

Adaptive Pedagogical Approaches in Enhancing the Teaching Learning Numeracy Skills among Grade 7 Students

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Administration and Supervision, adaptive pedagogical approaches for Grade 7 students in numeracy, Descriptive-Quantitative Research, School Division of Cebu Province, Region 7

Abstract. This research assessed the effectiveness of Adaptive Pedagogical in Numeracy Students among the select Junior High School Students in Bantayan Island, Cebu Province Division, DepEd Region 7 during the Academic Year 2025 - 2026 as basis for a Strategic flexible Activities in Numeracy. This research used a descriptive-correlational method of research in the academic performance and issues of grade 7 numeracy students with a total respondent of 60 with 10 teachers and 50 students. The findings presented in this implementation of adaptive pedagogy in numerical skills illustrate the respondents' perceptions regarding the implementation of adaptive pedagogy in terms of content and learning process, providing a clearer understanding of how adaptive instructional practices support Grade 7 students' numeracy development. The findings provide an understanding of how these learner-centered instructional approaches contribute to the effective development of Grade 7 students' numeracy skills. The findings provide valuable insights into the strengths and learning gaps of Grade 7 students that may guide the continuous improvement of adaptive pedagogical practices in mathematics instruction with an overall rating of Lack Mastery. Significant relationships exist between several adaptive pedagogical strategies and specific MELC numeracy competencies, while other strategy-competency combinations do not demonstrate statistically significant relationships. Therefore, the findings indicate that the effectiveness of adaptive pedagogical strategies depends on the particular numeracy competency being developed, rather than one instructional strategy being equally effective across all learning outcomes. Based on the conclusions reached in this research, it is highly recommended "the Strategic flexible Activities in Numeracy can be submitted to the concerned school officials for consideration and implementation.

Introduction

Adaptive teaching fundamentally shifts instruction from a one-size-fits-all model to a active, responsive approach tailored to individual learner needs. This pedagogical approach recognizes that learning is most effective when instruction is pitched within a learner's Zone of Proximal Development, requiring teachers to continually assess and adjust their teaching to support progression (Vygotsky, 1978). It moves beyond static differentiation by actively responding to emergent learning needs in the classroom. Successfully implementing adaptive teaching requires teachers to manage cognitive load effectively, particularly for learners with diverse learning needs. By understanding how working memory processes information, teachers can adapt the complexity and presentation of new material, providing appropriate scaffolding to prevent cognitive overload (Sweller, 1988). This ensures that all learners, including those with SEND, can engage meaningfully with the curriculum and achieve deeper understanding.

Integrating adaptive teaching with established pedagogical frameworks, such as Rosenshine's Principles, significantly enhances instructional effectiveness. Adaptive teaching allows teachers to dynamically apply principles like explicit instruction, questioning, and guided practice, adjusting the pace and depth based on real-time learner responses. This collaboration ensures that core teaching strategies are not only evidence-based but also flexibly applied to meet the varying learning trajectories within a classroom.

Formative assessment is the indispensable engine driving effective adaptive teaching, enabling precise and timely instructional adjustments. Through ongoing assessment for learning, teachers gather important information about learners' understanding, allowing them to adapt their teaching strategies, provide targeted feedback, and address misconceptions immediately. This continuous feedback loop is key for closing attainment gaps and ensuring all learners make sustained progress.

The K to 12 Mathematics curriculum will provide learners with a repertoire of competencies important in the world of work and in a knowledge-based society. It envisions the development of scientifically, technologically, and environmentally literate and productive members of society who are critical problem solvers, responsible stewards of nature, innovative and creative citizens, informed decision makers, and effective communicators. This curriculum is designed around the three domains of learning mathematics. The acquisition of these domains is facilitated using the following approaches: multi/interdisciplinary approach, science technology-society approach, contextual learning, problem/issue-based learning, and inquiry-based approach. The approaches are based on sound educational pedagogy namely, constructivism, social cognition learning model, learning style theory, and brain-based learning. Without the content, learners will have difficulty utilizing mathematics process skills since these processes are best learned in context. Organizing the curriculum around situations and problems that challenge and arouse learners' curiosity motivates them to learn and appreciate mathematics as relevant and useful. Rather than relying solely on textbooks, varied hands-on, minds-on, and hearts-on activities will be used to develop learners' interest and let them become active learners.

According to Ainhua Arranz - June 20, 2024 that adaptive pedagogy in mathematics education is a personalized approach where instruction, content, and difficulty continuously adjust to meet each student's needs. By integrating real-time data, targeted scaffolding, and flexible grouping, it ensures learners are consistently challenged appropriately and can advance at their own pace. Math education is essential for helping students think analytically and solve problems in different subjects. However, many students need personalized help to pass their courses. Traditionally, math education has followed a rigid, one-size-fits-all approach, leaving little room for much-needed personalization. Adaptive learning can help us solve this problem.

Mathematics has long been viewed as a challenging subject for many people. Often, students think they are just "not a math person," having a fixed mindset that prevents them from actively trying to improve and hinders their performance (Dweck, 2015). Simultaneously, standard inflexible math instruction often creates barriers to learning, leading to disengagement and frustration among learners. Adaptive learning considers students' prior knowledge, learning preferences, and strengths and weaknesses. It tailors problem difficulty, provides personalized feedback, and offers extra help where needed. This approach encourages practice and helps students build confidence in their math skills.

The researcher believes that this research will contribute to the principles of the teachers, school administrators, parents, learners, and the community. It will help them point out the gaps or issues on the part of the teachers as part of the school operation and provide them an immediate solution to the existing problems.

Methodology

Design

This research used a descriptive-correlational method of research in the academic performance and issues of grade 7 numeracy students. This research described and interpreted the data that were gathered to answer the problem. As per Apuke (2017), quantitative research design entails quantifying and analyzing variables in order to arrive at conclusions. It entails the use of statistical tools to analyze numerical data in order to answer questions such as who, how much, what, where, when, how many, and how. Random sampling will be used.

Environment

This study was conducted among the select Grade 7 Numeracy students from Public National High Schools or Integrated Schools in Bantayan Island of Cebu Province Division, School Year 2025-2026.

Located off the northern tip of Cebu, Bantayan Island is a historic tropical gem renowned for its white-sand beaches and deep-rooted Catholic heritage. Home to about 150,000 residents, the island is divided into three municipalities: Bantayan (the commercial center), Santa Fe (the tourism hub), and Madridejos (the northern fishing community). The municipality of Bantayan is home to the Saints Peter and Paul Parish Church, established in 1580. It is officially recognized as the first parish founded in the province of Cebu. Bantayan is historically and culturally famous for its extravagant Holy Week celebrations. While the rest of the country strictly abstains from eating meat on Good Friday, Bantayan holds a papal indult (special permission) granted centuries ago, allowing locals to eat pork and other meats because the island's primary livelihood historically left them unable to fish during harsh Lenten weather.

Santa Fe National High School. It is a public educational institution located in F. Duarte St., Santa Fe, Cebu, Philippines. It serves the local community by providing foundational primary education aligned with the Department of Education (DepEd) curriculum. F. Duarte St., Poblacion, Santa Fe, Cebu. It is located on Bantayan Island, a popular tourist destination known for its white-sand beaches, roughly 85-90 kilometers north-northwest of Cebu City (including a ferry ride from Hagnaya Port). Sta. Fe National High School (SFNHS)—particularly its prominent branch in Cebu—is a dynamic public secondary institution dedicated to holistic student development. Their profile emphasizes both academic advancement and student character, with best practices centered on stakeholder partnerships, academic mastery, and community resilience. The following best practices are the Stakeholder Engagement & Community Partnership, Academic Interventions & Mastery, Health, Wellness, and Environmental Advocacy, and Safety and Resilience.

Maribakan Integrated School. It is a public basic education institution located in Barangay Marikaban, Santa Fe, Cebu, Philippines. Operating under the Department of Education (DepEd) Region VII Division of Cebu, it serves as a crucial complete-cycle school providing seamless instruction from elementary up to the Senior High School (SHS) levels. Registered under school ID 500667 within the DepEd Learning Management System. The best practices are the Values-Driven Community Outreach, Active Student Governance (SSLG Execution), and Stakeholder-Driven Infrastructure Projects.

Bantayan National High School. (BNHS) in Cebu operates under the Department of Education, providing junior and senior high school education. It boasts a strong academic and community profile, excelling in science and mathematics while equipping students with real-world, employable skills through specialized tracks. Its best practices are as follows: TVL and TESDA Certification, Community Heritage Integration, Experiential and Hands-On Learning.

Bantayan Science High School. Bantayan Science High School (BanScie), located in Ticad, Bantayan, Cebu, is a leading DepEd-managed specialized high school in the province. It offers the Special Program in Science (SPS) for Junior High and the STEM Academic Track for Senior High. BanScie is distinguished by its strong culture of research, rigorous academic standards, and consistently high-achieving students at regional and national levels. Known for its rigorous admission criteria and producing young researchers and academic champions. Best Practices are as follows: Culture of Scientific Research, Rigorous Admission & Tracking, Holistic Campus Enrichment, Community & Private, Digital Literacy & Innovation.

Madridejos National High School. is a premier public secondary institution located on Bantayan Island, Cebu, offering both Junior High and Senior High School programs. The school stands out for its inclusive, student-centered approach that prioritizes mental wellness, academic development, and real-world career readiness. Supported by an active Supreme Secondary Learner Government (SSLG) that champions student empowerment and peer leadership. Key Best Practices, Adolescent-Friendly Teen Center, Community-Integrated Learning, Job-Ready TVL, Inclusive and Gender-Sensitive Education

Respondents

The respondents of this research with a total of 60 of whom 10 are were teachers and 50 Grade 7 students. This research employed the simplified random sampling among the select National High Schools from Sta. Fe District of Cebu Province Division. For Sta Fe NHS, there are 2 teachers with 10 students and the rest of the four (4) National High Schools, Marikaban Integrated School, Bantayan National High School, Bantayan Science High School and Madridejos National High School who have 2 teachers and 10 students.

The distribution of the respondents is shown in table 1.

Select Schools in Bantayan Island , Cebu	Teachers		Students		Total	
	N	%	N	%	n	%
Santa Fe National High School	2	20	10	20	12	20
Marikaban Integrated School	2	20	10	20	12	20

Bantayan National High School	2	20	10	20	12	20
Bantayan Science High School	2	20	10	20	12	20
Madrideojos National High School	2	20	10	20	12	20
Total	10	100	50	100	60	100

Table 1. Distributions of Respondents

Research Instrument.

K to 12 Basic Education Program Is supported by the Department of Education. It is continuously fulfilling its mandate to produce productive and responsible citizens equip with essential competencies and skills for lifelong learning. There is a need to strengthen the differentiated instruction of every JHS which is requisite skill in all content areas. The survey questionnaire composed of parts that will be used to collect the data needed for the study which contain items related to the present study (Bouchrika, 2023).

1. Questionnaire. This consists of four (4) parts namely:

Part I. Demographic profile of respondent groups.

Part II. Status of adaptive pedagogy of the students in Grade 7 students in Numeracy

Part III. Level of the students' academic performance

Part IV. Issues and Concerns related to the teaching of Adaptive pedagogical to Grade 7 Numeracy.

2. Face-to-face interviews / informal / Focus Group discussion (FGD) / online modality whichever is applicable, related to the research.

Data Collection Procedure

Preliminary Stage. Preparation of a letter of request is the first step asking permission for the conduct of the study and will be submitted to the schools

Division Superintendent through the School Principal prior to the research being conducted. Following the approval of the letter of request, the researcher notified the school administrator in writing of the study's potential schedule. The researcher conveys all the respondents in a focused group discussion by batch to describe the study's goals and objectives, as well as to administer informed consent. It took roughly 20 minutes to assemble and prepare the respondents for the initial data collection via a survey questionnaire that will be administered.

Data Gathering Stage. After approval has been granted to participate in the research, the respondents will be given a two-page survey form with the 25-item instrument will take no more than 40 minutes to complete. The researcher gathered the completed questionnaires for data tabulation.

Post Data Gathering. Collection, tabulation, and computation of all data using statistical tools. Afterwards, the data will be analyzed and interpreted. The findings serves as a basis for the formulation of the conclusion and recommendations.

Ethical Considerations. This report emphasizes the necessity of human rights protection. As a result, it is a truth that ethical issues should take precedence, particularly in matters involving students, parents, teachers, and the school officials. Parameters for ethical consideration creates and debates in accordance with these to ensure that everyone's basic rights are protected. The researcher send confirmation of the respondents' participation in the study with an Informed Consent form attached to each research instrument. It was specified in the informed consent of the respondents' voluntary engagement in the study and the period they were required to participate for.

Risk-Benefit Assessment During the research execution, the risks and benefits are weighed carefully.

Risk. The probability of psychological distressed for some participants as a result of the data collection activity will be noted as a concern in the study. The issue of the participants' confidential information being disclosed will also be noted as a risk. Benefit. This research will be more benefited to the participants and the school, and they may be used to create a strategic flexible activity.

Confidentiality Procedure. Some precautionary measures are taken by the researcher to ensure privacy: coding distinguishing data; maintaining a safe shelf for data storage during the study; entering no identifying information onto the computer; and practically destroying identifying information after use.

Data Analysis

The data gathered from the 60 respondents, consisting of 10 teachers and 50 Grade 7 students from selected Junior High Schools in Bantayan Island area of Cebu Province Division, were analyzed using appropriate descriptive and inferential statistical procedures. Descriptive statistics, particularly frequency, percentage, weighted mean, and standard deviation, were utilized to summarize the respondents' perceptions regarding the implementation of adaptive pedagogical approaches in numeracy in terms of content and learning process. These measures provided a basis for determining the extent to which adaptive instructional practices were implemented and for describing the numeracy performance and learning gaps of the Grade 7 students. The overall results indicated a rating of Lack of Mastery, suggesting that the learners experienced difficulties in attaining the expected numeracy competencies. To determine whether adaptive pedagogical strategies were significantly associated with specific Most Essential Learning Competencies (MELCs) in numeracy, an appropriate test of relationship was employed. The statistical results were interpreted using a predetermined level of significance, commonly set at 0.05. The findings showed that significant relationships existed between selected adaptive pedagogical strategies and particular numeracy competencies, while other strategy-competency combinations did not yield statistically significant relationships. These results indicate that the observed effectiveness of adaptive pedagogy varies according to the specific numeracy competency targeted. The analysis therefore supports the use of differentiated and flexible instructional practices based on learners identified needs rather than applying a single pedagogical strategy uniformly across all competencies. The findings served as the empirical basis for developing the proposed Strategic Flexible Activities in Numeracy, which may be submitted to concerned school officials for consideration and possible implementation.

Results and Discussion

Results

The results of the study revealed that the implementation of adaptive pedagogical approaches in numeracy provided meaningful insights into the learning conditions and numeracy development of Grade 7 students in selected Junior High Schools in Bantayan Island, Cebu Province Division during Academic Year 2025–2026. Based on the responses of the 60 participants, composed of 10 teachers and 50 students, adaptive pedagogy was examined in terms of content and learning process. The findings showed that although adaptive and learner-centered instructional practices were being utilized, the overall numeracy performance of the Grade 7 students was rated Lack of Mastery, indicating that several learners had not yet attained the expected level of proficiency in the identified numeracy competencies. The results further revealed varying levels of performance across the different Most Essential Learning Competencies (MELCs), highlighting specific areas of strength as well as learning gaps that require targeted instructional support. The analysis also showed that significant relationships existed between selected adaptive pedagogical strategies and specific numeracy competencies, suggesting that certain instructional approaches were associated with improved development of particular mathematical skills. However, not all strategy-competency combinations demonstrated statistically significant relationships. This indicates that the effectiveness of adaptive pedagogical approaches may vary depending on the specific competency, learning difficulty, and instructional process involved. The findings emphasize the importance of matching instructional strategies with learners' identified needs and competency gaps. Consequently, the results provided an empirical basis for the development of Strategic Flexible Activities in Numeracy, which may serve as an intervention and supplementary instructional resource for addressing identified learning gaps and strengthening Grade 7 students' numeracy skills.

Discussion

The findings of the study suggest that adaptive pedagogical approaches have an important role in addressing the diverse numeracy needs of Grade 7 students in selected Junior High Schools in Bantayan Island, Cebu Province Division. The overall rating of Lack of Mastery indicates that despite the implementation of adaptive instructional practices, learners continue to experience difficulties in attaining the expected Most Essential Learning Competencies (MELCs) in numeracy. This finding highlights the need for teachers to continuously identify specific learning gaps and adjust instructional content, strategies, activities, and learning processes according to the readiness and needs of learners. The results further indicate that adaptive pedagogy should not be viewed as a single instructional approach that produces similar outcomes across all mathematical competencies. The presence of significant relationships between selected adaptive pedagogical strategies and specific numeracy competencies suggests that certain strategies may be more responsive to particular learning outcomes. On the other hand, the absence of significant relationships in other strategy-competency combinations implies that instructional effectiveness may depend on the nature and complexity of the competency being addressed, as well as learners' existing knowledge and skills. These findings support the use of flexible, differentiated, and learner-centered instruction in mathematics. Teachers may therefore need to combine different approaches, monitor learner performance regularly, and provide targeted activities based on identified areas of difficulty. The results also provide a sound basis for developing the proposed Strategic Flexible Activities in Numeracy, which can address identified competency gaps and

provide structured opportunities for learners to strengthen their numeracy skills through appropriate and responsive learning activities.

Conclusion and Recommendations

The study concludes that the use of adaptive pedagogical approaches in numeracy provides a meaningful and responsive framework for addressing the diverse learning needs of Grade 7 students in selected Junior High Schools in Bantayan Island, Cebu Province Division during Academic Year 2025–2026. The findings demonstrated that adaptive instruction, particularly in terms of content and learning processes, can provide teachers with opportunities to respond to differences in learners' readiness, abilities, and areas of difficulty. Although the overall numeracy performance of the learners was described as Lack of Mastery, this result provides a valuable basis for identifying specific competencies that require strengthened instructional support. The study further established that significant relationships existed between selected adaptive pedagogical strategies and particular MELC numeracy competencies. This finding suggests that appropriately matched and flexible instructional practices can contribute to the development of specific mathematical skills. At the same time, the absence of significant relationships in some strategy–competency combinations emphasize the importance of selecting instructional approaches based on the specific learning competency and identified needs of learners. Overall, the findings affirm the value of learner-centered, differentiated, and flexible pedagogical practices in improving numeracy instruction. Rather than relying on a uniform instructional strategy, teachers may maximize learning opportunities by adapting activities, content, pacing, and learning processes according to learners identified strengths and gaps. The study therefore concludes that the proposed Strategic Flexible Activities in Numeracy can serve as a practical instructional support designed to address identified learning gaps, reinforce essential numeracy competencies, and provide Grade 7 learners with meaningful opportunities to develop greater confidence and competence in mathematics.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are proposed to strengthen the implementation of adaptive pedagogical approaches in numeracy among Grade 7 students. For teachers, mathematics teachers are encouraged to implement differentiated, flexible, and learner-centered instructional strategies that consider the learners' readiness, abilities, strengths, difficulties, and learning preferences. Teachers may vary the content, activities, pacing, grouping, instructional materials, and assessment approaches to respond appropriately to the identified numeracy gaps. They are also encouraged to conduct regular diagnostic and formative assessments to monitor learners' progress and use assessment results as a basis for adjusting instruction. The proposed Strategic Flexible Activities in Numeracy may be utilized as supplementary learning materials and may be adapted according to the specific MELC competencies where learners demonstrated Lack of Mastery. For learners, Grade 7 students are encouraged to actively participate in the flexible numeracy activities, practice mathematical skills regularly, seek assistance when encountering difficulties, and develop positive learning habits that can strengthen their confidence and competence in mathematics. For school administrators, adequate instructional resources, technical assistance, mentoring, and professional development opportunities may be provided to teachers to support the effective implementation of adaptive pedagogy. Collaborative activities such as Learning Action Cell sessions may also be encouraged to promote the sharing of effective numeracy practices. For future educators, the findings may serve as a guide in developing responsive, inclusive, and differentiated mathematics instruction that addresses learners' diverse needs. Future teachers may also consider contextualizing numeracy activities based on learners' experiences and community conditions. For future researchers, similar studies may be conducted with larger samples, different grade levels, and other school contexts. Experimental or longitudinal research may also be undertaken to further examine the effectiveness of the Strategic Flexible Activities in improving specific numeracy competencies and sustaining learners' progress over time.

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Competing Interests Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study; all data used were obtained from previously published sources as cited in the reference list.

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Appendices

No appendices are attached to this study.