



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

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ABSTRACT

Marginalized learners in Philippine public secondary schools often struggle to develop conceptual understanding in Mathematics under modular distance learning due to limited teacher–learner interaction. This quantitative action research examined the effectiveness of structured written feedback as a low-tech instructional support. Ten purposively selected Grade 10 marginalized learners identified through Students at Risk of Dropping Out records participated in the study. Learners documented weekly questions and misconceptions in Mathematics modules, 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. Results showed a statistically significant improvement in conceptual understanding from satisfactory to very satisfactory levels. Anchored in Bruner’s scaffolding theory, structured written feedback effectively supported learners’ conceptual development in resource-limited modular learning environments.

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1. INTRODUCTION

Marginalized learners in Philippine public secondary schools often face persistent challenges in developing conceptual understanding due to socioeconomic barriers, learning gaps, and limited access to educational resources, which necessitate targeted instructional support (Tadem, 2020; Barrot *et al.*, 2021). These challenges were further intensified during the COVID-19 pandemic, when modular distance learning became the primary instructional modality. In this learning context, students relied heavily on self-paced printed modules, frequently with limited opportunities for teacher–learner interaction, timely feedback, and clarification of misconceptions, all of which are essential for meaningful learning in Mathematics.

In a rural public high school in the Philippines, school records from the previous academic year indicated that a substantial proportion of learners belonged to marginalized groups, primarily due to low family socioeconomic status as reflected in students at risk of dropping out (SARDO) profiles. Anecdotal records and academic data consistently showed poor academic performance among these learners, particularly in mathematics. During School Year 2020–2021, the number of marginalized learners further increased as the pandemic exacerbated poverty, unemployment, and food insecurity (Tadem, 2020). After the first quarter, many learners continued to demonstrate low academic performance, which was attributed to factors such as 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 posed significant challenges in addressing complex mathematical concepts due to reduced teacher–learner interaction and delayed feedback (Anzaldo, 2021). To help address this gap, structured written feedback was introduced as a low-tech instructional strategy that allowed learners to express difficulties and misconceptions through written reflection, while teachers provided explanations, corrections, and guided solutions. Previous studies have shown that interactive and feedback-oriented instructional approaches can support conceptual understanding by addressing misconceptions and promoting deeper learning, particularly in distance learning environments. Anchored in Bruner’s scaffolding theory, structured written feedback provides temporary, adaptive support that helps learners bridge gaps between existing knowledge and new mathematical concepts (You *et al.*, 2021).

Specifically, this study sought to answer the following questions:

- (i) What is the level of conceptual understanding of the marginalized learners before the Interactive Journal is implemented?
- (ii) What is the level of conceptual understanding of the marginalized learners after the Interactive Journal is implemented?
- (iii) Is there a significant difference in the level of conceptual understanding of the marginalized learners before and after the Interactive Journal is implemented?
- (iv) What actions should 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 implemented 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 public high school in a rural area of the Philippines under the Department of Education (DepEd), where modular distance learning was implemented during School Year 2020–2021 due to the COVID-19 pandemic.

Ten Grade 10 learners were purposively selected based on their classification as marginalized and at risk of dropping out, as identified through the school's Students at Risk of Dropping Out (SARDO) records and teacher-adviser recommendations during the second grading period. The purposive sampling approach was appropriate because the study focused on learners who consistently experienced difficulties in Mathematics and required targeted instructional intervention. The sample size is consistent with school-based action research, which emphasizes intensive, context-specific intervention and close monitoring of learner progress 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 obtained from school records. Pre-intervention data were taken from second-quarter grades, while post-intervention data were drawn from third-quarter grades following the implementation of the intervention.

The Interactive Journal served as the primary instructional intervention. Each learner was provided with a simple notebook in which 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 clear conceptual explanations, step-by-step corrected solutions, and guiding notes to scaffold understanding. The journals were returned to learners during the subsequent module distribution, ensuring continuous asynchronous interaction without reliance on digital devices or internet access. The intervention was implemented throughout the entire third grading period.

Learners' conceptual understanding was quantified using mean percentage scores computed from their Mathematics grades using the following equation: Mean Percentage = (Learner's grade / Total possible score) × 100.

The levels of conceptual understanding were interpreted based on the standard DepEd grading scale, as presented in **Table 1**. Standard deviation was computed to describe the variability and consistency of learners' performance across the pre-intervention and post-intervention periods.

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

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 due to the small sample size and paired pretest–posttest design.

Ethical considerations were strictly 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 of the purpose of the study and their right to withdraw at any time without academic consequence.

3. RESULTS AND DISCUSSION

3.1. Temperature

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). In addition, the Wilcoxon signed-rank test was 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 using appropriate statistical software.

Table 2 presents the mean percentage scores and standard deviations of learners' conceptual understanding before (second quarter) and after (third quarter) the implementation of InJour. Before the intervention, the learners obtained a mean percentage score of 82.25% (SD = 2.04), which corresponds to a "Satisfactory" level of conceptual understanding based on the DepEd grading scale. After the implementation of InJour, the mean percentage score increased to 86.33% (SD = 2.05), indicating a "Very Satisfactory" level of conceptual understanding. The weighted mean of 84.29% reflects an overall satisfactory performance across both periods. The relatively low standard deviations in both the pre-intervention and post-intervention results indicate consistent performance among the participants.

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	2.04	Satisfactory
After	86.33	2.05	Very Satisfactory
Weighted Mean	84.29	2.045	Satisfactory

Note: Interpretation based on DepEd grading scale (90–100 Outstanding, 85–89 Very Satisfactory, 80–84 Satisfactory, 75–79 Fairly Satisfactory, below 74 Did Not Meet Expectations).

The increase in mean percentage scores indicates that learners demonstrated improved conceptual understanding in Mathematics following the intervention. To determine whether this observed improvement was statistically significant, the Wilcoxon signed-rank test was conducted. The results of the test are presented in **Table 3**. The analysis yielded a Z-value of -2.803 with a p-value of 0.005, which is lower than the 0.05 level of significance. This result led to the rejection of the null hypothesis, confirming that there was a statistically significant difference in learners' conceptual understanding before and after the implementation of InJour.

The statistically significant improvement from the satisfactory level (MP = 82.25%, SD = 2.04) to the very satisfactory level (MP = 86.33%, SD = 2.05) suggests that the Interactive Journal effectively supported learners' conceptual understanding in Mathematics. The structured written feedback process enabled learners to articulate difficulties and misconceptions encountered in modular learning activities, while the teacher's written explanations, corrections, and guided solutions helped clarify complex mathematical concepts. Similar improvements in conceptual understanding have been reported in studies

emphasizing guided feedback and teacher-supported learning in distance education contexts, where personalized responses contribute to deeper understanding and conceptual clarity.

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 low variability in scores across participants further indicates that the intervention was consistently beneficial for the group of marginalized learners. This consistency may be attributed to the shared challenges faced by the participants, including limited parental academic support and lack of access to digital learning resources (Barrot *et al.*, 2021). The findings align with previous research demonstrating that structured, low-tech instructional strategies can produce reliable learning gains in rural and resource-constrained settings, particularly when learners receive systematic scaffolding and feedback (Anzaldo, 2021).

The effectiveness of InJour can be explained through Bruner's scaffolding theory, which emphasizes the role of temporary and structured instructional support in helping learners progress toward independent understanding (You *et al.*, 2021). Through the Interactive Journal, learners were able to communicate their difficulties asynchronously, while the teacher provided step-by-step guidance tailored to individual needs. This process supported learners' movement within their zone of proximal development and gradually enhanced their confidence and conceptual clarity without reliance on digital technology. Consistent with recent syntheses of educational interventions, scaffolding mechanisms such as written feedback are particularly effective in Mathematics learning when access to technology is limited, underscoring the value of paper-based instructional alternatives in modular learning contexts.

Unlike many instructional interventions that rely on digital platforms, the Interactive Journal is a zero-cost, paper-based strategy that addresses interaction gaps commonly experienced in modular distance learning, especially in rural Philippine schools. Although the small sample size and absence of a control group limit the generalizability of the findings and do not fully rule out external influences such as increased learner familiarity with modules or motivational factors, the statistically significant improvement observed provides promising evidence of the intervention's effectiveness.

The results demonstrate that the Interactive Journal, implemented as a form of structured written feedback, significantly improved the conceptual understanding of marginalized Grade 10 learners in Mathematics during modular distance learning. Based on these findings, several actions are recommended to sustain and expand the use of InJour. At the classroom level, Mathematics teachers are encouraged to integrate InJour as a regular weekly component of modular distance learning, collecting learner entries during module retrieval and returning them with written explanations, corrections, and guiding notes. At the school level, school heads and SARDO coordinators may orient teachers on the use of InJour during Learning Action Cell sessions and monitor its consistent implementation among marginalized learners. At the division and regional levels, the Department of Education may consider promoting InJour as a recommended low-cost instructional strategy in modular learning guidelines and teacher development programs, particularly for schools with limited digital infrastructure.

Finally, future action research involving larger samples, comparison groups, or multiple subjects and grade levels is recommended to further validate the effectiveness of InJour and examine its long-term impact on learner performance, retention, and self-efficacy in modular learning environments. Finally, this study adds new information regarding mathematics, as reported elsewhere (Bendol and Dalayap, 2025; Sabugal and Apelindo, 2025; Agustin *et al.*, 2026; Jose, 2022; Dermawan *et al.*, 2022; Lagcao *et al.*, 2023; Awofala and Olaniyi, 2023; Obafemi *et al.*, 2024; Awofala and Agbolade, 2024).

4. CONCLUSION

The findings of this action research indicate that structured written feedback delivered through the Interactive Journal significantly improved the conceptual understanding of marginalized Grade 10 learners in Mathematics during modular distance learning. Learners' performance increased from satisfactory to very satisfactory levels, with statistical analysis confirming a meaningful difference between pre-intervention and post-intervention results. Grounded in Bruner's scaffolding theory, the intervention effectively addressed misconceptions through personalized, asynchronous feedback without reliance on digital technology. Despite limitations related to sample size and research design, the study provides practical evidence that low-cost, paper-based strategies can support equitable mathematics learning. The Interactive Journal is feasible.

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