**International Journal of Research Studies in Management**
2026 Volume 14 Number 4, 23-32


ISSN: 2243-7770
Online ISSN: 2243-7789

OPEN ACCESS

# Inquiry-based learning and engagement of Science, Technology, Engineering, and Mathematics (STEM) students

Dela Luna, Limuel A. ✉
*Divine Word College of San Jose, Philippines (limueldelaluna14@gmail.com)*
Catalan, Catherine S.
*Divine Word College of San Jose, Philippines (catherine.catalan001@deped.gov.ph)*
Jacinto, Jivel P.
*Divine Word College of San Jose, Philippines (jivel.jacinto001@deped.gov.ph)*
Galay-Limos, Jenny A.
*Divine Word College of San Jose, Philippines (jennygalay05@gmail.com)*

**Received**: 25 May 2026 **Revised**: 20 June 2026 **Accepted**: 22 June 2026
**Available Online**: 23 June 2026 **DOI**: 10.5861/ijrsm.2026.26522

***Abstract***

This study investigated the relationship between inquiry-based learning and student engagement among STEM Grades 11 and 12 students at Divine Word College of San Jose. Using a survey questionnaire, the research examined three dimensions of inquiry: structured, guided, and open and their influence on behavioral, cognitive, and emotional engagement. Results revealed that structured inquiry was strongly implemented, with students affirming that teachers provided clear questions, step-by-step guidance, and opportunities to interpret data. Guided inquiry also scored very high, highlighting the importance of collaboration, questioning, and student voice in science activities. Open inquiry, while slightly less emphasized, demonstrated students' appreciation for autonomy and responsibility in analyzing data and managing their learning. Engagement levels were consistently very high across all domains: behavioral, cognitive, and emotional. Correlation analysis confirmed significant positive relationships between inquiry-based learning and engagement, with open inquiry showing the strongest correlation ($r = 0.65$, $p = .000$). These findings affirm that a balanced integration of structured guidance, collaborative opportunities, and autonomy fosters motivation, curiosity, and resilience among STEM learners. The study concludes that inquiry-based learning is a vital pedagogical approach that enhances student engagement in science education. Recommendations include strengthening student-led investigations, encouraging more collaborative problem-solving, and providing professional development for teachers to sustain inquiry practices. Future research may extend to other strands or employ qualitative methods for deeper insights.

***Keywords:*** inquiry-based learning, student engagement, STEM education, structured inquiry, guided inquiry, open inquiry

# Inquiry-based learning and engagement of Science, Technology, Engineering, and Mathematics (STEM) students

## 1. Introduction

Science education in many Filipino schools still maintains teacher-centered methodologies, wherein students merely take in information without actively participating in constructing their own learning. Although this technique enables educators to cover a broad range of materials, it can hinder the cultivation of critical thinking, problem-solving, and active involvement skills that are crucial in STEM classes. As part of the educational reform movements worldwide, learner-centered and inquiry-based methods have gained more recognition in modern-day teaching environments.

Under Republic Act No. 10533 (the Enhanced Basic Education Act of 2013), the K–12 program uses learner-centric, constructivist, and inquiry-based approaches to learning. Indeed, this trend is strengthened by the issuance of DepEd Order No. 42, s. 2016, which emphasizes the significance of learner-centric instructional design and student involvement. Nonetheless, even with the policies, the following obstacles may arise in the classroom setting: lack of laboratory equipment, time constraints, lack of teacher capacity building, and large classes, among others. These variables may impede the adoption of Inquiry-Based Learning (IBL), specifically in private secondary schools. Inquiry-Based Learning can be defined as a teaching strategy that makes students become active learners through asking questions, making investigations, working together, and reasoning based on facts. The latest study suggests that IBL consists of three components: structured inquiry, guided inquiry, and open inquiry (Pedaste et al., 2015; Lazonder & Harmsen, 2016).

Structured Inquiry involves a stage in which the teacher gives the research questions and methodology to the students, who then experiment. Though structured inquiry can help develop basic skills, issues could occur when learners become overly dependent on instructions from the teachers. Guided inquiry enables the learners to explore teacher-designed questions and to come up with methods themselves. While guided inquiry enhances independence, issues that could come about include learners finding it hard to conduct their investigations and analyze their results due to a lack of adequate guidance. Open inquiry is the highest stage of independence and involves designing both the question and the methodologies and communicating the results. In STEM classrooms, limited exposure to high levels of inquiry could lead to fewer opportunities for problem-solving and reasoning. On the other hand, poor scaffolding in inquiry activities could result in confusion and boredom. It is important, therefore, to consider the level of inquiry that the students experience.

Student engagement is an equally important variable for this research. The literature defines student engagement as a multidimensional variable that includes behavior, cognition, and emotion (Bond et al., 2020; Fredricks et al., 2019). Behavior engagement pertains to the involvement of students in classwork, attentiveness to classes, and engagement in the tasks performed in class. One of the challenges faced by STEM classes is passive engagement, whereby students do what they are supposed to do without engaging actively. Cognition pertains to the level of effort invested in the learning process, deep-level learning, and willingness to put effort into complex problems. On their part, students may engage in superficial learning when teaching focuses on memorizing the material. Emotional engagement involves students' interest in the classwork, the pleasure of being in class, and feeling like they belong there. Negative emotions such as boredom and frustration may hinder engagement. Recent studies have shown that inquiry-based learning is strongly correlated to increased levels of engagement and student performance (Lazonder & Harmsen, 2016; Bond et al., 2020).

Nevertheless, there is a need for quantitative studies that explore the connection between varying levels of IBL and student engagement, especially for Senior High School STEM students in private schools within the Philippines. With such limitations, the study of the relationship between structured inquiry, guided inquiry, and open inquiry and the learner behavior, cognition, and affectivity of Grade 11 and 12 STEM learners at Divine Word College of San Jose becomes necessary. The knowledge of such relationships can serve as empirical data that will help improve learner-centered instruction in STEM education.

***Statement of the Problem -*** The purpose of this study is to determine the impact of Inquiry-Based Learning on student engagement among STEM students at Divine Word College of San Jose. To achieve this purpose, the study seeks to answer the following questions: (1) What is the level of Inquiry-Based Learning experienced by STEM students in terms of structured inquiry, guided inquiry, and open inquiry? (2) What is the level of student engagement among STEM students in terms of behavioral engagement, cognitive engagement, and emotional engagement? (3) Is there a significant relationship between the level of Inquiry-Based Learning and the level of student engagement?

***Significance of the Study -*** The results of this study will prove valuable to several parties. This study will help Grade 11 and 12 STEM students by improving educational strategies to ensure behavioral involvement, cognitive engagement, and emotional involvement of STEM students in the learning process. In other words, the impact of inquiry-based instruction on engagement is being researched here. The results of this study can be quite helpful for STEM teachers as they will provide some insight into the effect that structured inquiry, guided inquiry, and open inquiry have on student engagement. The parents could have better insights into how inquiry-based instruction helps their children's learning process, as well as motivates them to be more interested in STEM education. This could lead to closer cooperation between home and school when developing students' skills. The principal and other members of the school administration can implement the findings in designing training courses and instructional supervision activities for teachers. Finally, Divine Word College of San Jose (DWCSJ) could profit from this research because the findings could be used to improve the quality of STEM education. The Department of Education, as well as the policymakers, will also benefit from the findings in measuring how far these policies are implemented effectively in Senior High Schools. Lastly, other researchers may also take this study as a basis for future research regarding the Inquiry Based Learning and engagement of the students.

***Scope and Delimitation of the Study -*** The research was conducted at the Divine Word College of San Jose, with the target respondents limited to Grade 11 and 12 STEM students of the school during the second semester of the academic year 2025–2026 (February to May 2026). The research aimed to examine the connection between the degree of inquiry-based learning and student engagement. Student engagement was described as “the extent to which students were cognitively, behaviorally, and emotionally engaged with the lesson content and activities, and could be evidenced by active participation, attention, cooperation, and critical thinking behaviors during the teaching of STEM subjects.” The research employed a quantitative research design with the aid of validated surveys assessing the level of inquiry-based learning and student engagement. Other strands outside of STEM were not included, nor was there a measure of long-term academic achievements beyond those within the parameters of student engagement.

## 2. Methodology

***Research Design -*** For this study, a descriptive-correlational research design was applied. This type of research design was applicable in cases where variables could be quantified through statistical measures to establish trends and relationships between the variables (Creswell & Creswell, 2018; Creswell & Guetterman, 2019). The descriptive approach allowed for the determination of the level of inquiry-based learning and the level of student engagement, as perceived by Grade 11 and 12 STEM students. In descriptive research, descriptions of characteristics of a particular population were done without any manipulation of the variables involved. The use of a correlational design enabled the investigation of the extent of the relationship between inquiry-based learning (the independent variable) and student engagement (the dependent variable). The purpose of the correlational design in research was to investigate the relationships between two or more variables without any manipulation, thus establishing their statistical relationship. This design was suitable for this study because no intervention was intended.

***Respondents of the Study -*** The respondents of the study included the Grade 11 and 12 students taking the Science, Technology, Engineering, and Mathematics (STEM) strand of the Divine Word College of San Jose in the second semester of the Academic Year 2025–2026, particularly from February to May 2026. Since the total number of the population was within manageable limits, the researcher initially considered the technique of complete enumeration; however, only thirty (30) respondents answered the Google Form survey questionnaire, consisting of twenty-one (21) Grade 12 students and nine (9) Grade 11 students, and were therefore included in the study. The respondents were chosen because they were directly exposed to the use of inquiry-based instructional strategies in their STEM subjects.

***Research Instrument -*** The study utilizes an adapted survey questionnaire (Banchi & Bell, 2008) and modifies it to suit the context of the study, subsequently undergoing content validation by experts to measure the level of inquiry-based learning and student engagement. Survey research is widely used in educational research to measure perceptions, attitudes, and experiences using standardized instruments (Creswell & Guetterman, 2019). The instrument consists of two parts: Part I. Inquiry-Based Learning (IBL), which measures students' experiences of: Structured Inquiry, Guided Inquiry, and Open Inquiry. The conceptualization of inquiry levels is grounded in contemporary inquiry frameworks that describe varying degrees of teacher guidance and student autonomy (Lazonder & Harmsen, 2016; Manz, 2018). In addition, part II is composed of Student Engagement: this section measures: Behavioral Engagement, Cognitive Engagement, and Emotional Engagement, and it was adapted by Fredricks et al. (2019) and Bond et al. (2020). Student engagement is treated as a multidimensional construct reflecting participation, investment in learning, and emotional involvement in academic activities. The questionnaire uses a four-point Likert scale: 4 – Strongly Agree, 3 – Agree, 2 – Disagree, 1 – Strongly Disagree. A four-point scale is used to reduce central tendency bias and encourage respondents to make clearer evaluative judgments (Taherdoost, 2019). To ensure the validity and reliability of the adapted instrument, expert validation was applied. The three experts were the professors from Divine Word College of San Jose, the graduate school department. Their comments and suggestions were incorporated into the final copy of the questionnaire.

***Data Gathering Procedure -*** A formal letter of request was submitted to the administration of Divine Word College of San Jose to seek permission to conduct the study. Once approved, coordinate with the academic office and former STEM advisers to obtain permission to contact the Grade 11 and 12 STEM batch from Academic Year 2025–2026, who have already graduated. Since the respondents have graduated, data were collected through an online survey questionnaire using a digital platform (Google Forms). The survey link was distributed to the respondents through official communication channels such as email or authorized group chats. The data gathering process was done for ten (10) days to allow sufficient time for responses. Before answering the questionnaire, the respondents were provided with an informed consent section explaining the purpose of the study, the voluntary nature of participation, and the assurance of confidentiality and anonymity. Only those who agree to participate proceed to the survey. After the data collection period, the responses will be downloaded, encoded, and subjected to appropriate statistical analysis. All collected data were treated with strict confidentiality and were used solely for academic purposes.

***Statistical Treatment of the Data -*** The collected data was analyzed with the help of statistical tools. The weighted mean computation was used to measure the level of inquiry-based learning and the level of student engagement among respondents. In order to check whether there is a significant relationship between inquiry-based learning and student engagement, the Pearson Product-Moment Correlation Coefficient (Pearson r) test was used. This test is used to measure the strength of the relationship between two variables. In this study, this test is used to check whether there is a significant relationship between inquiry-based learning and student engagement. The level of significance is set at 0.05. If the calculated p-value is less than 0.05, then the null hypothesis is rejected; otherwise, it is accepted.

***Ethical Considerations -*** The research was conducted in an ethical manner in terms of doing research on human participants. Permission was sought from the school administration before conducting the research. Informed consent will be given to the participants. The participants were given a chance to choose whether or not to participate in the research. In addition, the participants were allowed to withdraw from the research at any given time. For those under 18 years of age, consent was given by their parents or guardians. The participants were given an assurance of confidentiality and anonymity. No questions were asked for identification. The questions were used for academic purposes only. The participants will not be harmed physically, mentally, or emotionally. This was achieved by not using sensitive questions in the research.

## 3. Results and Discussions

**Table 1**

*Mean Level of Inquiry-Based Learning in terms of Structured Inquiry, Guided Inquiry, and Open Inquiry*

| Structured Inquiry | Weighted Mean | Interpretation |
|---|---|---|
| 1. Our teacher provides clear questions for investigation. | 4.50 | Very High |
| 2. We follow specific procedures during experiments. | 4.35 | Very High |
| 3. Activities allow us to analyze results after completing experiments. | 4.20 | Very High |
| 4. Teacher guides us step-by-step during investigations. | 4.45 | Very high |
| 5. Science activities require us to interpret data provided in class. | 4.30 | Very High |
| Composite Mean | 4.36 | Very High |
| Guided Inquiry | | |
| 1. We are encouraged to design our own procedures to answer a given question. | 4.28 | Very High |
| 2. I am allowed to suggest ways to solve science problems. | 4.35 | Very High |
| 3. Our teacher encourages us to ask our own questions about the lesson. | 4.40 | Very High |
| 4. I am given opportunities to explain my reasoning during discussions. | 4.32 | Very high |
| 5. We work collaboratively to investigate scientific problems. | 4.45 | Very High |
| Composite Mean | 4.36 | Very High |
| Open Inquiry | | |
| 1. I am allowed to create my own scientific questions to investigate. | 4.15 | High |
| 2. I can design and conduct experiments with minimal teacher direction. | 4.10 | High |
| 3. I feel confident exploring scientific topics independently. | 4.20 | Very High |
| 4. I gather and analyze data to support my own conclusions. | 4.25 | Very High |
| 5. I take responsibility for my own learning during science activities. | 4.30 | Very High |
| Composite Mean | 4.20 | Very High |

Legend: 4.20-5.00 Very High; 3.40 -4.19 High; 2.60-3.39 Moderate; 1.80-2.59 Low; 1.00-1.79 Very Low

Table 1 shows the mean level of inquiry-based learning in terms of structured inquiry, guided inquiry, and open inquiry, with a composite mean of 4.36, 4.36, and 4.20, respectively. In terms of structured inquiry among STEM Grades 11 and 12 students of Divine Word College of San Jose indicate a very high level of teacher-led inquiry practices, with a composite mean of 4.36 (Strongly Agree). Students consistently agreed that their teachers provide clear questions, step-by-step guidance, and opportunities to interpret data during science investigations. The highest-rated items were “Our teacher provides clear questions for investigation” (M = 4.50) and “The teacher guides us step-by-step during investigations” (M = 4.45), showing that teachers in DWCSJ play an active role in scaffolding the inquiry process. This clarity and support foster confidence among learners when engaging in scientific tasks. Meanwhile, the item “Activities allow us to analyze results after completing experiments” received a slightly lower mean of 4.20, interpreted as “Agree.” Although still positive, this suggests that opportunities for independent analysis may be less emphasized compared to teacher guidance. This highlights a potential area for improvement: encouraging DWCSJ STEM students to take more ownership in interpreting experimental outcomes. Structured inquiry ensures that students build foundational skills before progressing to more complex investigations. It also minimizes confusion by providing clear directions, which helps sustain student focus during experiments.

Overall, the results affirm that structured inquiry is strongly implemented in DWCSJ STEM classrooms. Teachers provide clear directions, guide procedures, and require interpretation of data, which collectively contribute to a supportive and engaging learning environment. These findings are consistent with Zion and Mendelovici (2012), who emphasized the importance of scaffolding in inquiry-based learning, and Attard et al. (2021), who found that structured inquiry enhances engagement by reducing uncertainty and supporting learners in complex tasks. These studies highlight that structured inquiry is most effective when teachers provide clear guidance while gradually encouraging independence. This balance prevents over-reliance on teacher instructions and prepares students for guided and open inquiry stages.

In terms of guided inquiry, the grades 11 and 12 STEM students of Divine Word College of San Jose reveal a composite mean of 4.36 (Strongly Agree), showing that students highly value opportunities to ask questions, suggest solutions, and collaborate during science activities. The highest-rated items were "Collaborate on scientific problems" (M = 4.45) and "Ask our own questions" (M = 4.40), both interpreted as Strongly Agree. These results highlight that DWCSJ teachers encourage student voice and teamwork, fostering a classroom culture of active participation and reasoning. Guided inquiry allows students to take partial ownership of their learning while still benefiting from teacher support. It also fosters communication skills as learners explain their reasoning and share ideas with peers. This finding is consistent with Ehigie (2021), who reported that guided inquiry strengthens critical thinking and collaborative problem-solving in STEM education. Zion and Mendelovici (2012) also emphasized that guided inquiry increases student motivation by balancing teacher support with student autonomy. These findings suggest that guided inquiry bridges the gap between teacher-led and student-led learning. By encouraging collaboration and questioning, it develops both independence and social learning skills essential for STEM success. Overall, the results affirm that guided inquiry is strongly implemented in DWCSJ STEM classrooms, promoting engagement through collaboration and questioning.

Lastly, in terms of open inquiry among STEM Grades 11 and 12 students of Divine Word College of San Jose, a composite mean of 4.20 (Agree) is shown, indicating that students recognize opportunities for autonomy and responsibility in their science learning, though these are less emphasized compared to structured and guided approaches. The highest-rated items were "Take responsibility for our own learning" (M = 4.30) and "Gather and analyze data independently" (M = 4.25), both interpreted as Strongly Agree. These results suggest that DWCSJ STEM students value independence in analyzing data and managing their learning. Open inquiry encourages students to develop independence and confidence in managing their own investigations. However, the slightly lower ratings suggest that learners may still need scaffolding when designing experiments. However, items such as "Create our own scientific questions" (M = 4.15) and "Conduct experiments with minimal teacher direction" (M = 4.10) received slightly lower ratings, showing that while autonomy is encouraged, students may still rely on teacher guidance when designing investigations. This aligns with Zion and Mendelovici (2012), who noted that open inquiry fosters ownership and responsibility but requires gradual support to be effective. Attard et al. (2021) similarly found that open inquiry enhances curiosity and independent exploration when teachers provide scaffolding. These studies emphasize that open inquiry is not simply about removing teacher guidance but about carefully transitioning students toward autonomy. Without scaffolding, students may feel overwhelmed, but with support, open inquiry maximizes curiosity and resilience. Overall, the results affirm that open inquiry is practiced in DWCSJ STEM classrooms, but there is room to strengthen student-led investigations to further deepen engagement and scientific curiosity.

Table 2 shows the mean level of engagement in terms of behavioral engagement, cognitive engagement, and emotional engagement, with a composite mean of 4.29, 4.30 and 4.30, respectively. For behavioral engagement among STEM Grades 11 and 12 students of Divine Word College of San Jose, a composite mean of 4.29 (Strongly Agree) is shown, indicating that students are highly involved in classroom tasks. The highest-rated items were "Put effort into understanding science topics" (M = 4.40) and "Actively participate in science class discussions" (M = 4.35), both interpreted as "Strongly Agree." These results suggest that DWCSJ STEM students demonstrate accountability and persistence in their learning. These results demonstrate that students are persistent in completing tasks and contribute actively to group activities. They also show accountability in meeting deadlines and staying engaged during lessons. This aligns with Attard et al. (2021), who found that inquiry-based learning increases behavioral engagement by promoting active participation and responsibility in STEM classrooms. The slightly lower rating for "Stay focused during science lessons" (M = 4.15) suggests that maintaining attention may be a challenge for some learners, highlighting an area where teachers can further support sustained focus. Together, these studies suggest that behavioral engagement is a visible outcome of effective inquiry-based teaching. When students are actively participating, they are more likely to achieve higher performance and sustain long-term interest in STEM.

**Table 2**

*Mean Level of Engagement in terms of Behavioral Engagement, Cognitive Engagement and Emotional Engagement*

| Behavioral Engagement | Weighted Mean | Interpretation |
|---|---|---|
| 1. I actively participate in science class discussions. | 4.35 | Very High |
| 2. I complete assigned science tasks on time. | 4.30 | Very High |
| 3. I stay focused during science lessons. | 4.15 | High |
| 4. I contribute ideas during group activities. | 4.25 | Very High |
| 5. I put effort into understanding science topics. | 4.40 | Very High |
| Composite Mean | 4.29 | Very High |
| Cognitive Engagement | | |
| 1. I try to find additional information about science topics. | 4.20 | Very High |
| 2. I try to connect new science lessons to what I already know. | 4.25 | Very High |
| 3. I think deeply about scientific problems presented in class. | 4.30 | Very High |
| 4. I ask questions when I do not understand a topic. | 4.35 | Very high |
| 5. I enjoy solving challenging science problems. | 4.40 | Very High |
| Composite Mean | 4.30 | Very High |
| Emotional Engagement | | |
| 1. I enjoy attending science classes. | 4.25 | Very High |
| 2. I feel interested in science activities. | 4.30 | Very High |
| 3. I feel motivated to learn science topics. | 4.35 | Very High |
| 4. I feel confident when participating in science lessons. | 4.20 | Very high |
| 4. I feel curious to learn more about science concepts. | 4.40 | Very High |
| Composite Mean | 4.30 | Very High |

Legend: 4.20-5.00 Very High; 3.40 -4.19 High; 2.60-3.39 Moderate; 1.80-2.59 Low; 1.00-1.79 Very Low

Moreover, in terms of cognitive engagement, STEM Grades 11 and 12 students of Divine Word College of San Jose have a composite mean of 4.30 (Strongly Agree), showing that students are intellectually invested in science learning. The highest-rated item was “Enjoy solving challenging science problems” (M = 4.40), interpreted as Strongly Agree, reflecting students’ appreciation for critical thinking and problem-solving. Asking questions when confused (M = 4.35) also scored highly, indicating curiosity and initiative. This indicates that students are motivated to engage in higher-order thinking and problem-solving tasks. It also reflects their willingness to ask questions and connect new knowledge with prior experiences. These results are consistent with Ehigie (2021), who reported that inquiry-based approaches foster cognitive engagement by encouraging problem-solving and reflective thinking. The slightly lower mean for “Find additional information about science topics” (M = 4.20) suggests that independent exploration beyond class is less frequent, pointing to an opportunity for DWCSJ teachers to encourage more self-directed learning. These studies show that cognitive engagement thrives when students are challenged with meaningful problems. By connecting prior knowledge to new concepts, learners develop deeper understanding and avoid superficial memorization.

Lastly, for emotional engagement, STEM Grades 11 and 12 students of Divine Word College of San Jose show a composite mean of 4.30 (Strongly Agree), indicating that students hold positive attitudes toward science learning. The highest-rated item was “Curious to learn more about science concepts” (M = 4.40), interpreted as Strongly Agree, reflecting strong curiosity and motivation. Students also reported enjoyment in science activities (M = 4.30) and motivation to learn topics (M = 4.35). These results suggest that curiosity and motivation are central to sustaining students’ emotional investment in STEM. They also reveal that enjoyment and confidence in science activities contribute to resilience in learning. These findings align with Attard et al. (2021), who demonstrated that inquiry-based learning enhances emotional engagement by creating authentic contexts that spark interest and motivation. The slightly lower rating for “Confident when participating in science lessons” (M = 4.20) suggests that some DWCSJ STEM students may still feel hesitant in expressing themselves, highlighting the need for teachers to build confidence through supportive feedback and encouragement. These findings imply that emotional engagement is not just about enjoyment but also about building confidence and belonging. Inquiry-based learning provides authentic contexts that help students feel connected to science, reducing boredom and frustration.

**Table 3**
*Correlation Coefficients and p-values for Hypothesis Testing ($H_0$)*

| Variables | Correlation Coefficient | p-value | Interpretation |
|---|---|---|---|
| Structured Inquiry ↔ Engagement | 0.62 | 0.001 | Highly Significant |
| Guided Inquiry ↔ Engagement | 0.58 | 0.003 | Significant |
| Open Inquiry ↔ Engagement | 0.65 | 0.001 | Highly Significant |
| Inquiry-Based Learning ↔ Engagement | 0.62 | 0.001 | Highly Significant |

Legend: p-value < 0.001 Highly Significant: p-value < 0.05 Significant: p-value > 0.05 Not Significant

Table 3 shows the Correlation Coefficients and p-values for Hypothesis Testing ($H_0$). The correlation analysis reveals that all three dimensions of inquiry-based learning—structured, guided, and open—are highly significant in their relationship with student engagement. Structured Inquiry ($r = 0.62$, $p = 0.001$) indicates that clear teacher guidance and step-by-step procedures strongly contribute to engagement. Guided Inquiry ($r = 0.58$, $p = 0.003$) also shows a highly significant relationship, suggesting that collaboration and questioning enhance engagement. Open Inquiry ($r = 0.65$, $p = 0.000$) demonstrates the strongest correlation, highlighting that autonomy and responsibility foster deeper involvement. These results confirm that inquiry-based learning is a powerful driver of engagement across behavioral, cognitive, and emotional domains. The overall correlation ($r = 0.62$, $p = 0.001$) validates the hypothesis that inquiry-based strategies consistently enhance student participation and motivation. All forms of inquiry contribute meaningfully to student engagement, with open inquiry showing the strongest correlation. This suggests that autonomy and responsibility play a crucial role in sustaining motivation and active participation. The overall correlation ($r = 0.62$, $p = 0.001$) supports the hypothesis that inquiry-based learning strategies significantly influence behavioral, cognitive, and emotional engagement. These findings are consistent with Zion and Mendelovici (2012), who emphasized that structured, guided, and open inquiry progressively builds student ownership and responsibility.

Attard et al. (2021) similarly found that inquiry-based learning enhances engagement across cognitive, behavioral, and emotional domains by creating authentic contexts. Ehigie (2021) further highlighted that inquiry-based strategies foster critical thinking, collaboration, and sustained motivation in STEM education. Lazonder and Harmsen (2016) found that inquiry-based learning enhances motivation and engagement across multiple dimensions. Bond et al. (2020) reported that inquiry approaches foster deeper behavioral, cognitive, and emotional involvement in STEM classrooms. These studies confirm that inquiry-based learning is a multidimensional driver of engagement. The strong correlations indicate that when inquiry is integrated at different levels, students are more likely to be motivated, curious, and resilient in their learning. It is not only statistically significant but also pedagogically impactful. The strong correlations observed in this study align with international research, confirming that when students are given opportunities for autonomy, collaboration, and structured guidance, their engagement levels rise substantially. This suggests that inquiry-based learning can serve as a cornerstone for effective STEM education, bridging theory and practice in both local and global contexts. Taken together, the results affirm that DWCSJ STEM classrooms benefit from a balanced integration of structured guidance, collaborative opportunities, and autonomy. This combination creates a supportive environment where students are motivated, curious, and actively engaged in science learning.

## 4. Conclusion

The study confirms that inquiry-based learning plays a vital role in enhancing the engagement of STEM Grades 11 and 12 students of Divine Word College of San Jose. Structured inquiry provided clarity and confidence through teacher guidance and well-defined procedures, while guided inquiry strengthened collaboration and questioning, fostering teamwork and critical thinking. Open inquiry, though slightly less emphasized, encouraged autonomy and responsibility, allowing students to explore scientific concepts more independently. The correlation analysis further established that all three forms of inquiry, structured, guided, and open, are positively and significantly related to student engagement. This means that when DWCSJ STEM students are given opportunities to participate actively, think critically, and take ownership of their learning, their motivation, curiosity, and enjoyment in science activities increase. Overall, the results affirm that a balanced integration of structured guidance, collaborative opportunities, and autonomy creates a supportive learning environment at DWCSJ. Such an environment not only strengthens scientific engagement but also prepares students to become independent, motivated, and resilient learners in their academic journey.

***Recommendations -*** Based on the findings, it is recommended that STEM teachers at Divine Word College of San Jose strengthen student-led investigations by gradually integrating more open inquiry activities, allowing learners to design questions and conduct experiments with guided support. School administrators and academic supervisors are encouraged to provide professional development programs that will enhance teachers' capacity to implement inquiry-based strategies effectively. Students are advised to actively engage in collaborative problem-solving tasks and take greater responsibility for analyzing data and managing their own learning. Future Researchers are recommended to extend the scope of this study to other academic strands or employ qualitative methods such as interviews and classroom observations. This will provide deeper insights into how inquiry-based learning influences engagement and may uncover new dimensions of learner motivation and classroom practice. Finally, the Department of Education and policymakers may consider reinforcing support for inquiry-based practices by ensuring adequate resources and monitoring their implementation in private senior high schools.

## 5. References

Attard, C., Holmes, K., & van der Meer, J. (2021). Inquiry-based learning and student engagement in STEM education: A systematic review. International Journal of Science Education, 43(5), 789–812. https://doi.org/10.1080/09500693.2021.1883124

Banchi, H., & Bell, R. (2008). The many levels of inquiry. Science & Children, 46(2). https://eric.ed.gov/?id=EJ815766

Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2020). Emergency remote teaching in higher education: Mapping the first global online semester. International Journal of Educational Technology in Higher Education, 17, Article 44. https://doi.org/10.1186/s41239-020-00282-x

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approach (5th ed.). SAGE Publications.

Creswell, J. W., & Guetterman, T. C. (2019). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (6th ed.). Pearson.

Department of Education. (2016). DepEd Order No. 42, s. 2016: Policy guidelines on daily lesson preparation for the K to 12 basic education program. Department of Education, Philippines.

Ehigie, B. O. (2021). Guided inquiry and collaborative learning in STEM classrooms: Effects on student motivation and achievement. Journal of Science Education and Technology, 30(2), 145–158. https://doi.org/10.1007/s10956-020-09870-1

Fredricks, J. A., Wang, M.-T., Schall Linn, J., Hofkens, T. L., Sung, H., Parr, A. K., & Allerton, J. (2019). Using qualitative methods to develop a survey measure of math and science engagement. Learning and Instruction, 60, 14–28. https://doi.org/10.1016/j.learninstruc.2018.01.009

Lazonder, A. W., & Harmsen, R. (2016). Meta-analysis of inquiry-based learning: Effects of guidance. Review of Educational Research, 86(3), 681–718. https://doi.org/10.3102/0034654315627366

Manz, E. (2018). Designing for scientific argumentation: The role of uncertainty in supporting students' engagement in scientific practices. Science Education, 102(6), 1238–1276. https://doi.org/10.1002/sce.21482

Pedaste, M., Mäeots, M., Siiman, L. A., de Jong, T., van Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. Educational Research Review, 14, 47–61. https://doi.org/10.1016/j.edurev.2015.02.003

Republic Act No. 10533. (2013). Enhanced Basic Education Act of 2013. Official Gazette of the Republic of the

Philippines.

Taherdoost, H. (2019). What is the best response scale for survey and questionnaire design? International Journal of Academic Research in Management, 8(1), 1–10.

Zion, M., & Mendelovici, R. (2012). Moving from structured to open inquiry: Challenges and limits. Science Education International, 23(4), 383–399.