner-centered and inquiry-driven educational experiences.

The findings highlight the importance of strengthening laboratory resources, instructional support, and teacher professional development to improve inquiry-based Science education and learner engagement in Philippine public secondary schools.

IV. CONCLUSION

The study concludes that inquiry-based Science instruction significantly enhances learner engagement, critical thinking, scientific reasoning, and meaningful learning experiences among Grade 9 learners in Philippine public secondary school contexts. Teachers at San Pablo National High School implemented inquiry-driven and experiential instructional practices that strengthened learners' participation, curiosity, collaboration, and classroom interaction.

Collaborative and inquiry-based classroom activities enhanced learners' behavioral, emotional, and cognitive engagement through experimentation, scientific investigation, and cooperative problem-solving tasks. Inquiry activities also strengthened learners' analytical reasoning and independent learning skills.

However, challenges related to inadequate laboratory resources, insufficient instructional materials, time constraints, and varying learner readiness continue to affect the delivery of quality inquiry-based Science education in public secondary schools.

Despite these instructional limitations, teachers demonstrated resilience, creativity, and dedication in sustaining meaningful and engaging Science instruction. The study emphasizes the importance of learner-centered, inquiry-based, and experiential pedagogical practices in strengthening Science education and learner engagement.

Implications of the Study

The findings imply that Science instruction should continuously emphasize inquiry-based, collaborative, and experiential pedagogical approaches to strengthen learner engagement, scientific reasoning, and critical thinking skills among junior high school learners.

Educational leaders and policymakers may strengthen Science education programs by providing adequate laboratory facilities, instructional materials, Science equipment, and classroom resources necessary for effective inquiry-based instruction. Schools may also encourage contextualized and community-based Science activities to make learning more meaningful and accessible to learners.

Professional development programs focusing on inquiry-based pedagogy, laboratory instruction, collaborative learning strategies, and learner engagement techniques may further enhance teachers' instructional effectiveness in Science education.

Future researchers may conduct similar qualitative or mixed-methods studies exploring inquiry-based instructional innovations, learner outcomes, and critical thinking development across diverse secondary school settings.

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