

Adaptation and Utilization of Flipped Learning Strategy of Mathematics Teachers

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Abstract

This study investigated the adaptation and utilization of flipped learning strategies among Mathematics teachers at Governor Feliciano Leviste Memorial National High School, grounded in the principles of learner-centered instruction to enhance student engagement, independence, and mathematical proficiency. Anchored on the flipped learning framework, the study employed a descriptive quantitative research design, utilizing a validated researcher-made survey administered to 355 junior high school students across Grades 7 to 10, selected through stratified random sampling. The research examined teachers' adaptation of flipped learning strategies in terms of educational technology and learning through activities, as well as the extent of their utilization relative to conceptual understanding, procedural fluency, strategic competency, adaptive reasoning, and productive disposition. Results revealed that teachers highly adapted flipped learning strategies, particularly through the use of online and offline materials, video lectures, interactive modules, and technology-supported activities, which facilitated active learning and improved student mathematical performance. The extent of utilization was found to be moderate across all dimensions, indicating effectiveness tempered by challenges such as device accessibility and multimedia engagement. Significant positive relationships were established between the strategies adapted and the flipped learning strategies utilized by the teachers, confirming the impact of technology and structured activities on student learning outcomes. Based on these findings, the study recommended the development of an interactive Math Flip Book, institutional support for teacher training, and the provision of resources to foster a positive, engaging, and supportive learning environment. The study aligns with Sustainable Development Goal 4, promoting quality education through innovative teaching strategies that enhance critical thinking, problem-solving, and digital literacy. Its sustainability impact lies in strengthening educational practices, improving student learning outcomes, and providing a replicable model for effective mathematics instruction in technology-enhanced learning environments.

Keywords: Adaptive Reasoning, Conceptual Understanding, Educational Technology, Flipped Learning, Learning-Through-Activities, Mathematical Proficiency, Procedural Fluency, Productive Disposition, Strategic Competency, Student Engagement

1. Introduction

Flipped learning has emerged as a pedagogical tool addressing diverse learner needs and promoting independence, complementing modular distance learning practices globally. In the Philippine context, the Department of Education (DepEd) implemented Modular Distance Learning (MDL) via DepEd Order 37, s. 2022, aligning with flipped-learning strategies to support students who struggle academically or face learning challenges. The approach shifts instruction from teacher-centered to student-centered, allowing hands-on engagement, collaborative work, and personalized teacher support. Pre-recorded lectures, online modules, and interactive activities enable learners to process concepts at their own pace, fostering foundational knowledge and future academic performance.

Prior studies highlight that technology-enhanced learning tools support conceptual understanding and procedural fluency. Juarez et al. (2019) emphasize the evolving access to classroom technology, promoting distance and blended learning. Bhagat et al. (2016) stress differentiated instructional media, including video lectures and interactive modules, to meet student needs. Fitri (2024) identifies adaptive reasoning as critical for developing logical thinking in mathematics. Gilbert (2014) and Khrishan (2016) report that productive disposition and mastery-based flipped classrooms enhance learner engagement and problem-solving capabilities.

Globally, flipped learning is increasingly integrated into traditional classrooms, leveraging technological resources for pre-class instruction and in-class application. Nationally, DepEd's MDL framework encourages the use of technology to assist learners in underserved or struggling populations. Locally, Governor Feliciano Leviste Memorial National High School

implements flipped learning to bridge modern educational practices with digital media, including video lectures and virtual interactions.

The study is grounded in the principles of flipped learning, which emphasize learner autonomy, pre-class exposure to instructional content, and in-class active learning. Conceptual frameworks focus on integrating educational technologies and activity-based learning to develop mathematical competencies: conceptual understanding, procedural fluency, strategic competency, adaptive reasoning, and productive disposition.

Despite widespread adoption, limited research evaluates the combined effect of educational technology adaptation and learning-through-activity strategies on student mathematical proficiency in the Philippine context. This study addresses gaps by examining both the adaptation and the extent of utilization of flipped learning strategies, and by exploring their relationships with key learning outcomes.

The research aligns with SDG 4 – Quality Education, promoting inclusive, equitable, and effective learning experiences. By fostering critical thinking, creativity, digital literacy, and independent learning, flipped learning contributes to sustainable educational practices.

This study supports educational sustainability by informing policy, teacher training, and curriculum development. It strengthens technological, pedagogical, and socio-academic capacities among teachers and students, contributing to innovation, improved learning outcomes, and digital preparedness for a technologically evolving world.

2. Material and methods

2.1 Research Design

A descriptive quantitative research design was utilized, employing a researcher-made survey questionnaire to collect data. This design enabled the systematic assessment of how teachers adapted and implemented flipped learning strategies and the extent to which these strategies influenced various dimensions of mathematical proficiency.

2.2 Locale of the Study

The research was conducted at Governor Feliciano Leviste Memorial National High School, encompassing Grades 7 to 10 junior high school students. The school provided a setting where flipped learning strategies were implemented through a combination of pre-recorded lectures, online modules, and in-class interactive activities, bridging traditional instruction with technology-mediated learning.

2.3 Respondents of the Study

The respondents consisted of a total population of 4,650 junior high school students across Grades 7 to 10, irrespective of age, sex, or section. Enrollment records were provided by the school registrar, ensuring accurate representation of the target population.

2.4 Sample and Sampling Procedure

Stratified random sampling was employed to select 355 students from the total population, determined using the Raosoft Sampling Calculator with a 5% margin of error. The population was divided into strata corresponding to grade levels, ensuring proportionate representation. This approach allowed the researchers to capture a balanced sample reflecting the diversity of the student body.

2.5 Research Instrument

Data were collected using a survey questionnaire specifically designed for this study. The instrument was reviewed and validated by academic experts and subjected to pilot testing to ensure reliability and clarity. Cronbach's Alpha was employed to assess the internal consistency of the survey items. The final questionnaire incorporated items measuring the adaptation and utilization of flipped learning strategies across educational technology and learning-through-activity dimensions.

2.6 Data Gathering Procedure

Researchers administered the validated questionnaire to the selected sample, ensuring that all respondents comprehensively completed the instrument. Completed responses were collected systematically for subsequent analysis. The data collection process adhered to school policies and coordinated with administrative personnel to minimize disruption to regular instructional activities.

2.7 Data Analysis Techniques

Collected data were analyzed using the Statistical Package for the Social Sciences (SPSS). Weighted mean was computed to summarize respondents' perceptions, while Pearson's R correlation was applied to determine the relationships between adaptation strategies and the utilization of flipped learning strategies across the various mathematical proficiency dimensions. Reliability analyses, including Cronbach's Alpha, confirmed the consistency of the instrument, ensuring the validity of the interpretations.

3. Results and Discussion

3.1 Adaptation of Flipped Learning Strategies

3.1.1 In Terms of Educational Technology

The results revealed that Mathematics teachers highly adapted educational technology tools, enabling students to access learning materials online or offline, use video lectures and tutorials, and engage with interactive modules. The composite mean for adaptation in educational technology was 3.16, interpreted as adapted. Students reported that these technologies facilitated their learning, increased accessibility, and supported self-paced study. These findings align with Juarez et al. (2019), who noted that access to evolving classroom technologies enhances engagement and supports blended and distance learning approaches, allowing educators to meet diverse learner needs effectively.

3.1.2 In Terms of Learning through Activities

Teachers also adapted strategies emphasizing learning through activities, such as interactive modules, video presentations, and group assignments. Students reported improved analytical skills and collaborative learning opportunities, with a composite mean of 3.14, interpreted as adapted. These activities enabled learners to engage with concepts actively and reinforce understanding through practice. This supports Bhagat et al. (2016), who highlighted that differentiated instructional approaches, including pre-recorded videos and activity-based learning, promote better conceptual grasp and skill development among students.

3.2 Extent of Flipped Learning Strategy Utilization

3.2.1 Conceptual Understanding

Students indicated a moderate extent of utilization in conceptual understanding, with a composite mean of 3.16. They could solve mathematical steps accurately after using pre-recorded videos and e-modules, enhancing active engagement and cognitive processing of mathematical concepts. Obeida (2017) emphasizes that conceptual understanding emerges from accurately handling concepts and forming relevant generalizations, highlighting the effectiveness of technology-supported active learning.

3.2.2 Procedural Fluency

The extent of utilization for procedural fluency was moderate (composite mean 3.19). Students applied learned procedures from videos, online resources, and e-modules to solve problems, demonstrating systematic and accurate problem-solving approaches. Altarawneh et al. (2021) reported that incorporating instructional videos alongside written notes improves procedural skill acquisition, although frequent practice remains necessary for mastery.

3.2.3 Strategic Competency

Strategic competency was also utilized to a moderate extent (composite mean 3.23). Teachers encouraged students to analyze open-ended problems, formulate solutions, and apply models using pre-recorded lectures and reflection activities. According to Septiadi (2022), strategic competence is essential in solving mathematical literacy problems, with students developing cognitive strategies to tackle authentic tasks effectively.

3.2.4 Adaptive Reasoning

Adaptive reasoning utilization had a composite mean of 3.22, indicating a moderate extent. Students reflected on problem-solving processes, justified solutions, and used interactive modules to think logically before class. Fitri (2024) notes that adaptive reasoning enhances the capacity to reflect, explain, and justify mathematical reasoning, building deeper understanding and flexible problem-solving skills.

3.2.5 Productive Disposition

Teachers' strategies promoted productive disposition moderately (composite mean 3.23). Students engaged with positive mindset articles, interactive problem-solving modules, and video tutorials, fostering motivation, confidence, and proactive learning attitudes. Gilbert (2014) highlight that productive disposition encompasses task value, belief in ability, achievement goals, and emotional engagement, all of which are strengthened through consistent flipped classroom activities.

3.3 Relationship Between Strategies Adapted and Flipped Learning Utilized

Statistical analyses revealed strong positive relationships between educational technologies adapted and all dimensions of flipped learning utilization, including conceptual understanding ($R = .539$), procedural fluency ($R = .585$), strategic competency ($R = .521$), adaptive reasoning ($R = .504$), and productive disposition ($R = .510$), all statistically significant ($p < .001$). Similarly, learning-through-activity strategies demonstrated strong positive associations with these dimensions, with R -values ranging from .542 to .652 ($p < .001$). These findings indicate that the adaptation of technology and activity-based strategies directly supports the effective implementation of flipped learning. Sheerah (2022) and Palmero (2023) affirm that technology-enhanced pedagogical tools and flipped classroom approaches improve understanding, collaboration, and student satisfaction. Unakorn (2017) and Khrishan (2016) further suggest that learning-through-activity strategies promote mastery learning, enabling students to progress at their own pace while engaging critically with content.

3.4 Overall Interpretation

In summary, Mathematics teachers at Governor Feliciano Leviste Memorial National High School effectively adapted and moderately utilized flipped learning strategies across multiple dimensions. The positive and significant relationships between adapted strategies and their utilization indicate that integrating technology and learning activities enhances student engagement, mathematical proficiency, and overall learning outcomes, consistent with previous research findings.

4. Conclusion & Recommendations

The study concluded that Mathematics teachers at Governor Feliciano Leviste Memorial National High School highly adapted flipped learning strategies, particularly educational technology, effectively supporting students through online and offline materials and interactive activities. Students moderately utilized these strategies across conceptual understanding, procedural fluency, strategic competency, adaptive reasoning, and productive disposition, reporting that these methods were helpful and enhanced academic success. Additionally, a significant positive relationship was found between the strategies adapted and the flipped learning strategies utilized, indicating that technology and activity-based strategies effectively facilitate student engagement, skill development, and learning outcomes.

Based on the findings, the study recommends the development and implementation of the Math Flip Book to optimize the adaptation and utilization of flipped learning strategies for conceptual understanding, procedural fluency, strategic competency, adaptive reasoning, and productive disposition. Educators and administrators should provide workshops, resources, and support to enhance students' mathematical proficiency, foster positive and supportive learning environments, nurture growth mindsets, and emphasize individual progress. Future researchers may use this study as a guide for exploring the adaptation of flipped learning strategies to improve student proficiency in mathematics.

Compliance with ethical standards

The authors declare no conflict of interest. This study complied with recognized ethical standards for human-participant research by ensuring voluntary participation with informed consent, the right to withdraw without penalty, and strict confidentiality through anonymous, secure, and aggregated data handling. Given the focus on psychological well-being, procedures were non-invasive, and safeguards were observed to minimize discomfort, with guidance to appropriate support services when needed, and required institutional permissions were secured for instrument use and access to academic records.

REFERENCES

- Altarawneh, A. F., & Marei, S. T. (2021). Mathematical proficiency and preservice classroom teachers' instructional performance. *International Journal of Education and Practice*, 9(2), 354–364. <https://doi.org/10.18488/journal.61.2021.92.354.364>
- Bhagat, K. K., Chang, C.-N., & Chang, C.-Y. (2016). The impact of the flipped classroom on mathematics concept learning in high school. *Educational Technology & Society*, 19(3), 134–142.
- Fitri, K. A., et al. (2024). Students' adaptive reasoning in solving Pythagoras theorem problems viewed by gender. *KnE Social Sciences*. <https://doi.org/10.18502/kss.v9i13.15970>
- Gilbert, M. C. (2014). Using productive disposition to differentiate between students' level of precision when critiquing a peer's work. *School Science and Mathematics*, 114(7), 339–348. <https://doi.org/10.1111/ssm.12086>
- Juarez, M. J.-A., Marasigan, N. V., Natanauan, S. A. P., & Trinidad, G. M. (2019). *Readiness in mathematics flipped classroom of Filipino secondary school teachers*. *International Educational Research*, 1(2), 95–? <https://doi.org/10.30560/ier.v1n2p95>
- Obeida, N., et al. (2017). Flipped learning for 21st century competence development. *Advances in Social Science, Education and Humanities Research*. <https://doi.org/10.2991/assehr.k.210715.109>

- Palmero, J. R., et al. (2023). Effectiveness of the flipped classroom in the teaching of mathematics in an online environment: Identification of factors affecting the learning process. *Online Learning*, 27(2). <https://doi.org/10.24059/olj.v27i2.3239>
- Sheerah, H. (2022). The use of flipped learning as a technology-enhanced pedagogic tool to support EFL students' writing skills in Saudi context. *The Turkish Online Journal of Educational Technology*, 21(1), 187–188. <https://files.eric.ed.gov/fulltext/EJ1338132.pdf>
- Unakorn, C. B. (2017). Learning activity as a means of developing theoretical thinking capacities. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.603753>
- Khrishan, Z., et al. (2016). Flipped classroom research and trends from different fields of study. *International Review of Research in Open and Distributed Learning*, 17(3). <https://files.eric.ed.gov/fulltext/EJ1102721.pdf>
- Septiadi, D. D., et al. (2022). The students' strategic competence in solving mathematical literacy problems based on cognitive levels in Islamic-based schools. *AIP Conference Proceedings*, 2575, 040012. <https://doi.org/10.1063/5.0116901>