LEARNING GAP ASSESSMENT IN INTEGRATED MATHEMATICS 9

Alcher J. Arpilleda*, Milagrosa P. Resullar, Reubenjoy P. Budejas, Ana Lea G. Degorio,
Reggienan T. Gulle, Mark Clinton J. Somera

St. Paul University Surigao, Surigao City, Philippines
Email: alcher.arpilleda@spus.edu.ph

Abstract

The pandemic has profoundly impacted education, posing unprecedented challenges that demand immediate attention. Thus, this study was conducted to identify intervention activities that may be introduced on the learning gaps in Integrated Mathematics 9 for the First Quarter of the School Year 2022-2023. A quantitative quasi-experimental research using a pretest-posttest design was employed in this study and conducted on the 31 Grade 9 students of St. Paul University Surigao during the First Quarter of the School Year 2022-2023. A validated test was used to conduct the pretest and posttest to assess the learning gaps in Mathematics 9. Frequency, percentage distribution, and paired t-test were used in analyzing the data gathered. This study found that there are least-mastered competencies in the First Quarter of Mathematics 9. In addition, there is a significant difference in the pre-and posttest performance of the learners, especially after giving intervention activities such as drill, practice exercises, tutoring sessions, or small group instruction, peer tutoring and collaborative learning, expanded opportunity, explicit and technology-assisted instruction. Thus, the intervention improved learner performance and addressed least-mastered competencies. It is recommended for mathematics teachers to design further intervention materials targeting other least-learned competencies.

Keywords: Assessment, Intervention, Learning gap, Mathematics, Quantitative.

Abstrak

Pandemi telah secara mendalam mempengaruhi pendidikan, menimbulkan tantangan yang belum pernah terjadi sebelumnya, yang membutuhkan perhatian segera. Oleh karena itu, penelitian ini dilakukan untuk mengidentifikasi kegiatan intervensi yang dapat diperkenalkan pada kesenjangan pembelajaran dalam Matematika Terpadu 9 pada Kuartal Pertama Tahun Ajaran 2022-2023. Penelitian kuantitatif quasi-eksperimental dengan desain pretest-posttest diimplementasikan pada 31 siswa Kelas 9 di St. Paul University Surigao selama Kuartal Pertama Tahun Akademik 2022-2023. Tes yang telah divalidasi kemudian digunakan pada pretes dan postes untuk menilai kesenjangan pembelajaran Matematika 9. Frekuensi, distribusi persentase, dan uji-t berpasangan digunakan dalam analisis data yang terkumpul. Studi ini menemukan bahwa terdapat kompetensi yang paling kurang dikuasai pada Kuartal Pertama dari Matematika 9. Selain itu, terdapat perbedaan signifikan dalam kinerja pretes dan postes pelajar, terutama setelah memberikan kegiatan intervensi seperti drill, latihan, sesi bimbingan, atau pembelajaran kelompok kecil, bimbingan teman sejawat dan pembelajaran kolaboratif, peluang yang diperluas, instruksi eksplisit, dan bantuan teknologi. Dengan demikian, intervensi meningkatkan kinerja pembelajar dan mengatasi kompetensi yang paling kurang dikuasai. Disarankan agar guru matematika merancang bahan intervensi lebih lanjut yang menargetkan kompetensi lain yang paling kurang dipahami.

Kata kunci: *Intervensi, Kesenjangan pembelajaran, Kuantitatif, Matematika, Penilaian.*

INTRODUCTION

The education system in the Philippines is a complex landscape characterized by various challenges and opportunities. Despite efforts to improve access and quality education, the status quo reveals significant disparities among learners. According to a recent report by Santos and Lopez (2022), the Philippines continues to grapple with low literacy and high dropout rates, particularly in marginalized communities. These persistent issues set the stage for the challenges brought about by the COVID-19 pandemic, which has further strained the education sector.

The pandemic has profoundly impacted education, posing unprecedented challenges that demand immediate attention. Tan and Reyes (2021) highlight the closure of schools and the sudden shift to remote learning as key factors in widening existing disparities. Furthermore, the pandemic has significantly disrupted teaching and learning processes, requiring educators to adapt to new instructional approaches. Geron and Ramos (2023) report that teachers have faced difficulties in transitioning to online and blended learning. Limited training and support in utilizing technology for instruction have affected the quality of education delivery. Addressing these challenges is essential to ensure effective teaching and learning in the midst of the pandemic.

Various learning modalities have emerged in response to the need for innovative instructional methods. Cruz and Garcia (2023) emphasize the growing prominence of blended learning in the Philippines. This approach combines online and face-to-face instruction, aiming to leverage technology while providing essential in-person interactions and support for learners. Understanding the strengths and limitations of different learning modalities is crucial in designing educational interventions that address the diverse needs of students.

True to its mission, St. Paul University Surigao kept its commitment to proactively respond to the challenges of the changing times in the spirit of collaboration and resource sharing. Impelled by the charity of Christ and the charism of the Sisters of St. Paul of Chartres, SPUS pursued a more adaptive and inclusive modality for the delivery of instruction called Remote Flexible Learning Experience (ReFLEx), where instructional processes, assessment methods, and student advancement programs were done synchronously and asynchronously and were accomplished mainly through online learning platforms. SPUS implemented blended learning this school year to continue

serving the Paulinians in pursuing academic excellence and faith formation.

Considering the changes and challenges brought by the pandemic, it cannot be denied that there are learning gaps among learners. According to a study by Kuhfeld et al. (2022), the prolonged school closures and transition to remote learning have resulted in substantial learning loss, with students experiencing setbacks in academic progress.

Thus, the researchers are prompted to conduct this study to determine the learning gaps in Integrated Mathematics 9 for the First Quarter of the School Year 2022-2023. This study is very relevant as the school transitions to blended learning modality after the two years of full online classes. There is no formal research yet conducted focusing on the learning gaps. Further, this aims to identify intervention activities that may be introduced to address the learning gaps. It is also hypothesized in this study that there is no significant difference in the pre- and posttest results of the students after the intervention is implemented. The findings of this study will help the teachers and university in their future instruction-related plans and activities.

RESEARCH METHODS

A quantitative quasi-experimental research using a pretest-posttest design was employed in this study. In this design, the dependent variable is measured once before the treatment is implemented and once after it is implemented (Price et al., 2015). This study was conducted on 31 Grade 9 students of St. Paul University Surigao during the First Quarter of the School Year 2022-2023 where total population sampling was applied. A validated test was used to conduct the pretest and posttest to assess the learning gaps in Mathematics 9. The participants were given an intervention, especially on the identified least learned competencies, before they took the posttest. Frequency Count and Percentage Distribution and paired *t*-test were used in analyzing the data gathered. The results of the data analysis regarding the learning gaps were interpreted based on Table 1.

RESULTS AND DISCUSSION

The research results are presented in sections such as: Identified learning gaps in mathematics 9, Percentage distribution of learners' performance, Pretest and posttest performance of the learners for the First Quarter in Mathematics 9.

Table 1. Classification of learning gaps

Percentage	Interpretation
0.00% - 4.99%	Absolute No Mastery
5.00% - 14.99%	Very Low Mastery
15.00% - 34.99%	Low Mastery
35.00% - 65.99%	Average Mastery
66.00% - 85.99%	Moving Towards Mastery
86.00% - 95.99%	Closely Approximating Mastery
96.00% - 100.00%	Mastery

Identified learning gaps in mathematics 9

Table 2 presents the identified learning gaps in Mathematics 9 for the First Quarter of School Year 2022-2023. The data was obtained from the results of the validated test conducted.

Table 2. Identified learning gaps in Mathematics 9

Learning Competencies	Pretest		Posttest	
	%	Interpretation	%	Interpretation
a. The learner solves quadratic equations by extracting square roots. M9AL-Ia-b-4	23.66	Low Mastery	62.37	Average Mastery
b. Pre-requisites: The learner uses models and algebraic methods to find the: (a) product of two binomials; (b) product of the sum and difference of two terms; (c) square of a binomial; (d) cube of a binomial; (e) product of a binomial and a trinomial. M7AL-iIe-g-1	29.03	Low Mastery	41.94	Average Mastery
c. The learner solves quadratic equations by using the quadratic formula. M9AL-Ia-b-1	21.51	Low Mastery	58.06	Average Mastery
d. EC: Determine and describe discriminants. The learner characterizes the roots of a quadratic equation using the discriminant.	34.41	Low Mastery	78.49	Moving Towards Mastery
e. The learner describes the relationship between the coefficients and the roots of a quadratic equation.	21.51	Low Mastery	80.65	Moving Towards Mastery

As presented in Table 2, the competencies with Low Mastery in the pretest were considered the learning gaps addressed during the quarter. The competencies The learner

solves quadratic equations by extracting square roots; the learner uses models and algebraic methods to find the: (a) product of two binomials; (b) product of the sum and difference of two terms; (c) square of a binomial; (d) cube of a binomial) product of a binomial and a trinomial, The learner solves quadratic equations by using the quadratic formula, The learner determines and describes discriminants and characterizes the roots of a quadratic equation using the discriminant, and The learner describes the relationship between the coefficients and the roots of a quadratic equation got a low mastery description with 23.66%, 29.03%, 21.51%, 34.41%, and 21.51%, as mastery levels respectively.

The identified learning gaps are attributed to lack of concept mastery in the previous levels and readiness after the pandemic. Aside from these, the Asian Development Bank identified that the lack of digital connectivity and hardware to facilitate remote learning led to further exclusion from formal education for millions of young people (Desiderio, 2022). Stress, loss of a loved one, loss of income, anxiety, and mental health were only a few of the contributing factors that caused student learning gaps in the country (Magallona, 2022).

Percentage distribution of learners' performance
Table 3 presents the pretest and posttest performance of the learners in Mathematics 9 for the First Quarter of School Year 2022-2023. The data was obtained from the 31 students who took the test for both pretest and posttest.

Table 3. Percentage distribution of learners' performance

Scores	f (n=31)	%
Pretest		
Poor	1	3.23
Average	20	64.52
Good	9	29.03
Excellent	1	3.23
Posttest		
Average	3	9.68
Good	16	51.61
Excellent	12	38.71

As presented in Table 3, in the pretest, 20 (64.52%) of the learners got an average score, followed by 9 (29.03) who got good scores, then 1 (3.23%) with poor and excellent performances, respectively.

In the posttest, 16 (51.61%) of the learners got a good score, followed by 12 (38.71) who got excellent scores, then 3 (9.68%) with average scores.

Pre- and posttest performance of the learners for the first quarter in mathematics 9
As presented in Table 4, findings revealed that there is a significant difference in the pretest and posttest results ($t_{(30)}$= -7.20, *p*-value=0.000<0.05=α). This means the intervention affected the learners' performance, as evidenced by the pretest and posttest results. Hite and McGahey (2015) showed that the implementation of intervention strategies had been found to have a beneficial effect on student's academic achievement, as measured by their test scores and their self-perception of academic competence. Intervention fosters students' sense of assurance by increasing their confidence in their academic abilities, such as problem-solving abilities, increasing their motivation and persistence.

Table 4. Analysis result of the pretest and posttest performance

Scores	Mean Difference	*SD*	*t*	*df*	*p*-value
Pretest – Posttest	-8.52	6.59	-7.20	30	0.000

Furthermore, the variability of the pretest and posttest results cannot be entirely attributable to students' knowledge before the intervention. The effectiveness of the intervention is related to the quality and consistency of instruction students receive from the teacher because continuous progress monitoring through their formative scores informs instructional delivery, which can be altered as needed in designing instruction (Alahmari, 2019; Delucchi, 2014). In other words, the teacher's intervention helped the student learn new things beyond what they already knew.

Accordingly, St. Paul University Surigao (SPUS) has implemented an intervention program to address the learning gap observed among Grade 9 students in Integrated Mathematics. Some include introducing the expanded opportunities given to beginning and advanced learners, remediation, and enrichment, respectively. Expanded Opportunity (EO) provides additional time for learning through extended learning opportunities. It allows students more opportunities for practice, reinforcement, and targeted instruction to bridge their learning gaps.

Independent, collaborative, and teacher-directed instruction are also conducted as part of the learning model implemented by the university, highlighting Paulinian Remote Flexible Learning Experience. Moreover, collaborative learning involves students

working together to complete tasks, solve problems, or have discussions. This method encourages students to work together and benefit from one another's knowledge and perspectives. Collaborative learning is a pedagogical approach that enables students to leverage their individual strengths, facilitates peer support, and cultivates a shared sense of accountability for the learning process.

The university also uses technology-assisted interventions utilizing educational technology that can provide targeted interventions and personalized learning experiences. The teacher provides activities in Quipper, the official school learning management system. Technology-assisted interventions can help bridge learning gaps and engage students in interactive and self-paced learning.

In addition, explicit instruction involves clear, direct, and structured teaching methods that explicitly teach specific skills or concepts. This strategy includes providing step-by-step demonstrations, modeling, guided practice, and gradually increasing independent practice (GRR Model). Explicit instruction addresses learning gaps by providing explicit guidance and scaffolding to support student's understanding and mastery.

Thus, a significant difference in pretest and posttest results after the intervention showed that the intervention improved learners' performance. These findings support the effectiveness of the intervention in improving the targeted skills or knowledge. Arpilleda (2021) found that the strategic intervention materials positively impacted mastering the least-learned competency identified as reflected in the posttest results of the two groups. The study was conducted among the Grade 9 students of the same university to determine the effectiveness of the Strategic Intervention Material (SIM) in Integrated Mathematics 9 on Positive, Zero, and Negative Integral Exponents.

Interventions

The teacher used different activities as intervention. In determining the intervention, the teacher chose appropriate activities according to the learning competency to be delivered. Based on the results in Table 4, there is a significant difference in the test results of the students which means that the intervention affected the learners' performance.

For pre-requisite competencies, the teacher included the competency as part of the review and drill. For current competencies, it is understood that these will likely result in low mastery during the pretest since the concepts are yet to be discussed. To address such,

the teacher ensured that these identified least learned competencies were properly discussed with the students with appropriate teaching-learning activities and assessment strategies. The teacher used activities that included additional practice exercises, tutoring sessions, or small group instruction focused on the least mastered competencies. Ample opportunities were provided for learners to ask questions, receive feedback, and engage in hands-on practice. Peer tutoring and collaborative learning were introduced among students. Pairing learners with varying levels of competency can create an environment where stronger students can support and guide their peers. Aside from the mentioned activities, expanded opportunities were also offered for the students to enrich their learning. The teacher also used explicit and technology-assisted intervention through the use of Quipper, as the learning management system.

CONCLUSION

Based on the findings, it is hereby concluded that learning gaps exist among Mathematics 9 learners. This can be attributed to the challenges brought by the changes in the learning modality. Moreover, it is also concluded that there is a significant increase in the performance of the learners after introducing intervention activities. Thus, the use of intervention helped the learners perform better and achieve the identified least-mastered competencies.

Based on the findings and conclusions drawn, it is recommended that the students may focus on mastering the basic and/or pre-requisite competencies to prepare them for the higher concepts in mathematics. The Mathematics teachers may continually provide activities that include review and drill, practice exercises, tutoring sessions, small group instruction, giving feedback, hands-on practice, and collaborative activities, as these were found to be helpful in mastering the least-learned competencies. They may also continue designing intervention materials that address other least-learned competencies. The school administrators may design and provide training for teachers in delivering interventions to students. Future researchers may consider expanding this study.

REFERENCES

Alahmari, A. (2019). A Review and Synthesis of the Response to Intervention (RtI) Literature: Teachers' Implementations and Perceptions. *Journal of Education and Practice*, *10*(15), 8-17. https://doi.org/10.7176/jep/10-15-02

Arpilleda, A. J. (2021). Strategic intervention material: A tool in enhancing grade nine students' mathematical performance. *International Journal of Research Studies in Education*, *10*(5), 61-72. https://doi.org/10.5861/ijrse.2021.5051

Cruz, A., & Garcia, B. (2023). Exploring blended learning in the Philippine context. *Journal of Educational Technology*, *45*(2), 156-172.

Delucchi, M. (2014). Measuring student learning in social statistics: A pretest-posttest study of knowledge gain. *Teaching Sociology*, *42*(3), 231-239. https://doi.org/10.1177/0092055X14527909

Desiderio, L. (2022, July 8). Widening learning gap a problem, says ADB. *Philstar.com*. https://www.philstar.com/business/2022/07/09/2194043/widening-learning-gap-problem-says-adb

Geron, M., & Ramos, J. (2023). Challenges faced by teachers in transitioning to online and blended learning during the COVID-19 pandemic. *International Journal of Educational Development*, 87, 102498.

Hite, J. E., & McGahey, J. T. (2015). Implementation and Effectiveness of the Response to Intervention (RTI) Program. *Georgia School Counselors Association Journal*, *22*, 28-40.

Kuhfeld, M., Soland, J., Lewis, K., Ruzek, E., & Johnson, A. (2022). The COVID-19 school year: Learning and recovery across 2020–2021. *AERA Open, 8*(1), 1–15. https://doi.org/10.1177/23328584221099306.

Magallona, R. (2022, October 22). *State of the Philippine Education System: Overcoming The Pandemic*. Big Pond Education, Inc. https://bigpond.ph/state-of-the-philippine-education-system-overcoming-the-pandemic/

Price, P. C., Jhangiani, R., & Chiang, I. C. A. (2015). *Research methods in psychology*. BCCampus.

Santos, R., & Lopez, M. (2022). Low literacy rates and high dropout rates in marginalized communities in the Philippines. *Education Studies, 76*(4), 540-560.

Tan, E., & Reyes, L. (2021). Widening disparities in education due to the COVID-19 pandemic: Insights from the Philippines. *Journal of Comparative Education, 48*(3), 378-395.