



Article

## Reframing Student-Centered Pedagogy in Mathematics Instruction: Evidence from Dinadiawan National High School

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### Abstract

*Student-centered pedagogy has been widely promoted as an effective approach for improving learner engagement and achievement in mathematics. However, empirical evidence from rural secondary school contexts in the Philippines remains limited. This qualitative case study examined how student-centered pedagogical practices were enacted in Mathematics instruction at Dinadiawan National High School and how these practices shaped students' classroom engagement. Data were gathered through classroom observations, semi-structured interviews with Mathematics teachers and students, and document analysis of lesson plans and instructional materials. Thematic analysis revealed four interrelated practices: (1) contextualized problem-solving anchored in learners' lived experiences, (2) collaborative and dialogic learning structures, (3) guided facilitation and formative feedback, and (4) flexible instructional adaptations responsive to learner needs. Findings indicate that reframing instruction around active student participation fostered behavioral, emotional, and cognitive engagement in Mathematics learning. The study contributes contextualized evidence supporting student-centered pedagogy and offers practical implications for Mathematics teachers, instructional leaders, and curriculum planners in similar secondary school settings.*

**Keywords:** *student-centered pedagogy, mathematics instruction, classroom engagement, secondary education, Philippines*



## **1. Introduction**

Mathematics education has long been confronted with persistent challenges related to low learner engagement, heightened mathematics anxiety, and underachievement, particularly among secondary school students. These challenges are frequently associated with traditional teacher-centered instructional approaches that emphasize lecture-dominated delivery, repetitive procedural drills, and passive reception of knowledge. Such practices often prioritize correct answers over conceptual understanding, limiting students' opportunities to actively engage in reasoning, exploration, and sense-making processes that are central to meaningful mathematical learning (Boaler, 2016). As a result, many learners experience Mathematics as abstract, disconnected from real-life contexts, and inaccessible, which further exacerbates disengagement and negative attitudes toward the subject.

In response to these enduring concerns, student-centered pedagogy has emerged as a prominent reform-oriented approach in Mathematics education. Grounded in constructivist learning theory, this pedagogical orientation positions learners as active constructors of mathematical knowledge rather than passive recipients of information. Instructional practices under this approach emphasize inquiry-based learning, collaborative problem-solving, dialogic interaction, and the use of contextualized tasks that draw on learners' prior knowledge and lived experiences (Hiebert et al., 2014). Empirical studies have shown that when students are given opportunities to explore multiple solution strategies, articulate their reasoning, and engage in peer discourse, they develop deeper conceptual understanding and greater ownership of their learning processes.

Within the Philippine basic education context, recent curriculum reforms and policy frameworks strongly advocate for learner-centered and contextualized teaching approaches aligned with 21st-century skills development, inclusive education, and equity-oriented learning outcomes. The Department of Education's MATATAG K-10 Curriculum Framework explicitly underscores the importance of active learning, relevance to local contexts, and responsiveness to diverse learner needs as core principles of effective instruction (Department of Education [DepEd], 2022). These policy directions reflect a broader national commitment to transforming classroom practices in ways that promote critical thinking, collaboration, and meaningful engagement across subject areas, including Mathematics.

Despite these progressive policy mandates, the actual enactment of student-centered pedagogy in Mathematics classrooms remains uneven. Variations are particularly evident in rural public secondary schools, where contextual realities such as limited instructional resources, large class sizes, constrained time allotments, and differences in teacher preparation and professional development opportunities may hinder consistent implementation. In many cases, teachers continue to rely on traditional instructional routines due to curricular pressures and systemic constraints, resulting in a gap between policy intentions and classroom realities. Consequently, there is a pressing need for school-based empirical studies that document how student-centered pedagogical practices are operationalized in authentic classroom settings and how these practices influence students' engagement in Mathematics learning.

This study responds to this gap by examining Mathematics instruction at Dinadiawan National High School, a public secondary school serving learners from diverse socio-economic and cultural backgrounds in a rural Philippine context. Rather than treating student-centered pedagogy as an abstract or prescriptive framework, the study reframes it through the lens of actual classroom practices and learner experiences. By focusing on how teachers design learning tasks, facilitate

interaction, and respond to learners' needs, the study provides grounded insights into the ways student-centered pedagogy shapes students' behavioral, emotional, and cognitive engagement in Mathematics. Guided by this perspective, the study addresses the following research question: *How do student-centered pedagogical practices in Mathematics instruction shape students' classroom engagement at Dinadiawan National High School?*

## **2. Review of Related Literature**

Student-centered pedagogy is rooted in constructivist learning theory, which posits that learners actively construct knowledge through interaction with ideas, tasks, and social contexts (Piaget, 1973; Vygotsky, 1978). In Mathematics education, this approach emphasizes problem-solving, reasoning, discussion, and multiple solution strategies rather than rote memorization (Hiebert et al., 2014).

Research has shown that student-centered Mathematics instruction enhances conceptual understanding and persistence by allowing learners to explore, justify, and reflect on mathematical ideas (Boaler, 2016; Stein et al., 2008). Teachers act as facilitators who guide inquiry, pose probing questions, and scaffold learning rather than simply transmitting procedures.

Classroom engagement is commonly conceptualized as a multidimensional construct encompassing behavioral, emotional, and cognitive components (Fredricks et al., 2004). Behavioral engagement refers to participation in tasks and activities, emotional engagement involves interest and positive attitudes toward learning, and cognitive engagement reflects effort, persistence, and use of learning strategies.

Studies indicate that student-centered approaches are positively associated with all three dimensions of engagement, particularly when instruction is relevant to learners' experiences and provides opportunities for collaboration and dialogue (Klem & Connell, 2004; Reeve, 2012). In Mathematics classrooms, engagement is critical, as sustained effort and sense-making are essential for problem-solving and conceptual development.

Local studies in Philippine basic education contexts highlight the value of contextualized and learner-centered strategies in improving participation and understanding, especially in resource-constrained settings (David & Maligalig, 2019; Lucenario et al., 2016). However, many existing studies focus on elementary or urban schools, underscoring the need for research situated in rural secondary Mathematics classrooms.

## **3. Methodology**

This study employed a qualitative case study research design to enable an in-depth examination of student-centered pedagogy within a real-life school context, particularly in Mathematics instruction at the secondary level. The case study approach was deemed appropriate as it allowed for a detailed exploration of instructional practices and learner experiences within their natural classroom setting, capturing the complexity and contextual specificity of pedagogical processes (Yin, 2018). The research was conducted at Dinadiawan National High School, a public secondary school located in a rural municipality in the Philippines. Participants included two Mathematics teachers handling junior high school classes and twenty students selected through purposive sampling to ensure representation across varying levels of academic performance and classroom participation.

Data were gathered using multiple qualitative methods to enhance depth and credibility. These included non-participant classroom observations of Mathematics lessons, semi-structured interviews with both teachers and students, and document analysis of lesson plans, activity sheets,

and assessment tools. The use of multiple data sources enabled triangulation, thereby strengthening the trustworthiness of the findings and providing a more comprehensive understanding of how student-centered pedagogy was enacted in practice (Creswell & Poth, 2018). Collected data were analyzed through thematic analysis following Braun and Clarke's (2006) six-phase process. Interview transcripts, observation notes, and documentary evidence were systematically coded, reviewed, and organized into emergent themes that reflected recurring patterns related to student-centered instructional practices and dimensions of student engagement.

Ethical considerations were carefully observed throughout the study. Approval to conduct the research was obtained from the school administration, and informed consent was secured from all participants prior to data collection. Participants were assured of confidentiality, and pseudonyms were used in all transcripts and reports to protect identities. All data were stored securely and used solely for academic purposes, in accordance with established ethical standards for qualitative educational research.

Analysis of the data yielded four major themes describing how student-centered pedagogy was enacted in Mathematics instruction and how it shaped student engagement.

#### **4.1 Contextualized Problem-Solving**

Contextualized problem-solving emerged as a central feature of student-centered Mathematics instruction at Dinadiawan National High School. Teachers deliberately framed mathematical tasks using situations familiar to learners, such as buying goods in the local market, managing household expenses, and estimating farm-related quantities. This instructional practice allowed abstract mathematical concepts to be embedded in learners' everyday experiences, making lessons more meaningful and accessible. One teacher explained, "*Kapag inuugnay ko ang problema sa aktuwal na buhay nila, mas mabilis nilang naiintindihan at mas willing silang sumagot.*" Students similarly expressed increased interest and comprehension, with one learner noting, "*Mas madali po ang Math kapag parang totoong sitwasyon ang problema, kasi alam na namin kung paano siya nangyayari sa araw-araw.*"

These accounts suggest that contextualization functioned as a cognitive bridge between formal mathematical representations and learners' lived realities. By situating problems within familiar contexts, teachers reduced abstraction and supported conceptual understanding, particularly among students who previously struggled with symbolic manipulation. This finding aligns with constructivist perspectives that emphasize learning as a process of meaning-making grounded in experience (Vygotsky, 1978). Empirical studies have consistently shown that contextualized Mathematics instruction enhances engagement and understanding by increasing relevance and motivation (Boaler, 2016; Gravemeijer & Doorman, 1999). In the Philippine setting, contextualization also resonates with curriculum mandates advocating for localized and culture-responsive instruction (Department of Education [DepEd], 2022), underscoring its pedagogical and policy relevance.

#### **4.2 Collaborative and Dialogic Learning**

Collaborative and dialogic learning was another prominent theme observed across Mathematics lessons. Teachers frequently organized students into small groups and encouraged peer discussion during problem-solving activities. Rather than emphasizing individual seatwork, lessons were structured to allow learners to explain their reasoning, compare solution strategies, and jointly arrive at answers. A student shared, "*Kapag nagpapaliwanag ako sa kaklase ko, mas naiintindihan ko rin ang sagot ko.*" Another noted, "*Nakakatulong po na marinig ang ibang paraan ng pagsolve, kasi minsan mas simple pala.*"

From the teachers' perspective, collaborative learning was viewed as a strategy for increasing participation and reducing anxiety. One teacher remarked, "*Mas nagiging confident ang mga bata kapag hindi sila nag-iisa sa pagsagot.*" These interactions indicate that dialogue and collaboration fostered a supportive learning environment where students felt more comfortable expressing ideas and making mistakes. Interpretation of this theme suggests that social interaction served as a mechanism for deepening mathematical understanding and sustaining engagement. This finding is consistent with sociocultural theories of learning, which posit that knowledge is co-constructed through interaction and discourse (Vygotsky, 1978). Prior studies have demonstrated that dialogic teaching and group work in Mathematics classrooms enhance reasoning, conceptual clarity, and learner confidence (Stein et al., 2008; Webb et al., 2014). Thus, collaborative structures at Dinadiawan National High School functioned not merely as classroom management strategies but as core pedagogical tools supporting student-centered learning.

#### **4.3 Guided Facilitation and Formative Feedback**

Guided facilitation and formative feedback characterized the teachers' instructional roles during Mathematics lessons. Instead of immediately providing correct answers, teachers posed probing questions, offered hints, and encouraged learners to reflect on their solution processes. One teacher explained, "*Hindi ko agad sinasabi ang sagot. Tinatanong ko muna kung paano nila nakuha para makita nila kung saan sila nagkamali.*" Students recognized the value of this approach, with one stating, "*Kahit mali po kami, tinutulungan kami ng teacher na itama, kaya hindi po kami natatakot sumagot.*"

This facilitative stance shifted the focus from answer-getting to reasoning and learning from errors. Formative feedback helped students identify misconceptions while maintaining motivation and persistence. Interpretation of this theme indicates that guided facilitation supported cognitive engagement by encouraging learners to think critically and regulate their own learning. These findings align with research highlighting the role of formative assessment and feedback in promoting deeper learning and self-efficacy in Mathematics (Black & William, 2009; Hattie & Timperley, 2007). Moreover, autonomy-supportive teaching practices, such as asking open-ended questions and valuing student thinking, have been shown to reduce anxiety and enhance engagement (Reeve, 2012), reinforcing the significance of this instructional approach.

#### **4.4 Flexible Instructional Adaptations**

Flexible instructional adaptation emerged as a key strategy for sustaining student engagement across varying levels of mathematical proficiency. Teachers adjusted lesson pacing, modified tasks, and used multiple representations such as visual aids, step-by-step examples, and oral explanations based on learners' responses during instruction. A teacher noted, "*Kapag nakikita kong nahihirapan sila, binabago ko ang approach o dinadagdagan ko ng halimbawa.*" Students acknowledged these adjustments, with one commenting, "*Kapag inuulit o ine-explain ulit ng teacher sa ibang paraan, mas naiintindihan namin.*"

These practices indicate that flexibility allowed instruction to remain responsive rather than rigid, ensuring that learners with differing needs remained included and engaged. Interpretation of this theme suggests that adaptive teaching practices are central to effective student-centered pedagogy, particularly in heterogeneous classrooms. This finding is supported by research emphasizing differentiated and responsive instruction as critical for maintaining engagement and equity in Mathematics education (Tomlinson, 2014; Anthony & Walshaw, 2009). In rural school contexts

where learner diversity and resource constraints coexist, teacher adaptability plays a crucial role in translating student-centered principles into sustainable classroom practice.

## **5. Discussion**

The findings of this study demonstrate that reframing Mathematics instruction around student-centered pedagogy fosters meaningful learner engagement across behavioral, emotional, and cognitive dimensions. By shifting the instructional focus from procedural transmission to active participation and sense-making, learners were positioned as agents in their own learning processes. Behavioral engagement was evident in sustained participation during problem-solving tasks and group discussions, while emotional engagement was reflected in learners' increased interest, confidence, and reduced anxiety toward Mathematics. Cognitive engagement was manifested through persistence, reasoning, and reflective thinking as students navigated mathematical challenges. These multidimensional outcomes reinforce the assertion that engagement is not a singular construct but a dynamic interaction of participation, affect, and intellectual effort (Fredricks et al., 2004).

Contextualized problem-solving emerged as a particularly powerful mechanism for enhancing relevance and comprehension. Anchoring mathematical tasks in familiar community and everyday contexts enabled learners to connect abstract concepts to lived experiences, thereby facilitating deeper understanding. This finding aligns with constructivist and situated learning perspectives, which emphasize that knowledge is constructed through interaction with meaningful contexts rather than decontextualized symbols (Vygotsky, 1978; Lave & Wenger, 1991). Research in Mathematics education has similarly shown that contextualized and realistic problems promote conceptual understanding and sustained engagement, especially among learners who struggle with traditional symbolic instruction (Gravemeijer & Doorman, 1999; Boaler, 2016). In developing and rural school settings, contextualization also serves as an equity-oriented practice by valuing learners' cultural and social realities as legitimate resources for learning.

Collaborative and dialogic learning structures further supported engagement by creating social spaces for collective sense-making. Through peer discussion and shared problem-solving, learners were able to articulate reasoning, encounter alternative strategies, and negotiate meaning. Such interaction not only enhanced understanding but also normalized productive struggle and error-making in Mathematics learning. This finding is consistent with sociocultural theories that view learning as inherently social and mediated through discourse (Vygotsky, 1978). Empirical studies have demonstrated that dialogic instruction and collaborative learning promote higher-order thinking and mathematical reasoning by making student thinking visible and open to critique (Stein et al., 2008; Webb et al., 2014). Moreover, discourse-rich classrooms have been shown to strengthen students' mathematical identities and sense of belonging, both of which are critical for sustained engagement (Sfard, 2008).

Guided facilitation and formative feedback played a crucial role in supporting learners' self-efficacy and persistence. Rather than evaluating learning solely through summative outcomes, teachers provided ongoing feedback that emphasized reasoning processes and incremental improvement. This approach encouraged learners to view mistakes as opportunities for learning rather than as indicators of failure. Such findings resonate with research on formative assessment, which highlights feedback as one of the most influential factors in improving learning outcomes when it is timely, specific, and focused on process rather than correctness alone (Hattie & Timperley, 2007; Black & William, 2009). Additionally, autonomy-supportive instructional practices such as asking open-ended questions and allowing students to explore solutions have been shown to enhance intrinsic

motivation and engagement by satisfying learners' needs for competence and autonomy (Reeve, 2012; Ryan & Deci, 2020).

Importantly, teacher adaptability emerged as a critical factor in sustaining student-centered pedagogy within a rural school context. Teachers' ability to adjust pacing, modify tasks, and employ multiple representations in response to learners' needs ensured inclusive participation and continuity of engagement. This finding underscores the importance of professional judgment in navigating contextual constraints, such as limited resources and heterogeneous classrooms. Studies on adaptive teaching emphasize that responsive instructional decision-making is essential for translating learner-centered principles into effective practice, particularly in under-resourced settings (Anthony & Walshaw, 2009; Tomlinson, 2014). Thus, while curriculum frameworks provide important guidance, the enactment of student-centered pedagogy ultimately depends on teachers' capacity to interpret and adapt these frameworks to the realities of their classrooms.

## **6. Conclusions**

This study provides empirical evidence that student-centered pedagogy can be meaningfully and effectively enacted in secondary Mathematics classrooms to enhance student engagement, even within the constraints of rural and resource-limited school contexts. The findings demonstrate that when Mathematics instruction is reframed around learners' active participation—through contextualized problem-solving, collaborative and dialogic learning, guided facilitation, and flexible instructional adaptations—students exhibit heightened behavioral, emotional, and cognitive engagement. Learners were more willing to participate in tasks, showed increased interest and confidence, and demonstrated greater persistence and reasoning during mathematical problem-solving activities.

Importantly, the study highlights that student-centered pedagogy is not dependent solely on the availability of advanced resources or technologies. Rather, its effectiveness is rooted in teachers' pedagogical choices, professional judgment, and responsiveness to learners' needs and contexts. At Dinadiawan National High School, teachers' ability to connect mathematical concepts to everyday experiences, create supportive social learning spaces, and provide formative guidance fostered inclusive learning environments where students felt valued and capable. These findings contribute to the growing body of research affirming the relevance of student-centered approaches in Mathematics education and underscore their applicability in rural secondary school settings within the Philippine basic education system.

## **7. Implications**

### **7.1 Implications for Classroom Practice**

The findings suggest that Mathematics teachers should intentionally design learning experiences that position students as active participants in the construction of mathematical knowledge. Contextualized tasks that draw on learners' everyday experiences and community realities can enhance relevance and comprehension, particularly for students who struggle with abstract representations. Collaborative learning structures and dialogic classroom practices should be integrated to promote peer interaction, shared reasoning, and confidence in mathematical thinking. Additionally, teachers are encouraged to adopt a facilitative instructional role by using probing questions and formative feedback to support learners' reasoning processes, persistence, and self-efficacy.

### **7.2 Implications for School Leadership and Professional Development**

For student-centered pedagogy to be sustained, instructional leaders play a crucial role in creating supportive conditions for teachers. School leaders should prioritize professional development initiatives that focus on learner-centered Mathematics instruction, formative assessment practices, and adaptive teaching strategies. Providing opportunities for collaborative lesson planning, peer observation, and reflective practice can help teachers refine their pedagogical approaches and respond effectively to diverse learner needs. Furthermore, leadership support in terms of time allocation, instructional resources, and mentoring is essential in bridging the gap between curriculum policy and classroom enactment, particularly in rural school contexts.

### **7.3 Implications for Curriculum and Policy**

The findings reinforce the alignment between student-centered pedagogical practices and current curriculum reforms emphasizing contextualized, inclusive, and competency-based learning. Curriculum planners and policymakers may consider strengthening guidance on the practical implementation of student-centered strategies in Mathematics, particularly for schools facing contextual constraints. Explicit support for contextualization, formative assessment, and flexible instructional design can enhance the coherence between national curriculum frameworks and classroom practice.

### **7.4 Directions for Future Research**

Future research may build on the findings of this study by employing mixed-methods designs to examine the relationship between student-centered pedagogy, student engagement, and academic achievement in Mathematics. Studies involving multiple schools across diverse geographic and socio-cultural contexts would provide broader generalizability and comparative insights. Longitudinal research may also explore how sustained implementation of student-centered practices influences learners' mathematical understanding, attitudes, and performance over time.

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