Implementing PISA Bites to Enhance Mathematics Instruction: A Pedagogical Innovation in Philippine Junior High Schools

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Abstract

The "PISA Bites Corner," a creative classroom technique incorporating PISA-like activities into Grade 8 Mathematics teaching, is investigated in this study for its pedagogical effects. Designed to boost students' critical thinking, problem-solving, and application of mathematical ideas in actual situations, the intervention established specific classroom areas for weekly PISA-like activities. Using a mixed-methods approach, the study included pre- and post-assessments together with qualitative data gathered from surveys, interviews, and focus group discussions with 168 pupils and 14 teachers. Results showed noteworthy improvement in students' post-test performance and pointed up greater engagement, confidence, and analytic skill among those exposed to the PISA Bites Corner. Teachers admitted both difficulties and advantages, pointing out time limits yet confirming the worth of the method in improving student performance and encouraging pedagogical innovation. The results support the inclusion of PISA-like activities into classroom practice as a method of aligning instruction with international norms and equipping students for international assessments.

1. Introduction

The Programme for International Student Assessment (PISA) is one of the most widely recognized tools for evaluating educational systems across the globe. Conducted every three years by the Organisation for Economic Co-operation and Development (OECD), PISA assesses the competencies of 15-year-old students in reading, mathematics, and science, emphasizing the application of knowledge in real-life contexts [1]. Unlike traditional assessments that prioritize content recall, PISA tasks focus on higher-order thinking, critical reasoning, and problem-solving, aiming to capture students' ability to transfer knowledge to unfamiliar situations [2].

The inclusion of real-world mathematical problems in the PISA framework reflects a broader shift in educational priorities—from rote memorization of concepts to the development of 21st-century skills. This global emphasis on application-based learning underscores the need for educational systems around the world to adapt their instructional methods and assessment strategies accordingly [3]. In response to this shift, several countries have redesigned their curricula to align with the demands of PISA, incorporating context-based, interdisciplinary tasks that foster deep learning and critical analysis [4].

In the Philippines, PISA has provided valuable insight into student learning outcomes and system-level challenges. During its initial participation in 2018, the country ranked near the bottom among 79 participating nations, with Filipino students scoring an average of 357 in mathematics—well below the OECD average of 489 [3]. The trend continued in the 2022 cycle, where the Philippines ranked 77th out of 81 countries in mathematics, registering a national average of 355 against the OECD benchmark of 472 [5]. The 2022 assessment also introduced creative thinking as an innovative domain, in which Filipino students scored an average of

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only 14 points, ranking second to last among 64 countries [6].

These recurring outcomes reveal persistent gaps in foundational skills and problem-solving ability among Filipino learners. Education experts and policymakers have attributed these gaps to several factors, including traditional teaching practices, limited classroom resources, and a curriculum that often emphasizes theoretical knowledge over practical application [7]. In response, the Department of Education (DepEd) has launched the Professional Development Program on Assessment and Emerging Literacies, which focuses on PISA-like assessment and instruction. The program aims to equip teachers with tools and training to better integrate global competencies into classroom practice [8].

Studies have shown that contextualized and cognitively demanding tasks, such as those used in PISA, significantly enhance student engagement, comprehension, and analytical thinking [9]. When embedded into regular instruction, PISA-like activities—also referred to as "PISA Bites"—can expose students to real-world scenarios, helping them connect abstract mathematical concepts to everyday problems. According to the OECD, instructional strategies that promote cognitive activation—such as presenting challenging tasks and encouraging student reasoning—are positively correlated with improved student performance [10]. Furthermore, research by the Welsh Government supports the idea that integrating PISA tasks into daily lessons leads to deeper questioning, broader understanding, and improved cross-disciplinary skills [11].

To localize this global strategy, this study introduced the "PISA Bites Corner," an innovative intervention designed to integrate PISA-like mathematical tasks into Grade 8 classrooms. The intervention involved the weekly administration of PISA-like questions posted in a dedicated classroom space—referred to as the "corner"—followed by teacher-facilitated discussions. The PISA Bites Corner aimed not only to increase familiarity with PISA-type format questions but also to develop students' ability to reason, reflect, and solve complex problems collaboratively.

Given the persistent underperformance of Filipino students in international assessments and the urgent need to enhance mathematics instruction, this study was conducted to explore whether regular exposure to PISA-like assessments can improve learners' application of mathematical concepts. Specifically, it investigates the challenges and opportunities encountered by teachers in implementing the PISA Bites Corner, learners' perceptions of the intervention, and the quantitative improvement in student performance before and after its implementation. By examining these dimensions, this research sought to provide empirical evidence to inform pedagogical innovation and teacher professional development aimed at raising the quality of mathematics instruction at par with global standards.

2. Methods and Materials

2.1. Research Methodology

This study employed a mixed-methods research design to comprehensively examine the implementation and effects of the PISA Bites Corner in Grade 8 Mathematics instruction. A mixed-methods approach integrates both quantitative and qualitative data to provide a richer and more reliable understanding of the intervention's impact on student performance, engagement, and perception [12]. The quantitative component assessed students' performance through pre-, and post-tests aligned with PISA-like assessments, while the qualitative component explored experiential insights through interviews, surveys, and focus group discussions.

The PISA Bites Corner was implemented over four weeks during the third quarter of the academic year 2024-2025. Weekly tasks modeled after actual PISA mathematics items were posted in a designated classroom space and integrated into regular remedial sessions. This intervention aimed to foster students' mathematical reasoning, real-world problem solving, and critical thinking by exposing them to context-rich scenarios [13].

Table 1. Participants of the study

Participant Group	Section/Grade Level	Number of Respondents	Percentage (%)
Experimental Group	Grade 8 – Section 1	37	22%
	Grade 8 – Section 2	30	18%
	Grade 8 – Section 3	17	10%
Control Group	Grade 8 – Section 4	39	23%
	Grade 8 – Section 5	29	17%
	Grade 8 – Section 6	16	10%
Total Students		**168**	**100%**
Teachers	Grade 7 Mathematics	7	50%
	Grade 8 Mathematics	7	50%
Total Teachers		**14**	**100%**

The study involved a total of 168 Grade 8 students and 14 mathematics teachers from a junior high school in the Philippines. The student participants were evenly distributed across experimental and control groups. The experimental group consisted of 84 students from three sections: Section 1 (37 students), Section 2 (30 students), and Section 3 (17 students). Similarly, the control group comprised 84 students from Section 4 (39 students), Section 5 (29 students), and Section 6 (16 students). This balanced grouping ensured comparability between the two conditions.

In addition, 14 mathematics teachers participated in the study, with seven teaching Grade 7 and seven teaching Grade 8, representing an equal distribution across these grade levels. This composition allowed for a robust integration of pedagogical insights across two consecutive levels of mathematics instruction.

2.2. Data Gathering

Pre-tests, post-tests, and interviews were employed as the primary data-gathering methods in this study. These approaches allowed the researcher to collect both measurable and experiential data to assess the implementation and effectiveness of the PISA Bites Corner intervention. Interviews, in particular, were instrumental in generating rich and diverse insights into student and teacher perceptions regarding the use of PISA-like tasks in the classroom.

Prior to data collection, the researcher secured approval from the Schools Research Coordinator of Cavite National High School, with endorsement from the school principal and the Head Teacher of the Mathematics Department. This authorization allowed the researcher to proceed with the scheduled implementation of PISA Bites Corner during the third quarter of the school year.

The data collection procedure was carried out in five key phases. Initially, the researcher administered a pre-test to both the control and experimental groups using PISA-like assessments to establish baseline performance data. Following this, the PISA Bites Corner was activated in the experimental group classrooms, where PISA-like tasks were posted weekly for a period of four weeks. These tasks were incorporated into the existing remedial sessions and accompanied by teacher-

facilitated discussions aimed at unpacking the mathematical reasoning behind each item.

In parallel, surveys and interviews were conducted with both teachers and students to gain insight into their experiences with the intervention. Focus group discussions were held separately with student participants from the experimental group to explore their engagement with the PISA Bites Corner and its perceived relevance to their learning process. A total of 18 student participants from the experimental group were purposively selected for the semi-structured interviews. The selection was based on availability, willingness to participate, and a representation of varied performance levels as indicated by the pre-test results. This ensured that both high-performing and struggling students were included. The interviews were conducted in small groups of 5–6 participants to foster open discussion while maintaining individual contributions, with each session lasting approximately 30–45 minutes. Teachers involved in the intervention were also interviewed to identify challenges, opportunities, and instructional strategies related to the integration of PISA-like tasks.

At the conclusion of the fourth week, a post-test was administered to evaluate performance gains, followed by semi-structured interviews with selected student participants. These interviews provided deeper insight into their learning experiences and attitudes toward mathematical problem solving. All interviews and discussions were documented with participant consent and later transcribed and coded for analysis.

This multi-layered approach to data collection ensured a comprehensive evaluation of the intervention's outcomes, capturing both the cognitive development and the attitudinal responses of learners toward the integration of international-standard problem-solving in everyday instruction.

2.3. Data Analysis

This study utilized both quantitative and qualitative methods of data analysis to evaluate the effectiveness of the PISA Bites Corner intervention in enhancing students' mathematical performance and critical thinking skills. The integration of multiple analytical techniques allowed for a comprehensive assessment of student outcomes and perceptual insights.

To analyze the quantitative data, descriptive statistics were used to determine the mean and standard deviation of student scores in both pre- and post-tests. This facilitated the evaluation of student performance prior to and following the intervention. The results were interpreted using a four-point mastery scale ranging from Below Basic to Advanced, which provided a clear understanding of student achievement levels [14].

In addition, a paired sample t-test was employed to identify whether there were statistically significant differences between pre- and post-test scores of the experimental and control groups. This inferential test is commonly used to measure the impact of an intervention by comparing two sets of related data [15]. In this study, the t-test helped determine the extent of improvement attributed to the PISA Bites Corner strategy.

For qualitative data, thematic analysis was conducted on the transcripts from interviews, surveys, and focus group discussions. This approach allowed for the systematic identification of recurring themes and patterns in the participants' responses. Thematic analysis is a widely accepted method in educational research for interpreting meaning across qualitative data sets and revealing insights into participant experiences, perceptions, and attitudes [16]. In this study, emerging themes captured student engagement, perceived usefulness of PISA-like tasks, and instructional challenges encountered by teachers.

3. Results and Discussion

Two objectives guided this research: (1) to explore students' and teachers' perceptions of the PISA Bites Corner as an instructional strategy in mathematics, and (2) to determine whether there is a significant difference in student performance on PISA-like assessments before and after the implementation of the intervention. The results of the quantitative and qualitative data gathering are presented as follows:

3.1. Challenges in Implementing the PISA Bites Corner

Figure illustrates various challenges reported by teachers in integrating the PISA Bites Corner into classroom instruction. The most prominent concerns include time constraints and lack of resources, with 13 teachers strongly agreeing with both items. This suggests that despite the pedagogical potential of the intervention, teachers struggled to find sufficient time within the existing curriculum schedule to consistently implement the weekly PISA-based tasks. This aligns with prior findings that underscore time management as a key barrier in implementing instructional innovations within rigid school structures.

Similarly, the lack of instructional resources was viewed as a major challenge. Teachers may have found it difficult to sustain the intervention without sufficient access to printed materials, task samples, or technology for content support.

Another significant concern was lack of training, where a number of teachers agreed (7 responses) or disagreed (5 responses) on its impact. This split response indicates that while some teachers felt confident implementing the strategy, others perceived a gap in professional preparation. This observation supports the call for enhanced capacity-building programs focused on the use of international assessment frameworks like PISA in everyday instruction.

Regarding student engagement, 12 teachers strongly agreed and 2 agreed that it remained a challenge. This suggests that while PISA-like tasks are inherently engaging for some students, others may require more structured scaffolding and motivational strategies to fully participate in the intervention. Lastly, room maintenance difficulty was also reported, with 8 teachers strongly agreeing and 6 agreeing. The physical setup of a dedicated PISA Bites Corner—meant to be a permanent, accessible space—appears to require continuous upkeep, which may add to teachers' existing workload and logistical burdens.
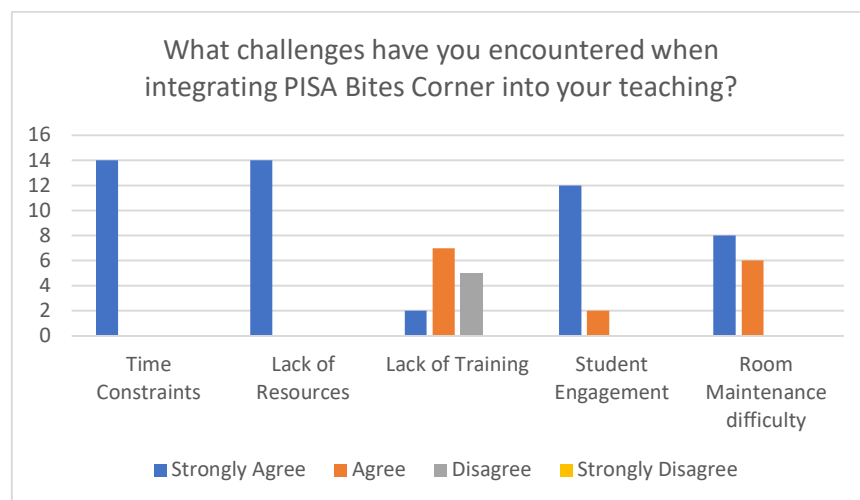

Figure 1. Challenges of PISA Bites implementation

3.2. Opportunities Observed in Using PISA Bites Corner

Despite the challenges, figure 2 reveals overwhelmingly positive perceptions about the opportunities afforded by the PISA Bites Corner. The most strongly agreed-upon benefits include the development of critical thinking (15 teachers) and professional growth (15 teachers), indicating that the intervention was seen as both pedagogically transformative and professionally enriching. These results reinforce earlier findings that PISA-like instruction promotes higher-order thinking and reflective teaching practices [14].

In terms of engagement with real-world issues, 12 teachers strongly agreed while 3 agreed. This indicates that PISA Bites activities successfully contextualize learning and help students connect mathematical concepts with everyday life—one of the foundational goals of the PISA framework.

Similarly, teachers acknowledged that the intervention enhanced analysis and interpretation skills, with 13 responses indicating strong agreement. This affirms the strategy's role in moving beyond procedural fluency to deeper conceptual understanding, particularly in word problems and situational mathematics.

In terms of collaborative learning, 10 teachers strongly agreed and 5 agreed that the intervention supported student collaboration. This likely stems from the discussion-based setup of the PISA Bites Corner, where students were encouraged to work together and share problem-solving strategies.

Taken together, these findings suggest that while the PISA Bites Corner presents certain implementation challenges—mainly logistical and resource-related—it also offers significant instructional opportunities. Teachers view it as a powerful approach to cultivating key mathematical competencies aligned with international standards.
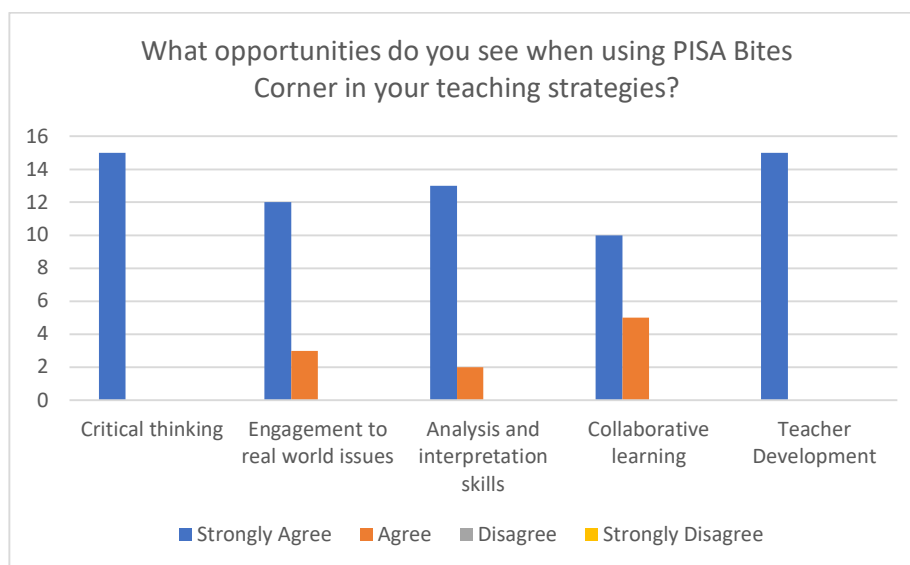

Figure 2. Opportunities of PISA Bites

3.3. Student Perceptions

Student responses regarding the PISA Bites Corner reveal largely positive perceptions, both in terms of engagement and perceived learning gains. The majority of students—over 100 respondents—described the activities as "Very Engaging and Interesting," indicating a strong sense of motivation and involvement. An additional 35 students found the activities "Engaging," suggesting that more than 80% of respondents viewed the intervention favorably. Only a minority—approximately 40 students—reported finding the activities "Not Interesting," while a very small group (around 10 respondents) labeled the intervention as "Boring."

These results suggest that the contextual, real-world nature of the PISA-like tasks may have played a role in capturing student interest. Previous research has established that students are more likely to engage deeply with content when it is perceived as relevant and applicable to real-life situations [15]. By embedding these tasks into a visible, interactive classroom space (the PISA Bites Corner), the intervention likely increased both novelty and accessibility, contributing to higher engagement levels.

In terms of learning outcomes, students most frequently identified "Problem Solving" as the primary area of improvement, with

approximately 67 respondents selecting it. This aligns with the intended design of PISA-style tasks, which are built to assess and strengthen non-routine problem-solving abilities in mathematical contexts. This was followed by "Analysis and Interpretation," selected by about 52 students, reinforcing the claim that the PISA Bites Corner facilitated the development of higher-order cognitive skills.

While fewer students (around 25) reported enhanced understanding of real-world issues, and a smaller group (18) indicated a stronger appreciation of mathematics, these figures still represent meaningful subsets of the population. These responses suggest that while the tasks were successful in strengthening core cognitive competencies, they also supported affective and contextual learning dimensions to some extent.

Only a very small number of students—approximately 6—indicated that the intervention did not help them improve in any area. This minimal level of perceived ineffectiveness may be attributable to individual differences in learning style, instructional delivery, or task difficulty. Nonetheless, the overwhelmingly positive response demonstrates that the intervention was broadly effective in engaging students and supporting key mathematical learning outcomes.

Student perception data reinforces the quantitative findings and teacher feedback, indicating that the PISA Bites Corner serves not only as an effective instructional tool for enhancing performance, but also as a means of fostering student interest, critical thinking, and problem-solving—skills essential for success in both academic and real-world settings.

3.4. Student Performance

The analysis of student performance before and after the intervention reveals a significant improvement in both the control and experimental groups, with markedly higher gains observed in the group exposed to the PISA Bites Corner.

For the control group, the mean pre-test score was 3.3864 (SD = 1.1884), interpreted as Basic level of proficiency based on the adopted mastery scale. After regular instruction without the PISA Bites intervention, the post-test mean increased to 6.3068 (SD = 1.7640), corresponding to a Proficient level. This suggests that traditional instruction contributed to a modest enhancement in students' ability to solve mathematical problems, potentially due to general learning progression over time.

In contrast, the experimental group, which participated in the PISA Bites Corner intervention, demonstrated more substantial improvement. Their pre-test mean was 3.5250 (SD = 1.1021), also interpreted as Basic level—comparable to the control group at baseline. However, after four weeks of exposure to PISA-style tasks, their post-test mean increased sharply to 8.2125 (SD = 1.3659), reaching the Advanced level of proficiency.

The results indicate that while both groups started at similar performance levels, the experimental group outperformed the control group significantly in the post-test. This improvement may be attributed to the strategic use of real-world problem-solving tasks embedded in the PISA Bites Corner, which are known to develop students' analytical reasoning, conceptual understanding, and adaptive problem-solving skills.

These findings support previous research that shows task-based, contextualized instruction aligned with global assessment frameworks—such as PISA—can lead to deeper learning and improved student achievement in mathematics. The structured routine of engaging with PISA-like problems, combined with reflective discussions during remedial sessions, likely contributed to both skill mastery and test familiarity.

The data demonstrate that the PISA Bites Corner is an effective instructional intervention, capable of significantly elevating student performance in mathematical tasks designed to mirror international standards.

Table 2: Student Performance Data

		Mean	N	Std. Deviation	Interpretation
Pair 1	Controlled Pre-Test	3.3864	88	1.1884	Basic
	Controlled Post-Test	6.3068	88	1.7640	Proficient
Pair 2	Experimental Pre-Test	3.5250	80	1.1021	Basic
	Experimental Post-Test	8.2125	80	1.3659	Advanced

3.5. Significant differences between pre and post test results

To determine the impact of the PISA Bites Corner intervention on student performance, a paired samples t-test was conducted to compare the mean differences between the pre-test and post-test scores of the control and experimental groups.

For the control group, the mean difference between the pre-test and post-test scores was 2.9205 (SD = 1.4244), with a t-value of -19.238 and a p-value of 0.000, indicating a statistically significant improvement at the 0.05 level. Although this result shows that students benefited from regular classroom instruction, the magnitude of the gain remained moderate, suggesting that while learning occurred, it was likely constrained by the traditional instructional approach used.

In comparison, the experimental group, which participated in the PISA Bites Corner intervention, recorded a larger mean difference of 4.6875 (SD = 1.5144), with a t-value of -27.684 and a p-value of 0.000. This result also indicates a statistically significant improvement, but with a considerably higher gain than the control group. The strong effect size implied by the t-value supports the effectiveness of the intervention in enhancing mathematical performance.

These findings demonstrate that while both groups experienced improvements over the study period, the experimental group achieved significantly greater learning gains. The use of PISA-aligned tasks, which emphasize real-world application, problem solving, and critical thinking, appears to have fostered a deeper understanding of mathematical concepts. The format of the intervention—engaging tasks, consistent exposure, and reflective discussions—likely contributed to the accelerated improvement in student outcomes.

This result reinforces the growing body of research advocating for pedagogical shifts toward assessment-integrated instruction. Studies have shown that instructional strategies based on international benchmarks, such as PISA, not only improve student outcomes but also promote transferable thinking skills that are essential for 21st-century learners.

The t-test results confirm that the PISA Bites Corner had a statistically and educationally significant impact on students' mathematics performance, validating its potential for wider implementation in similar educational settings.

Table 3: T test results

	Mean	SD	t	p value	Interpretation
Controlled	2.9205	1.4244	-19.238	0.000	Significant at 0.05 level
Experimental	4.6875	1.5144	-27.684	0.000	Significant at 0.05 level

4. Conclusions

This study aimed to evaluate the effectiveness of the PISA Bites Corner as a pedagogical intervention in Grade 8 Mathematics instruction, with the aim of improving student engagement, problem-solving skills, and performance on PISA-like assessments. Grounded in both quantitative and qualitative data, the findings indicate that the integration of PISA-aligned tasks significantly enhanced the learning experience and outcomes of the experimental group compared to their peers in the control group.

The results reveal a statistically significant improvement in the post-test scores of students exposed to the intervention, with the experimental group advancing from the Basic to Advanced proficiency level. In contrast, the control group exhibited only moderate gains, moving from Basic to Proficient. This contrast underscores the value of task-based, context-rich learning in promoting deeper mathematical understanding.

Teachers identified clear instructional opportunities in implementing the PISA Bites Corner, particularly in developing critical thinking, analysis, and collaborative learning. However, they also acknowledged key challenges, such as time constraints, limited resources, and the need for targeted teacher training. Despite these barriers, the overwhelmingly positive perception among educators suggests that the intervention is both viable and scalable.

From the perspective of the learners, the PISA Bites Corner was widely perceived as engaging and meaningful. Students credited the intervention with improving their problem-solving and analytical skills—competencies that are central not only to PISA assessments but to lifelong learning.

These findings provide compelling evidence that integrating PISA-like activities into regular instruction—through a structured, student-centered approach like the PISA Bites Corner—can elevate student achievement and prepare learners for the demands of global assessments. Furthermore, the approach fosters a learning environment that promotes real-world application, critical thinking, and instructional innovation.

Future efforts to implement the PISA Bites Corner should be supported by professional development, adequate resource allocation, and sustained institutional commitment to ensure its long-term success and potential replication across other grade levels and subject areas.

5. Recommendations

In light of the findings and conclusions drawn from this study, the following recommendations are presented to various education stakeholders to support the integration, enhancement, and sustainability of the PISA Bites Corner as an instructional innovation:

5.1. Recommendations to Learners

Students are encouraged to actively participate in PISA Bites Corner activities by engaging deeply with the tasks, collaborating with peers, and reflecting on their problem-solving strategies. Learners should view these activities as opportunities to strengthen their real-world mathematical reasoning and critical thinking—skills that are essential not only for academic success but also for future careers and lifelong learning.

5.2. Recommendations to Teachers

Teachers are recommended to integrate PISA-like assessments regularly into instruction by utilizing the PISA Bites Corner as a dedicated space for higher-order thinking tasks. They should facilitate discussions that encourage analytical reasoning and real-life application of mathematical concepts. Continuous professional development on designing and implementing PISA-style questions is also essential to build teacher confidence and instructional effectiveness.

5.3. Recommendations to Schools

School administrators should support the institutionalization of the PISA Bites Corner by allocating time, space, and materials necessary for its regular implementation. Schools should also provide teachers with resources and scheduling flexibility to embed the intervention within existing curricula. Collaboration among departments is

encouraged to ensure consistency and sustainability across grade levels.

5.4. Recommendations to the Schools Division Office

The Schools Division Office is encouraged to develop policies that promote the use of PISA-aligned instructional practices, such as the PISA Bites Corner, across public schools. Division-led training and workshops should be organized to capacitate teachers and instructional leaders in designing PISA-like assessments and integrating them into daily teaching. Monitoring and evaluation frameworks should also be established to assess the long-term impact of such interventions on learner achievement.

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