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EFFECTIVENESS OF AN INSTRUCTIONAL MANUAL FOR FOSTERING METACOGNITIVE SKILLS AND REFLECTIVE PRACTICES AMONG GRADE 8 STUDENTS WITH HEARING IMPAIRMENT

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ABSTRACT

This study examined the effectiveness of a structured instructional manual developed to foster metacognitive skills and reflective practices among Grade 8 students with hearing impairment. A quasi-experimental pre-test-post-test control-group design was employed. One public-sector special education school was selected through convenience sampling, and two intact Grade 8 sections were randomly allocated to an experimental group (n = 16) and a control group (n = 16). The experimental group received a 12-week classroom intervention comprising 35 strategies and activities related to planning, monitoring, evaluating, reflection-in-action, and reflection-on-action, while the control group continued routine instruction. Outcomes were assessed through the Metacognitive Skills Scale for Hearing Impaired and the Reflective Practices Questionnaire. No statistically significant pre-test differences were found in metacognitive skills, t(30) = -1.548, p = .132, or reflective practices, t(30) = -1.557, p = .130. At post-test, the experimental group obtained significantly higher mean scores than the control group in metacognitive skills (3.74 vs. 2.93, p < .001) and reflective practices (3.72 vs. 2.95, p < .001). It also achieved larger mean gains in metacognitive skills (1.25 vs. .60) and reflective practices (1.11 vs. .51). Although both groups improved, the magnitude of improvement was considerably greater in the experimental group. Within the participating setting, the findings support sustained, explicit, activity-based, and communication-accessible instruction for strengthening metacognitive and reflective learning among students with hearing impairment.

Keywords: *instructional manual; metacognitive skills; reflective practices; students with hearing impairment; quasi-experimental design; special education*

INTRODUCTION

Background of the Study

Hearing impairment includes different degrees of hearing loss and does not affect all students in the same way. Educational experiences may differ according to the age of onset, language background, communication mode, family support, access to hearing technology, and the quality of classroom instruction. In school, students with hearing impairment may need to divide their visual attention among the teacher, sign language, written information, visual examples, the board, and peer interaction. These demands can make it more difficult to follow a sequence of ideas, connect new information with prior knowledge, and judge whether a task has

been understood. Educational outcomes therefore cannot be explained by hearing status alone; language access, prior learning, cognitive demands, and instructional conditions also play important roles (Marschark & Knoors, 2012).

These learning demands should not be interpreted as evidence of limited potential. Rather, they highlight the need for instruction that is visually clear, linguistically accessible, and deliberately structured. Students benefit when teachers explain the learning process, model appropriate strategies, use written and visual prompts, provide guided practice, and allow sufficient time for discussion and review. Metacognitive skills and reflective practices are especially relevant because they help learners plan an approach, monitor understanding, evaluate performance, make adjustments during a task, and learn from completed experiences.

Metacognition refers to awareness and regulation of one's own thinking. Through planning, learners set goals and select an approach; through monitoring, they check their understanding and progress; and through evaluating, they judge the quality of their performance and the usefulness of the strategy used (Flavell, 1979; Fogarty & Pete, 2020). Reflective practice complements these processes by helping learners examine experience during and after action. Reflection-in-action supports immediate adjustment while an activity is underway, whereas reflection-on-action involves reviewing a completed experience and using what has been learned to guide future action (Schön, 1983). Both areas can be developed through explicit modelling, structured questioning, guided practice, feedback, and repeated opportunities for application (Markkanen et al., 2020; Quigley et al., 2018).

Need for an Instructional Manual

For students with hearing impairment, metacognitive skills and reflective practices can provide practical support for managing classroom learning. A learner who misses part of an instruction must first recognize that understanding is incomplete and then decide how to respond, for example by requesting clarification, consulting written material, observing a visual example, or discussing the task with a peer. During the activity, the learner may need to check progress and change an ineffective approach. After completing the task, the learner may need structured support to identify what worked, explain what caused difficulty, and decide what should be done differently next time. The instructional manual was therefore designed to make these processes visible and usable through teacher modelling, guided questioning, visual materials, activity-based practice, peer interaction, feedback, and reflection. It contained 21 metacognitive strategies and 14 reflective-practice activities, giving a total of 35 structured strategies and activities.

Rationale of the Study

Routine participation in classroom activities does not necessarily teach students how to plan, monitor, evaluate, or reflect on their learning. Students may complete an assignment without setting a clear goal, checking whether they understand the instructions, examining an error, or considering a more effective approach for a similar task. This concern is particularly relevant when access to classroom learning depends on visual, written, signed, and other supported forms of communication. Although metacognitive and reflective instruction is well established in general education, comparatively little intervention research has examined their combined use with students with hearing impairment in Pakistan. The present study therefore evaluated whether a structured instructional manual could produce greater improvement in metacognitive skills and reflective practices than routine classroom instruction.

Statement of the Problem

Metacognitive skills and reflective practices are important for purposeful and increasingly independent learning. However, there is limited empirical evidence on how these abilities can be fostered among elementary-level students with hearing impairment in Pakistani special education settings. The problem addressed in this study was whether an instructional manual organized around planning, monitoring, evaluating, reflection-in-action, and reflection-on-action

would improve students' metacognitive skills and reflective practices.

Research Objective, Question, and Hypotheses

Research Objective

To evaluate the effectiveness of the instructional manual in fostering metacognitive skills and reflective practices among Grade 8 students with hearing impairment.

Research Question

To what extent is the instructional manual effective in fostering the metacognitive skills and reflective practices among Grade 8 students with hearing impairment?

Research Hypotheses

Ho1: There is no significant difference in the pre-test scores of metacognitive skills between the control and experimental groups.

Ho2: There is no significant difference in the pre-test scores of reflective practices between the control and experimental groups.

Ho3: There is no significant difference in the post-test scores of metacognitive skills between the control and experimental groups after the instructional manual-based intervention.

Ho4: There is no significant difference in the post-test scores of reflective practices between the control and experimental groups after the instructional manual-based intervention.

Significance of the Study

This study contributes intervention evidence on the development of metacognitive skills and reflective practices among students with hearing impairment. It evaluates a classroom resource organized around five connected components and designed for sign-supported, visual, written, and activity-based instruction. The findings may help special education teachers incorporate goal setting, self-questioning, monitoring, evaluation, and reflection into regular lessons. They may also assist school leaders, teacher educators, curriculum developers, and policymakers in planning communication-accessible support that promotes learner participation, self-awareness, and greater independence.

Methodology

Research Design

A quasi-experimental pre-test-post-test control-group design was employed. The participating school was selected through convenience sampling. Two intact Grade 8 classroom sections were used because reorganizing students into newly formed groups was not feasible within the existing school structure. The two sections were randomly allocated to the experimental and control conditions. The instructional manual served as the independent variable, while metacognitive skills and reflective practices were the dependent variables. This arrangement preserved the natural classroom setting while providing a comparison group for evaluating the intervention.

Participants

The participants were 32 Grade 8 students with hearing impairment enrolled in a public-sector special education school in Dera Ghazi Khan. Sixteen students were in the experimental group and 16 were in the control group. The participants were drawn from the broader baseline sample of 112 students involved in the doctoral study.

Measures

Metacognitive skills were assessed through the 40-item Metacognitive Skills Scale for Hearing Impaired (MSSHI), which measured planning, monitoring, and evaluating. Reflective practices were assessed through the 30-item Reflective Practices Questionnaire (RPQ), which covered reflection-in-action and reflection-on-action. Both instruments used five-point response formats, with higher scores indicating stronger metacognitive skills or more frequent engagement in reflective practices. In a pilot sample of 10 students, Cronbach's alpha was .85 for the MSSHI and .82 for the RPQ. These coefficients indicated good internal consistency, although they were interpreted cautiously because of the small pilot sample.

The Instructional Manual and Intervention

The instructional manual was developed through a review of relevant literature, a baseline assessment of 112 students, a need assessment and

consultation with 83 professionals, professional evaluation of the proposed strategies and activities, and validation by 10 experts. The final manual contained 35 strategies and activities: 21 addressed metacognitive planning, monitoring, and evaluating, while 14 addressed reflection-in-action and reflection-on-action. Activities included goal setting, K-W-L, think-aloud procedures, self-questioning, checklists, peer sharing, concept mapping, self-talk, task review, post-activity wrappers, reflective discussion, role play, and short written or visual reflection. The manual was designed to embed metacognitive and reflective processes within ordinary classroom learning rather than teach them only as abstract terminology.

The intervention was delivered over 12 instructional weeks. The wider calendar period included school holidays, assessment days, and other interruptions. Sessions were conducted five days per week and lasted approximately 45 minutes. Before implementation, the class teacher was oriented to the purpose, sequence, materials, and use of the activities. The teacher then delivered the intervention with the researcher's support and supervision. The control group continued routine classroom instruction based on the regular curriculum and did not receive the structured metacognitive and reflective-practice activities during the intervention period.

Total communication was used to make the instruction accessible. Depending on the task, explanations were provided through sign language, oral explanation, written text, gestures, demonstrations, examples, and visual materials. Teacher modelling was followed by guided practice, individual or peer application, feedback, and reflection. This sequence provided repeated opportunities for students to use the strategies in different classroom situations.

Procedure and Data Analysis

Both groups completed the MSSHI and RPQ before the intervention and again after its completion. Independent-samples t tests were used to compare the control and experimental groups at pre-test, post-test, and on mean gain scores. Paired-samples t tests were conducted separately for each group to examine change from pre-test to post-test. Results were interpreted using statistical significance and the study's mean-score criteria: 1.00-2.40 = low, 2.41-3.50 = moderate, and 3.51-5.00 = high. All tests were two-tailed, and statistical significance was assessed at alpha = .05.

Results

Pre-test Comparison

Ho1: There is no significant difference in the pre-test scores of metacognitive skills between the control and experimental groups.

Ho2: There is no significant difference in the pre-test scores of reflective practices between the control and experimental groups.

Table 1

Pre-test Comparison of the Control and Experimental Groups (N = 32)

Outcome	Group	n	M	SD	t(30)	p	Decision
Metacognitive skills	Control	16	2.33	.34	-1.548	.132	Ho1 retained
	Experimental	16	2.49	.26			
Reflective practices	Control	16	2.44	.30	-1.557	.130	Ho2 retained
	Experimental	16	2.61	.31			

Note. Mean-score criteria: 1.00-2.40 = low; 2.41-3.50 = moderate; 3.51-5.00 = high.

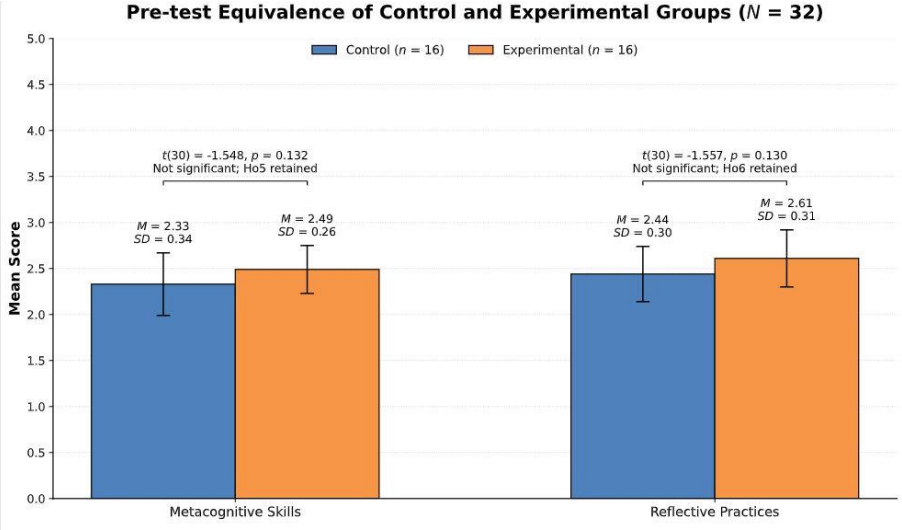
Table 1 presents the pre-test comparison of the control and experimental groups. For metacognitive skills, the control group obtained a mean score of 2.33 (SD = .34), which fell within the low range, whereas the experimental group obtained a mean score of 2.49 (SD = .26), which fell within the moderate range. The descriptive mean difference was .16 in favour of the

experimental group. However, the independent-samples t test showed that the difference was not statistically significant, t(30) = -1.548, p = .132. The fact that the two means fell on opposite sides of the 2.40 interpretive boundary does not, by itself, establish a reliable difference between the groups. Ho1 was therefore retained.

For reflective practices, both groups were within the moderate range at pre-test. The control group recorded a mean score of 2.44 (SD = .30), while the experimental group recorded a slightly higher mean score of 2.61 (SD = .31). The mean difference of .17 was not statistically significant, t(30) = -1.557, p = .130. Ho2 was therefore retained.

Overall, no statistically significant pre-test differences were detected in either outcome. The groups were therefore reasonably comparable before implementation of the manual, although they should not be described as completely identical. Because intact classroom sections were used, the pre-test findings are best interpreted as evidence of comparability rather than proof of full equivalence.

Figure 1 Pre-test Mean Scores of the Control and Experimental Groups



Post-test Comparison

Ho3: There is no significant difference in the post-test scores of metacognitive skills between students with hearing impairment in the control and experimental groups after the instructional manual-based intervention.

Ho4: There is no significant difference in the post-test scores of reflective practices between students with hearing impairment in the control and experimental groups after the instructional manual-based intervention.

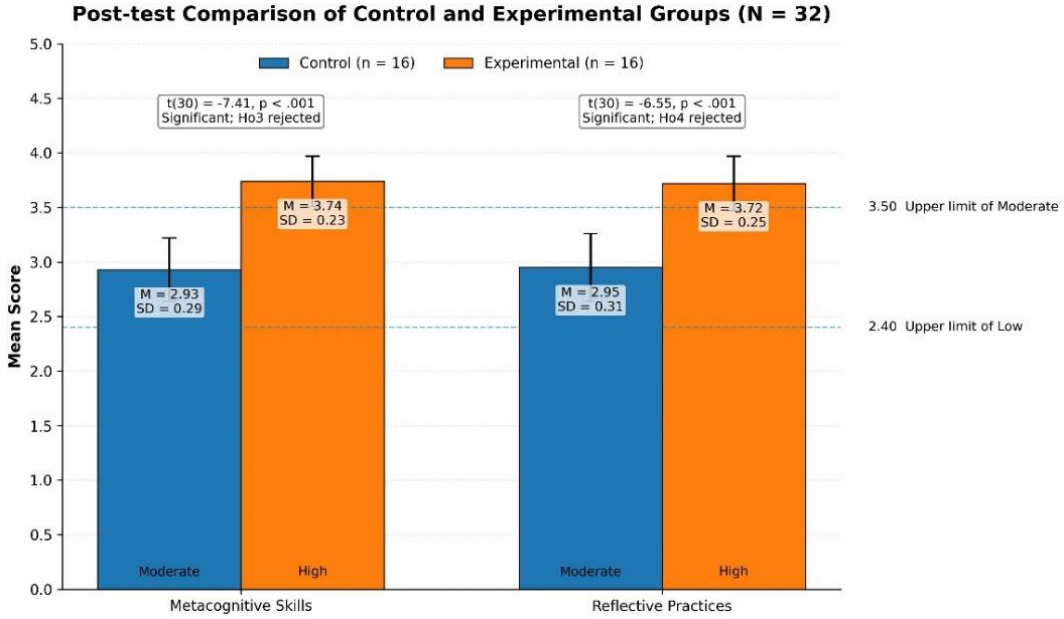
Table 2
Post-test Comparison of the Control and Experimental Groups (N = 32)

Outcome	Group	n	M	SD	t(30)	p	Decision
Metacognitive skills	Control	16	2.93	.29	-7.41	< .001	Ho3 rejected
	Experimental	16	3.74	.23			
Reflective practices	Control	16	2.95	.31	-6.55	< .001	Ho4 rejected
	Experimental	16	3.72	.25			

Table 2 presents the post-test comparison of the control and experimental groups. For metacognitive skills, the control group obtained a mean score of 2.93 (SD = .29), which remained within the moderate range. In contrast, the experimental group achieved a mean score of 3.74 (SD = .23), placing it within the high range. The mean difference was .81 in favour of the experimental group, and the difference was statistically significant, $t(30) = -7.41$, $p < .001$. Ho3 was therefore rejected.

For reflective practices, the control group obtained a post-test mean of 2.95 (SD = .31), which was classified as moderate. The experimental group obtained a substantially higher mean score of 3.72 (SD = .25), which fell within the high range. The mean difference of .77 was statistically significant, $t(30) = -6.55$, $p < .001$. Ho4 was therefore rejected. The post-test pattern was educationally meaningful as well as statistically significant. For both outcomes, the control group remained in the moderate range, whereas the experimental group moved into the high range. When considered alongside the absence of statistically significant pre-test differences, the widened post-test gap indicates that students who received the instructional manual-based intervention demonstrated stronger metacognitive skills and reflective practices than those who continued routine instruction. This interpretation remains specific to the participating school and the quasi-experimental conditions of the study.

Figure 2 Post-test Mean Scores of the Control and Experimental Groups



Gain-Score Comparison

Table 3 Gain-Score Comparison between the Control and Experimental Groups

Outcome	Group	Pre-test M	Post-test M	Mean gain	SD of gain	t(30)	p
Metacognitive skills	Control	2.33	2.93	.60	.48	-4.33	< .001
	Experimental	2.49	3.74	1.25	.36		
Reflective practices	Control	2.44	2.95	.51	.46	-4.24	< .001
	Experimental	2.61	3.72	1.11	.33		

Table 3 compares the mean gains made by the two groups. In metacognitive skills, the experimental group improved by 1.25 points (SD = .36), compared with a gain of .60 points (SD = .48) in the control group. The experimental group's gain was approximately twice that of the control group, and the difference was statistically significant, $t(30) = -4.33$, $p < .001$. For reflective practices, the experimental group gained 1.11 points (SD = .33), whereas the control group gained .51 points (SD = .46). This difference was also statistically significant, $t(30) = -4.24$, $p < .001$. These findings show that the experimental group made considerably greater progress than the control group.

Within-Group Change

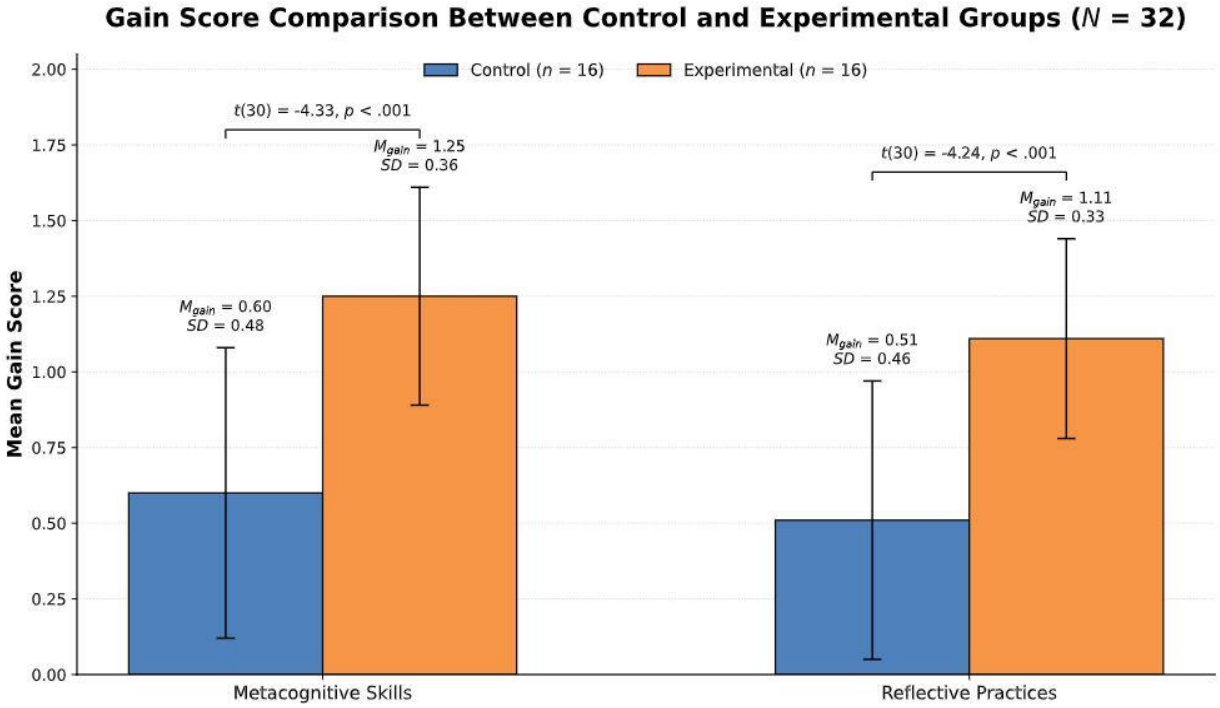
Table 4 Within-Group Pre-test and Post-test Comparisons

Outcome	Group	Pre-test M (SD)	Post-test M (SD)	t(15)	p
Metacognitive skills	Control	2.33 (.34)	2.93 (.29)	-4.99	< .001
	Experimental	2.49 (.26)	3.74 (.23)	-13.78	< .001
Reflective practices	Control	2.44 (.30)	2.95 (.31)	-4.50	< .001
	Experimental	2.61 (.31)	3.72 (.25)	-13.57	< .001

Table 4 shows that both groups improved significantly from pre-test to post-test. In metacognitive skills, the control group increased from 2.33 (SD = .34) to 2.93 (SD = .29), moving from the low to the moderate range, $t(15) = -4.99$, $p < .001$. The experimental group increased from 2.49 (SD = .26) to 3.74 (SD = .23), moving from the moderate to the high range, $t(15) = -13.78$, $p < .001$. In reflective practices, the control group increased from 2.44 (SD = .30) to 2.95 (SD = .31) but remained within the moderate range, $t(15) = -4.50$, $p < .001$. The experimental group increased from 2.61 (SD = .31) to 3.72 (SD = .25), moving from the moderate to the high range, $t(15) = -13.57$, $p < .001$.

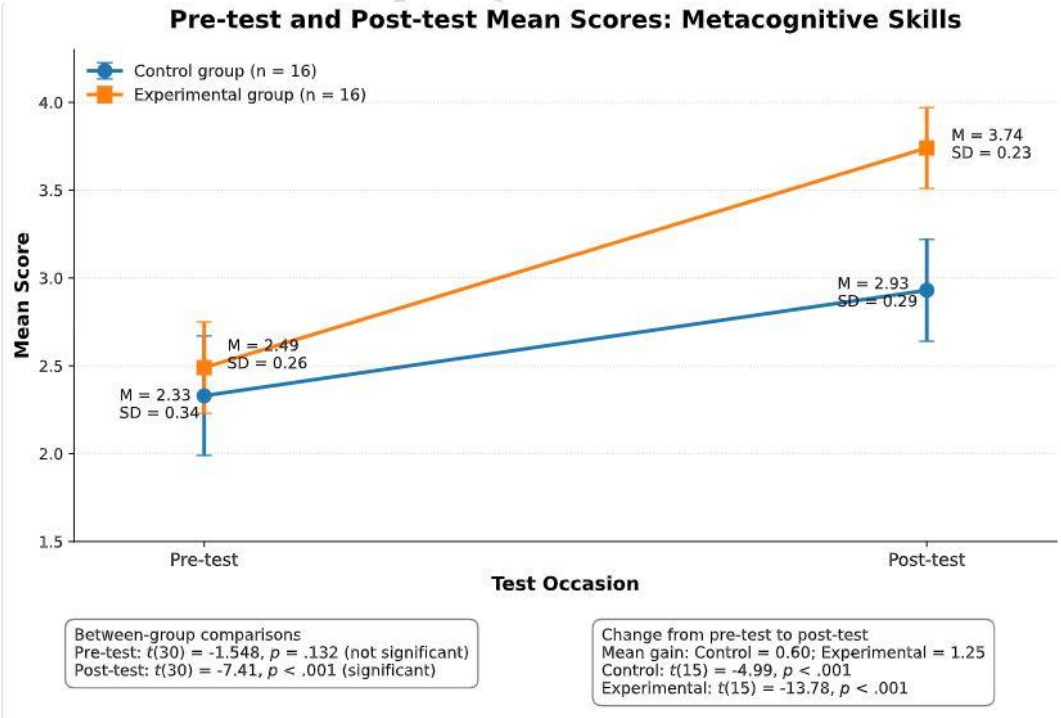
The significant improvement in the control group suggests that routine instruction, continued school experience, familiarity with the measures, maturation, or other influences may also have contributed to change. However, the experimental group achieved larger gains and moved into the high range for both outcomes. Taken together, the pre-test, post-test, gain-score, and within-group analyses provide consistent evidence in support of the instructional manual-based intervention within the context of this study.

Figure 3 Gain-Score Comparison between the Control and Experimental Groups



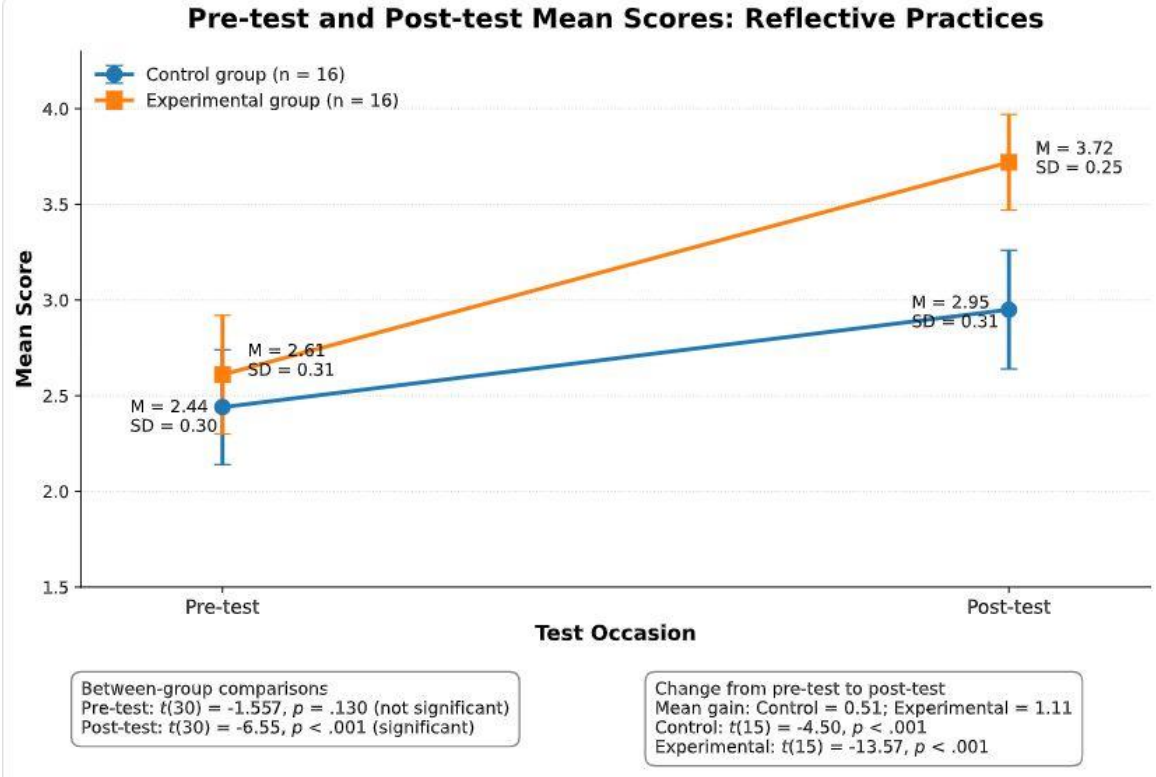
Graphical Summary of Intervention Outcomes

Figure 4 *Pre-test and Post-test Mean Scores for Metacognitive Skills in the Control and Experimental Groups*



Note. Error bars represent ±1 standard deviation; n = 16 in each group

Figure 5 Pre-test and Post-test Mean Scores for Reflective Practices in the Control and Experimental Groups



Note. Error bars represent ±1 standard deviation; n = 16 in each group.

The figures show a consistent pattern. The control and experimental groups began with relatively close mean scores, but their trajectories diverged after the intervention. The experimental group showed a steeper increase and reached the high range in both metacognitive skills and reflective practices, whereas the control group remained in the moderate range. This visual pattern is consistent with the post-test and gain-score analyses reported above.

Discussion

The pre-test findings showed that the control and experimental groups were reasonably comparable before the intervention. Although the experimental group began with slightly higher descriptive means, neither difference reached statistical significance. The pattern changed clearly after the 12-week intervention: the experimental group achieved high-level post-test means in both metacognitive skills and reflective practices, whereas the control group remained in the moderate range. The gain-score analysis also showed that the experimental group improved by approximately twice as much as the control group. Although a quasi-experimental design cannot exclude every alternative explanation, the consistency of the post-test, gain-score, and within-group findings indicates that the structured instructional experience contributed to the stronger outcomes observed in the experimental group.

The findings should be understood as evidence for the manual as an implemented instructional program, not merely as a printed resource. Its apparent effectiveness was closely connected with regular classroom use, teacher modelling, guided practice, accessible communication, feedback, and repeated opportunities for students to apply and reflect on the strategies. The manual provided the structure, but the quality and consistency of implementation were central to the learning experience.

The findings are consistent with evidence that metacognitive strategies are most useful when instruction is explicit, sustained, connected with meaningful tasks, and supported through guided practice. Meta-analytic studies have reported positive effects of metacognitive and self-regulated learning interventions on student performance (de Boer et al., 2018; Dignath et al., 2008). Quigley et al. (2018) also recommended a gradual sequence that begins with activating prior knowledge and explaining a strategy, then moves through teacher modelling, guided practice, independent application, and reflection. The manual followed this broad sequence by moving from demonstration to supported use and, where appropriate, to more independent application.

The duration and frequency of the intervention may also have contributed to the findings. Metacognitive skills are unlikely to become established through a single lesson or an occasional worksheet. Students need repeated opportunities to decide when a strategy is useful, apply it across different tasks, receive feedback, and review its effectiveness. Mevarech and Kramarski (2014) similarly emphasized repeated questioning, practice, review, and reflection. The 12-week schedule allowed the participating students to encounter the strategies regularly and become increasingly familiar with their use.

The improvement in reflective practices may be related to the deliberate opportunities provided for students to pause, explain, discuss, review, and plan. Reflection-in-action was supported through prompts that encouraged students to check their progress and modify an approach while working. Reflection-on-action was developed through discussion, task wrappers, self-assessment, written or visual review, and planning for the next activity. These practices reflect Schön's (1983) distinction between reflection during and after action and are consistent with Markkanen et al.'s (2020) emphasis on structured frameworks that help learners move beyond simple recall towards purposeful analysis.

Communication accessibility was an integral part of the intervention. The strategies were presented through sign language, written cues, visual examples, gestures, demonstrations, and teacher modelling. This reduced dependence on spoken explanation and made the processes of planning, monitoring, evaluating, and reflecting more visible. The approach is consistent with the view that learning among deaf and hard-of-hearing students is influenced by language access, communication conditions, and instructional design rather than by hearing level alone (Marschark & Knoors, 2012).

The control group also improved significantly, although its gains were smaller. This improvement may reflect continued classroom learning, greater familiarity with the measures, teacher interaction, maturation, or other experiences during the study period. Because both groups attended the same school, some informal exchange between students during shared activities cannot be ruled out. Nevertheless, the larger gains and higher post-test performance of the experimental group indicate that routine instruction was not associated with improvement of the same magnitude as the structured manual-based intervention.

Conclusion

Within the participating setting, the instructional manual-based intervention was effective in fostering metacognitive skills and reflective practices among Grade 8 students with hearing impairment. The groups showed no statistically significant differences before the intervention. At post-test, however, the experimental group achieved significantly higher scores and moved into the high range for both outcomes, while the control group remained in the moderate range. The experimental group also obtained significantly larger gain scores. Although the control group improved over time, the magnitude of its progress was smaller. These findings support systematic, sustained, activity-based, and communication-accessible instruction for strengthening planning, monitoring, evaluating, reflection-in-action, and reflection-on-action.

Educational Implications

- Metacognitive and reflective strategies should be embedded in regular subject teaching rather than taught only as isolated concepts.
- Teachers should combine sign language, written prompts, visual supports, modelling,

guided questioning, practice, feedback, and reflection.

- Students should receive repeated opportunities to use the same strategy across different tasks and to explain when and why it was helpful.
- Teacher training should precede implementation so that activities are delivered consistently and the purpose of each strategy is clear.
- Schools may use the manual as a supplementary resource, while adapting examples and communication supports to the needs of individual learners.

Limitations and Directions for Future Research

The study involved 32 students from one public-sector special education school and used two intact classroom sections. Random allocation occurred at the section level rather than at the level of individual students, and the small sample limits the generalizability of the findings. Outcomes were measured through student response scales and may have been influenced by item interpretation or response tendencies. Because both groups attended the same school, some informal exchange of strategies between students could not be completely prevented. No delayed follow-up assessment was conducted, so the maintenance and transfer of learning were not established. Implementation was supported and supervised by the researcher, and no independent fidelity measure was used.

Recommendations for Further Research

Future studies should evaluate the manual with larger samples drawn from several schools and regions. Individual randomization, where feasible, and independent measures of implementation fidelity would strengthen the design. Follow-up assessment is needed to determine whether improvements are maintained and transferred to later learning. Research should also examine subject-specific achievement, classroom observation, communication mode, language proficiency, hearing technology, and the extent to which teachers can use the manual independently after training.

Delimitations

The experimental evaluation was delimited to Grade 8 students with hearing impairment from one public-sector special education school in Dera Ghazi Khan. It examined the effects of a 12-week instructional manual on metacognitive skills and reflective practices, using the MSSHI and RPQ as outcome measures. Students from other grade levels, schools, and regions were not included.

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