Inquiry-Based Learning in Action: Perspectives from International Baccalaureate Mathematics Classrooms

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Research Article

Inquiry-Based Learning in Action: Perspectives from International Baccalaureate Mathematics Classrooms

CHRISTIAN L. SALAZAR[1]*, RAZIL M. GUMANOY, PhD

[1]North Eastern Mindanao State University, Tandag City, Surigao del Sur, Philippines
*christiansalazar.0926@gmail.com

ABSTRACT
Despite the widespread adoption of inquiry-based learning (IBL) in mathematics education to enhance critical thinking and problem-solving, significant challenges continue to hinder its intended impact, further exacerbating the issue and underscoring the urgent need for in-depth analysis. This study explores the influence of IBL approaches using a phenomenology. Participants included six mathematics teachers, ten students, and seven school administrators who participated in focus group discussions. Essential themes emerged around pedagogical strategies, classroom practices, challenges, and contextual factors, highlighting the complex interplay between inquiry-based learning implementation, teacher facilitation, curriculum demands, and the institutional dynamics of IB Mathematics classrooms.

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Introduction

Inquiry-Based Learning (IBL) approaches in IB Mathematics classrooms refer to teaching and learning methods that emphasize active exploration, investigation, and problem-solving. These approaches encourage students to take an active role in their learning by asking questions, making connections, and developing their own strategies to solve mathematical problems (IBO, 2022). Rather than simply memorizing formulas and procedures, students are encouraged to think critically, analyze data, and apply mathematical concepts in real-world contexts. IBL approaches promote student engagement, collaboration, and a deeper understanding of mathematical concepts, as students are encouraged to explore multiple solutions and justify their reasoning (Stoffova, 2020). This learner-centered approach fosters curiosity, creativity, and a growth mindset, empowering students to become independent and lifelong learners in mathematics; however, its effective implementation can be challenging due to varying student readiness levels, the need for extensive teacher guidance, and potential resistance from those accustomed to traditional methods.

According to Smith and Johnson (2017), inquiry-based learning approaches in IB Mathematics classrooms have been widely acknowledged for their effectiveness in promoting student engagement, critical thinking, and problem-solving skills. They argue that inquiry-based learning encourages students to actively construct their own knowledge and develop a deeper understanding of mathematical concepts. Similarly, Brown and Jones (2019) highlight the benefits of inquiry-based learning, stating that it fosters a collaborative and student-centered environment, allowing students to explore mathematical ideas, make connections, and develop a conceptual understanding of mathematics. They further emphasize that inquiry-based learning approaches in IB Mathematics classrooms support the development of essential skills such as communication, reasoning, and mathematical modeling. These findings collectively demonstrate the positive impact of inquiry-based learning on student outcomes in IB Mathematics education; however, its implementation poses challenges, including increased lesson planning time, difficulty in assessing open-ended tasks, and the need for teachers to balance guidance with student autonomy..

Despite the growing recognition and implementation of inquiry-based learning approaches in IB Mathematics classrooms, there is still a need for further research in this area, particularly from the perspective of teachers, students and school administrators. Existing studies have primarily focused on the benefits and impact of inquiry-based learning on student outcomes, such as problem-solving skills and conceptual understanding. However, there is a gap in understanding how students, teachers, and administrators perceive and implement inquiry-based learning in the classrooms, the challenges they face, and the strategies they use to overcome these challenges. Exploring their experiences and perspectives can provide valuable insights into the effective implementation of inquiry-based learning approaches, as well as inform professional development initiatives and support systems.

Method

The study employed a phenomenological approach, collecting non-numerical data through semi-structured interviews. It was conducted at Sekolah Victory Plus in Bekasi, Indonesia. Participants included seven school administrators, ten students, and six mathematics teachers, all directly involved in implementing inquiry-based learning (IBL) approaches and selected through purposive sampling. Thematic analysis, specifically Colaizzi's approach, was used to derive meaningful insights into pedagogical strategies, classroom practices, challenges, perceived impacts, and contextual factors related to the implementation of IBL in IB Mathematics classrooms.

Results and Discussion

Figure 1 presents five essential themes that describe the pedagogical strategies and classroom practices employed by IB Mathematics teachers when implementing inquiry-based learning approaches. These themes include guided questioning, collaborative learning and peer interaction, scaffolding and gradual release of learning responsibility, facilitation of student-centered discussions, and the use of diverse assessments that promote self-reflection and critical thinking.

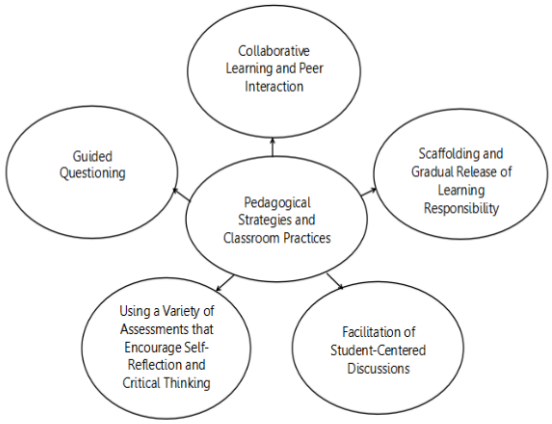

Figure 1. Pedagogical Strategies and Classroom Practices that IB Mathematics Teachers Employ when Implementing Inquiry-Based Learning

Figure 2 shows four essential themes that describe the challenges IB Mathematics teachers face when integrating inquiry-based learning approaches into their classrooms, as well as the strategies they use to address them. These themes include student learning behaviors and engagement, teachers' teaching preferences and comfort, time constraints and planning, and class size and classroom management.

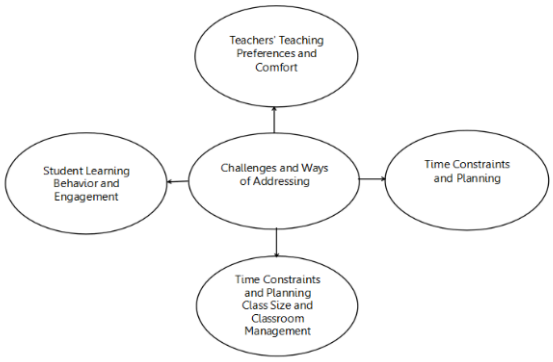

Figure 2. Challenges that IB Mathematics Teachers Encounter when Integrating Inquiry-Based Learning Approaches into their Classrooms, and their Ways of Addressing

Figure 3 illustrates the five essential themes that highlight the impact of inquiry-based learning approaches on student engagement, critical thinking, and problem-solving skills. These themes include improved critical thinking and problem-solving abilities, intensified student engagement, development of independent learning and self-regulation, augmented collaboratic

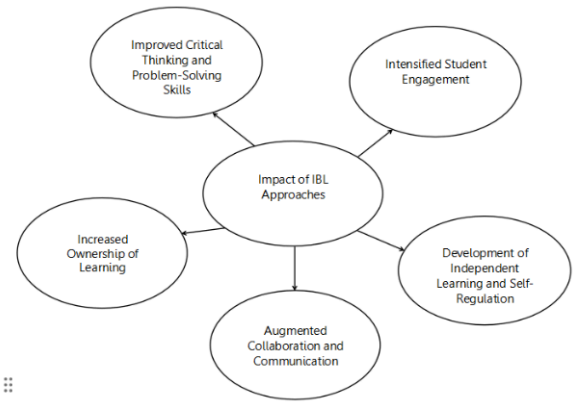

Figure 3. Impact of Inquiry-Based Learning Approaches on Student Engagement, Critical Thinking, and Problem-Solving Skills as Perceived by Mathematics Teachers Based on Their Classroom Experiences

Figure 4 displays the seven essential themes that describe the factors influencing the successful implementation of Inquiry-Based Learning approaches within IB mathematics classrooms. These themes include classroom environment and culture, teacher expertise and professional development, student profiles and readiness, curriculum and assessment framework, time and resource availability, classroom size and demographics, and support from the school and community

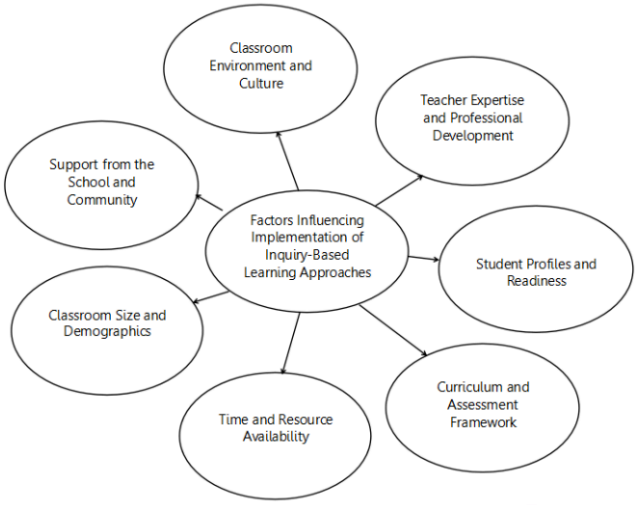

Figure 4. Factors within IB Mathematics Classrooms that Influence the Successful Implementation of Inquiry-Based Learning Approaches

The results of the study align with multiple learning theories that emphasize the value of active, social, and student-centered learning. From a constructivist and socio-cultural perspective, developed in the early to mid-20th century by Jean Piaget and Lev Vygotsky, Inquiry-Based Learning (IBL) supports knowledge construction through exploration, questioning, and collaboration, leading to deeper understanding and critical thinking. The IBL utilization and its perceived impact also reflects principles from Bloom's Taxonomy, developed by Benjamin Bloom in the 1950s, as students engage in higher-order cognitive tasks such as analyzing and problem-solving. Cognitive Load Theory, proposed by John Sweller in 1988, is also supported, as IBL allows students to process information meaningfully without becoming overwhelmed. Moreover, IBL fosters autonomy, competence, and relatedness, aligning with Self-Determination Theory, developed by Edward Deci and Richard Ryan in the 1980s, thereby promoting intrinsic motivation. It further supports learning within the Zone of Proximal Development (ZPD), introduced by Vygotsky, as students tackle complex tasks with appropriate guidance. Additionally, IBL encourages persistence and embraces challenge, aligning with the growth mindset theory pioneered by Carol Dweck in the 1980s. Lastly, the collaborative nature of IBL reflects the concept of Communities of Practice, coined by Jean Lave and Etienne Wenger in 1991, where students engage in shared inquiry and collective meaning-making, enhancing both individual and group learning outcomes.

Conclusion

The pedagogical strategies and classroom practices employed by IB Mathematics teachers when implementing inquiry-based learning approaches emphasized the importance of creating a dynamic, student-centered learning environment that actively promotes critical thinking, collaboration, and self-reflection.

The challenges IB Mathematics teachers faced when integrating inquiry-based learning approaches into their classrooms, along with the strategies they used to address them, highlighted the need for teachers to navigate various classroom dynamics and limitations while adapting their practices to ensure successful implementation, emphasizing flexibility, effective time management, and tailored instructional strategies.

The impact of inquiry-based learning approaches emphasizes the importance of enhancing students' cognitive and social abilities, creating a more engaging and self-directed learning environment that encourages critical thinking, problem-solving, collaboration, and independent learning. These approaches are essential for fostering deeper engagement and developing key skills that are crucial for student success.

The successful implementation of IBL in IB mathematics classrooms depends on several critical factors, including a supportive classroom environment, well-trained educators, appropriate resources, and the readiness of students. Addressing these factors ensures that inquiry-based approaches can effectively meet the diverse needs of students and enhance their learning experience.

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Conflict of Interest

A potential conflict of interest in the conduct of this study arises from the research being conducted at Sekolah Victory Plus, where the researcher may have existing professional or personal relationships with participants, such as school administrators, teachers, or students. Given that all participants—seven administrators, ten students, and six mathematics teachers—were selected through purposive sampling within the same institution, there is a risk of biased responses influenced by familiarity or perceived expectations. These dynamics could affect the openness of participants during interviews or the interpretation of data. However, efforts were made to mitigate this conflict through the use of a semi-structured interview guide, adherence to ethical protocols, and the application of Colaizzi's method of thematic analysis to ensure rigor, transparency, and objectivity in data interpretation.

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