



Supporting Conceptual Understanding of Marginalized Learners in Mathematics through Structured Written Feedback

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ABSTRACT

This quantitative action research examined the effectiveness of structured written feedback in supporting the conceptual understanding of marginalized Grade 10 learners in Mathematics during modular distance learning. Ten purposively selected learners identified through Students at Risk of Dropping Out records participated in the study. The intervention used an Interactive Journal in which learners recorded weekly questions, difficulties, and misconceptions, while the teacher provided written explanations, corrections, and guided solutions. Pre-intervention and post-intervention grades were analyzed using mean percentage scores and the Wilcoxon signed-rank test. The findings showed a statistically significant improvement from satisfactory to very satisfactory levels. Grounded in Bruner's scaffolding theory, structured written feedback supported conceptual development in resource-limited learning contexts.

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1. INTRODUCTION

Marginalized learners in Philippine public secondary schools often face persistent challenges in developing conceptual understanding in Mathematics due to socioeconomic barriers, learning gaps, and limited access to educational resources. These conditions require targeted instructional support, particularly for learners who are at risk of academic failure or dropping out of school (Barrot *et al.*, 2021; Tadem, 2020). These challenges became more severe during the COVID-19 pandemic, when modular distance learning became the primary instructional modality in many public schools. In this context, students relied heavily on self-paced printed modules, often with limited opportunities for teacher-learner interaction, timely feedback, and clarification of misconceptions.

In a rural public high school in the Philippines, school records from the previous academic year indicated that many learners belonged to marginalized groups, primarily because of low family socioeconomic status as reflected in Students at Risk of Dropping Out (SARDO) profiles. Anecdotal records and academic data also showed poor performance among these learners, particularly in Mathematics. During School Year 2020-2021, the number of marginalized learners increased as the pandemic intensified poverty, unemployment, and food insecurity (Tadem, 2020). After the first quarter, many learners continued to demonstrate low academic performance, which was associated with child labor, lack of access to digital devices and internet connectivity, insufficient resources for completing performance tasks, and limited parental academic support (Barrot *et al.*, 2021). Improving conceptual understanding in Mathematics among marginalized learners, therefore, became a pressing concern. However, modular distance learning made it difficult for teachers to address complex mathematical concepts because teacher-learner interaction was reduced and feedback was often delayed (Anzaldo, 2021). To address this gap, structured written feedback was introduced as a low-tech instructional strategy through the use of an Interactive Journal. This strategy allowed learners to express their questions, difficulties, and misconceptions in writing, while the teacher provided explanations, corrections, and guided solutions. Anchored in Bruner's scaffolding theory, structured written feedback provides temporary and adaptive support that helps learners bridge the gap between their existing knowledge and new mathematical concepts (You *et al.*, 2021).

This study examined the effectiveness of structured written feedback delivered through an Interactive Journal in improving the conceptual understanding of marginalized Grade 10 learners in Mathematics during modular distance learning. Specifically, the study sought to answer the following questions:

- (i) What is the level of conceptual understanding of marginalized learners before the implementation of the Interactive Journal?
- (ii) What is the level of conceptual understanding of marginalized learners after the implementation of the Interactive Journal?
- (iii) Is there a significant difference in the level of conceptual understanding of marginalized learners before and after the implementation of the Interactive Journal?
- (iv) What actions may be taken after determining the effect of the Interactive Journal on learners' conceptual understanding?

2. METHODS

This study employed a quantitative action research design to evaluate the effectiveness of structured written feedback delivered through an Interactive Journal in improving the

conceptual understanding of marginalized Grade 10 learners in Mathematics during modular distance learning. The study was conducted in a rural public high school in the Philippines under the Department of Education during School Year 2020-2021, when modular distance learning was implemented due to the COVID-19 pandemic.

Ten Grade 10 learners were purposively selected based on their classification as marginalized learners and Students at Risk of Dropping Out (SARDO). The participants were identified through school SARDO records and teacher-adviser recommendations during the second grading period. Purposive sampling was appropriate because the study focused on learners who consistently experienced difficulties in Mathematics and required targeted instructional intervention. The small sample size was also consistent with school-based action research, which emphasizes intensive and context-specific intervention within a single educational setting (Anzaldo, 2021). All participants provided informed consent and agreed to participate throughout the intervention period. Before data collection, formal permission to conduct the study was obtained from the school principal. Learners' conceptual understanding was measured through document analysis of official Mathematics grades from school records. The second-quarter grades served as pre-intervention data, while the third-quarter grades served as post-intervention data after the implementation of the Interactive Journal. The Interactive Journal served as the primary instructional intervention. Each learner was provided with a notebook where they recorded weekly questions, difficulties, and misconceptions encountered while working on Mathematics modules. The journals were submitted during the regular module retrieval schedule. The teacher reviewed each entry and provided structured written feedback, including conceptual explanations, corrected solutions, and guiding notes to scaffold learners' understanding. The journals were returned during the next module distribution, allowing continuous asynchronous interaction without the need for digital devices or internet access. The intervention was implemented throughout the third grading period. Learners' conceptual understanding was quantified using mean percentage scores computed from their Mathematics grades. The computation followed this formula: Mean percentage = learner's grade / total possible score \times 100. The level of conceptual understanding was interpreted using the standard Department of Education grading scale, as shown in **Table 1**. Standard deviation was computed to describe the variability and consistency of learners' performance before and after the intervention. To determine whether the difference between pre-intervention and post-intervention conceptual understanding was statistically significant, the Wilcoxon signed-rank test was applied at the 0.05 level of significance. This non-parametric test was appropriate because of the small sample size and paired pretest-posttest design.

Ethical considerations were observed throughout the study. Participant identities were protected through the use of pseudonyms, and no identifying information was included in the analysis or reporting. All participants were informed about the purpose of the study and their right to withdraw at any time without academic consequences.

Table 1. Level of learners' conceptual understanding.

SCALE	VERBAL INTERPRETATION
90-100	Outstanding
85-89	Very satisfactory
80-84	Satisfactory
75-79	Fairly satisfactory
Below 74	Did not meet expectations

3. RESULTS AND DISCUSSION

The data were analyzed using descriptive statistics, specifically mean percentage scores and standard deviations, to determine the level of learners' conceptual understanding before and after the implementation of the Interactive Journal (InJour). The Wilcoxon signed-rank test was also applied to examine whether the observed change in learners' performance was statistically significant. All statistical analyses were conducted at the 0.05 level of significance. **Table 2** presents the mean percentage scores and standard deviations of learners' conceptual understanding before and after the implementation of InJour. The pre-intervention data were based on learners' second-quarter Mathematics grades, while the post-intervention data were based on their third-quarter grades after the intervention. Learners obtained a mean percentage score of 82.25% before the intervention, which corresponds to a satisfactory level of conceptual understanding. After the implementation of InJour, the mean percentage score increased to 86.33%, indicating a very satisfactory level. Structured written feedback helped learners clarify mathematical misconceptions, revisit difficult concepts, and strengthen their understanding through guided written explanations. The relatively low standard deviations before and after the intervention indicate that learners' scores were clustered closely around the mean. The improvement was not limited to only a few learners but was relatively consistent across the group. Considering that the participants were marginalized learners who experienced limited access to learning resources and teacher support during modular distance learning, the increase in performance indicates the potential value of structured, paper-based feedback as an accessible instructional support.

Table 2. Mean percentage and standard deviation of conceptual understanding before and after InJour implementation.

PERIOD	MEAN PERCENTAGE (%)	STANDARD DEVIATION	VERBAL INTERPRETATION
Before	82.25	2.040	Satisfactory
After	86.33	2.050	Very satisfactory
Weighted mean	84.29	2.045	Satisfactory

Note: Interpretation was based on the Department of Education grading scale: 90-100 = Outstanding; 85-89 = Very satisfactory; 80-84 = Satisfactory; 75-79 = Fairly satisfactory; below 74 = Did not meet expectations.

To determine whether the improvement in learners' conceptual understanding was statistically significant, the Wilcoxon signed-rank test was conducted. The results are presented in **Table 3**. The Wilcoxon signed-rank test yielded a Z-value of -2.803 and a p-value of 0.005, which is lower than the 0.05 level of significance. Therefore, the null hypothesis was rejected. There was a statistically significant difference in learners' conceptual understanding before and after the implementation of InJour.

Table 3. Wilcoxon signed-rank test results for conceptual understanding before and after InJour.

CRITERIA	Z-VALUE	P-VALUE	SIGNIFICANCE LEVEL	DECISION ON HO	VERBAL INTERPRETATION
Conceptual understanding	-2.803	0.005	< 0.05	Reject Ho	Significant

Note: Significant at $p < 0.05$.

The significant improvement from a satisfactory to a very satisfactory level indicates that the Interactive Journal was effective in supporting learners' conceptual understanding in Mathematics. Through the journal, learners were able to write their questions, difficulties, and misconceptions while working on the mathematics modules. The teacher then provided written explanations, corrections, and guided solutions that helped learners understand mathematical concepts more clearly. This process addressed one of the major limitations of modular distance learning: the lack of immediate and sustained teacher-learner interaction (Anzaldo, 2021).

The findings also support the importance of feedback in helping learners overcome conceptual difficulties. In modular learning environments, students often work independently and may continue to misunderstand concepts when clarification is delayed or unavailable. The Interactive Journal reduced this problem by creating a regular feedback cycle between the learner and the teacher. This written exchange provided learners with personalized support while remaining feasible in contexts where digital devices and internet connectivity were limited. This is particularly important for marginalized learners, who often face socioeconomic and technological barriers to learning (Barrot *et al.*, 2021; Tadem, 2020).

The effectiveness of InJour can also be explained through Bruner's scaffolding theory. Scaffolding involves providing temporary instructional support to help learners accomplish tasks that they may not yet be able to complete independently. In this study, the teacher's written explanations, corrected solutions, and guiding notes functioned as scaffolds that helped learners move from confusion toward clearer conceptual understanding. As learners received repeated support through the Interactive Journal, they were given opportunities to revisit errors, correct misconceptions, and develop greater confidence in solving mathematical problems. This interpretation is consistent with the view that structured support can promote conceptual development when learners are guided toward independent understanding (You *et al.*, 2021). The low-tech nature of the Interactive Journal is another important contribution of the intervention. Unlike digital learning platforms, InJour required only a notebook and regular module retrieval schedules. This made it suitable for rural and resource-constrained learning environments, where many learners have limited or no access to internet connectivity and digital devices. In this sense, the Interactive Journal provided a practical and inclusive strategy for sustaining teacher-learner interaction during modular distance learning.

This finding is consistent with studies emphasizing the need for flexible instructional supports in modular and technology-mediated learning environments. Teacher feedback can help bridge learning gaps in Mathematics during modular distance learning, while low-tech interventions remain important for sustaining learning continuity in rural Philippine schools (Santos and Cruz, 2024; Villanueva and De Guzman, 2022). Studies on teachers' experiences in modular distance learning also highlight the need for practical strategies that allow learners to receive guidance despite limited face-to-face interaction (Ocampo and Reyes, 2023). Although digital tools such as interactive notebooks and educational robotics can enrich Mathematics and STEM learning, their use may be limited in contexts where learners lack stable access to devices and internet connectivity, making paper-based feedback strategies such as InJour especially relevant (Galanti *et al.*, 2020; Ouyang and Xu, 2024).

The findings are also relevant to previous studies on modular distance learning and Mathematics education. Modular distance learning has been associated with challenges such as delayed feedback, limited teacher guidance, and difficulty in understanding complex

lessons independently (Anzaldo, 2021; Manalo and Lapuz, 2022). In Mathematics, these challenges may be more serious because learners often need step-by-step explanations to understand abstract procedures and concepts. The improvement observed in this study suggests that structured written feedback may help bridge this instructional gap by providing learners with targeted explanations even without face-to-face or online interaction. These findings also contribute to the broader literature on Mathematics education by showing that structured instructional support can improve learners' mathematical performance and understanding, particularly when learning is affected by contextual, technological, or instructional constraints. This interpretation is consistent with studies emphasizing the role of instructional strategies, learner readiness, teacher support, and structured interventions in improving Mathematics achievement and problem-solving skills (Agustin *et al.*, 2026; Awofala and Agbolade, 2024; Awofala and Olaniyi, 2023; Bendol and Dalayap Jr., 2025; Dermawan *et al.*, 2022; Jose, 2022; Lagcao *et al.*, 2023; Obafemi *et al.*, 2024; Sabugal and Apelindo, 2025). At the same time, the findings should be interpreted with caution. The study involved only ten purposively selected learners and did not include a control group. Therefore, the results cannot be generalized to all Grade 10 learners or all modular learning contexts. Other factors, such as increased familiarity with Mathematics modules, learner motivation, or support from family members, may also have influenced the improvement. Nevertheless, the statistically significant increase in scores provides promising evidence that the Interactive Journal can support marginalized learners' conceptual understanding in Mathematics.

Several actions may be considered. At the classroom level, Mathematics teachers may integrate the Interactive Journal as a regular component of modular distance learning, particularly for learners who require additional support. Teachers may collect journals during module retrieval, provide written explanations and guided corrections, and return them during the next distribution schedule. At the school level, school heads, teacher-advisers, and SARDO coordinators may orient teachers on the use of InJour and monitor its implementation among marginalized learners. At the division or regional level, education offices may consider promoting structured written feedback as a low-cost intervention for schools with limited digital infrastructure. Future action research may involve larger samples, comparison groups, or implementation across different grade levels and subject areas. Further studies may also examine the long-term effects of the Interactive Journal on learners' retention, confidence, and self-efficacy in Mathematics. Structured written feedback delivered through an Interactive Journal can serve as a feasible, low-cost, and learner-centered strategy for improving conceptual understanding among marginalized learners in modular distance learning environments.

4. CONCLUSION

This action research examined the effectiveness of structured written feedback delivered through the Interactive Journal in improving the conceptual understanding of marginalized Grade 10 learners in Mathematics during modular distance learning. Learners' conceptual understanding improved from a satisfactory to a very satisfactory level after the intervention. The difference between pre-intervention and post-intervention results was statistically significant. The Interactive Journal provided meaningful instructional support by allowing learners to express their questions, difficulties, and misconceptions in writing, while enabling the teacher to provide explanations, corrections, and guided solutions. Grounded in Bruner's scaffolding theory, the intervention helped address learning gaps through personalized and

asynchronous feedback without requiring digital technology. Although the study was limited by its small sample size and absence of a control group, structured written feedback can serve as a feasible, low-cost, and inclusive strategy for supporting marginalized learners in resource-limited modular learning environments.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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