



Effectiveness of the Cognitive Load-Aware Scaffolded Program for Writing (CLASP-W) in Developing Urdu Writing Skills among Students with Learning Disabilities

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Abstract

This study was conducted to determine the effectiveness of Cognitive Load-Aware Scaffolded Program for Writing (CLASP-W) to improve the Urdu writing skills amongst the students with learning disabilities. A pre-test-post-test control group experimental design was utilized, with a sample of 40 students selected through purposive sampling, who were then put into two groups; the control group ($n = 20$) and the experimental group ($n = 20$). The experimental group received 32 sessions of CLASP-W intervention. Urdu Writing Assessment Rubric (UWAR) ($\alpha = 0.82$; ICC(3,3) = 0.77) was used to collect pre-test and post-test data of students' Urdu writing performance. Data were analyzed through descriptive and inferential statistical tests. Data analysis revealed that the performance of both groups was same at pre-test establishing the baseline equivalence ($p = .44$). In-group pre-test-post-test analysis showed that the control group did not show any significant improvement ($p = .089$), on the other hand, the experimental group demonstrated a significant improvement in Urdu writing score ($t(19) = 6.15, p < .001, d = 1.37$). Post-test between-group comparisons also proved that the experimental group performed much better than the control group ($t(38) = 5.14, p < .001, d = 1.35$). Results of ANCOVA also confirmed the effectiveness of the intervention ($F(1, 37) = 24.80, p < .001$). Results indicate that CLASP-W is an effective strategy to improve the writing skills of LD students in Urdu classrooms. Findings of the study suggest that the instruction of LD students may be designed to target their unique cognitive needs.

Keywords: CLASP-W, Cognitive Load Theory, Scaffolding, Urdu Writing Skills, Learning Disabilities, Special Education

1. INTRODUCTION

Writing is a complex process that involves linguistic, motor, and executive processes. It becomes even more challenging in the case of students with learning disabilities (LD students) since they struggle with limited working memory and processing speed (Re et al., 2023). Under these circumstances, they are unable to

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originate a well-structured composition. They repeatedly exhibit mistakes in spelling and articulateness as well as sentence formation of sentences. Urdu is a language from the family of Persio-Arabic languages and is scripted in the Nastalique script, which has a right-to-left orientation and context-based letter forms. Ascribable to these characteristics, Urdu writing demands access cognitive load and consequently becomes more challenging for LD students. As a result, the execution and self-confidence of LD students are adversely affected.

Cognitive Load Theory (CLT) was proposed by Sweller (1988). CLT provides a framework to beget an instructional plan that could heighten learning outcomes (Zou et al., 2025). It talks around three types of cognitive load that need to be managed during instruction: intrinsic load (complexity of the task), extraneous load (due to instructional design), and germane load (accountable for schema construction) (Ouwehand et al., 2025). A qualified instructional design manages these three types of cognitive loads in an effective way to increase learning outcomes (Choi et al., 2014). When these three types of cognitive loads are managed in a good way, the working memory may be optimized, and learning outcomes may be enhanced. An instructional plan that fails to manage cognitive load may result in unwanted outcomes. This scenario is peculiarly applicable in the case of LD students.

Vygotsky (1978) presented the concept of scaffolding, according to which if support is provided to learners in initial instructions and then is stepwise faded out, it can encourage them to enhance their learning. Over time, these learners turn sovereign, and no supplementary support is mandatory. Scaffolding helps learners to operate in the zone of proximal development (ZPD), where they are able to perform complex tasks independently (Xi & Lantolf, 2021). The principles of CLT and scaffolding can be incorporated to design an instructional program that can encourage students who need extra cognitive aid.

Although research increasingly confirms that CLT-based instructional designs and scaffolded teaching methods are successful in enhancing writing outcomes, there are several salient limitations in the current research. Most of the studies carried out are in English or alphabetic languages and are mainly restricted to the general education context, which has restricted relevance in linguistically different contexts like Urdu and in the context of LD students. In addition, most previous studies have focused on either cognitive load management or scaffolding as individual teaching methods, and there is still scarce empirical data on the systematic application of both methods in a single teaching structure.

The visual, orthographic, and cognitive complexity of Urdu Nastalique script poses significant challenges to the working memory of LD learners, especially in Urdu writing instruction. Thus, there is a need for an empirically validated instructional program that provides integration of CLT and scaffolding in Urdu writing domain, due to its special cognitive and linguistic challenges. The present study aims to fill this void by conceptualizing and testing the Cognitive Load-Aware

Scaffolded Program for Writing (CLASP-W) for a new, previously unexplored linguistic and special education setting.

CLASP-W is an instructional plan grounded in the principles of CLT and scaffolding. It is particularly designed to elevate the Urdu writing skills of LD students while keeping their unique cognitive needs in mind. CLASP-W is designed in a way that it reduces the extraneous load, manages the intrinsic load, and boosts the germane processes, consequently improving the learning outcomes. A pre-test-post-test control group experimental design was used in this study to appraise the effectiveness, where a sample of 40 students participated in the experimentation who were divided into two groups, i.e., an experimental group ($n = 20$) and a control group ($n = 20$). A teacher-rated Urdu Writing Assessment Rubric (UWAR) was developed for this study to fetch pre-test and post-test data.

1.1 Statement of the Problem

Accomplishment in writing is an indispensable literary skill, but LD students face challenges while gaining it. It becomes more challenging in the case of Urdu, which has a composite script linguistically and visually. Urdu is written in Nastalique script, which makes it complex due to the right-to-left orientation and context-specific forms of letters. It increases the visual-motor and cognitive demands to learn to write. LD students face challenges of working memory and cognitive processing, and, therefore, Urdu writing becomes more challenging for them. As a result, their achievement in academics as well as their self-esteem is affected negatively.

Although there is a growing focus of literature on inclusive education, Urdu writing is still treated through traditional methods, e.g., rote memorization, copying, and full-class instruction. These traditional methods do not address the unique cognitive needs of LD students and fail to produce fruitful results. There is a requirement for the development of an instructional plan for the promotion of writing skills among LD students by taking their cognitive needs into account. Due to the unavailability of such unified programs, teachers in special and inclusive institutions stay unarmed to tackle the writing issues of LD students. As a result, these LD students cannot perform at grade-level expectations and persist underperformed and underconfident. There is an indispensable need to originate an instructional plan to elevate Urdu writing that targets the cognitive needs of these LD students.

1.2 Significance of the Study

This study is valuable theoretically, practically, and socially. Theoretically, it integrates the principles of CLT and scaffolding in the domain of Urdu writing. It applies the concepts of these two theories to the local linguistic considerations and, accordingly, contributes to a deeper notion on how principles of cognitive load dispensation assist teaching instruction for LD students. It extends the application of CLT beyond its allegorical verge into Urdu classrooms, an unexplored area.

Practically, it develops and validates CLASP-W as an evidence-based instructional plan to improve Urdu writing among LD students. It provides teachers with an integrated instructional plan that can be implemented in special and inclusive classrooms easily.

Socially and at the policy stage, the study supports Pakistan's national goal of inclusive education by offering a program that is theory-grounded to assist LD students. The outcomes of the study can likewise be suitable for teacher grooming programs, curriculum development, and special education practices.

1.3 Objectives of the Study

The main objective of the study is:

1. To evaluate the effectiveness of CLASP-W in improving Urdu writing performance as compared to traditional methods.

1.4 Research Questions

This research is conducted to find the answer to the question:

1. Does CLASP-W significantly improve the Urdu writing performance of LD students as compared to traditional methods?

1.5 Hypotheses

The following are the hypotheses of the study:

- Null Hypothesis (H_0): The CLASP-W does not significantly improve the Urdu writing performance among LD students as compared to traditional methods.
- Alternative Hypothesis (H_1): The CLASP-W significantly improves the Urdu writing performance of LD students as compared to traditional methods.

2. LITERATURE REVIEW

2.1 Writing and Its Importance

Writing is one of the most vital skills in academics. It allows students to mold ideas, narrate them, and carry over noesis (Bereiter et al., 2023). It plays its part in all domains of acquisition and in intellection (Teng & Yue, 2023). Students with accomplished writing skills perform remarkably better than their peers and actively participate in classroom activities (Taye et al., 2025). Good writing skills serve students in learning attainment and self-assurance (Julian et al., 2021). On the other hand, students with weak writing repeatedly face troubles in learning outcomes and remain underperforming and underconfident (Sari & Setyowati, 2021). Due to these reasons, it is essential to develop writing skills among students so that they can perform better.

2.2 Urdu Writing and Its Complexities

Urdu language has its own novel characteristics. Urdu is a Persio-Arabic language and uses Nastalique script (Ali et al., 2022; Muhammad & Soomro, 2024).

It is written right to left, and the shapes of letters inside a word change according to context and location (Khan et al., 2021; Imtiaz et al., 2022). Many of them are written in joining and many have the shapes that are similar (Jabbari, 2023). These characteristics of the Urdu language script make it difficult to write for many students (Azhar et al., 2025). Students must pay heed not alone to the grammar and composition but, furthermore, to the complexities of script (Saeed et al., 2025). These multiple demands of Urdu writing set cognitive load on the working memory of students, and the situation becomes even worse in the case of struggling students.

2.3 Students with Learning Disabilities

LD students are those students who face long-lived challenges in learning and frequently stay underperformed as compared to their peers in the same age orbit. These students have the limitations of working memory, attention, and cognitive processing (Aro et al., 2022). LD students postulate more time to perform tasks and activities (Rim et al., 2024). They face challenges in participating in classroom activities (Schwartz et al., 2021). As a result, these students cannot get benefits from the traditional instructional methods used in customary classrooms.

2.4 LD Students and Writing Issues

Writing is cognitively one of the most demanding skills, and LD students face limitations of cognitive processing. LD students often struggle with transcription of ideas and the construction of meaningful sentences (Graham et al., 2024). Writing needs respective cognitive processes to work at a time, and due to diminutive working memory potential, these LD students cannot perform these tasks at a time (Niazov et al., 2022). Many LD students, including those with dysgraphia, have handwriting issues as well (Kalenjuk et al., 2022). Some others, e.g., those with dyslexia, possess reading issues (Catts et al., 2024). These handwriting issues make it more abstruse for them to write befittingly. Under these circumstances, LD students struggle to learn writing from traditional methods.

2.5 Cognitive Load Theory (CLT)

CLT was initially introduced by Sweller (1988). This theory offers a framework to construct a clever instructional design (Sweller, 2023). According to theory, the working memory of students is limited, and if it is overloaded, learning becomes obscure (Greenberg & Zheng, 2022). CLT talks around three types of cognitive load that contribute to learning: intrinsic load, extraneous load, and germane cognitive load. Intrinsic cognitive load is consanguineous to the complexity of the task; extraneous cognitive load comes from the delivery procedure; and germane cognitive load is pliant for schema building (Skulmowski & Xu, 2022). If an instructional plan has the vigor to negotiate these loads effectively, it can produce qualified learning outcomes (Greenberg & Zheng, 2023). On the other hand, if an instructional design fails to accomplish suitably, it cannot originate craved results (Beege et al., 2021). So, a suitable instructional plan manages these cognitive loads in an effective way so that the working memory may be optimized and learning could be improved. While there are some studies that have proved the effectiveness of CLT-

based writing interventions, but the studies carried out are mostly in English language context, and in Urdu writing context, the application of CLT-based writing intervention is not sufficiently investigated.

2.6 CLT-Based Interventions

Many researchers have benefited from the framework provided by CLT. There is a developing body of literature that demonstrates that application of CLT principles can be suitable for improving learning outcomes. CLT-based techniques have been established as effective in literature, such as worked examples (Chen et al., 2023), scaffolding (Faber et al., 2024), chunking (Putri et al., 2024), removing redundancy (Baceviciute et al., 2022), and modality effect (Chen & Yen, 2021). Their effectuality is also attested across subjects like mathematics (Barbieri & Rodrigues, 2025); science (Liu et al., 2022); and linguistics (Roussel et al., 2022). Studies had been conducted across the domains of linguists like writing (Chen, 2025); handwriting (Li et al., 2024); reading (Bahari et al., 2024); and comprehension (Liu, 2024). Effectiveness of CLT is furthermore authenticated across contexts such as in general education (Baxter et al., 2025); multimedia pedagogy (Surbakti et al., 2024); and special education (Khasawneh et al., 2024). It indicates that principles of CLT can be used across subjects, contexts and domains. Notwithstanding, most of these interventions were conducted in English or other alphabetic languages.

2.7 Scaffolding Principle

Scaffolding is a scheme that is intimately kindred with the CLT. The principle of scaffolding was first presented by Vygotsky (1978). According to the principle, if the aid is provided temporarily to the learners and then step-by-step withdrawn, their acquisition becomes accomplished (Larkin, 2001). In scaffolded instructions, teachers supply help to the students in the initial stage and then stepwise cut the quantity of help to arrive the excretion (Puntambekar, 2022). It helps the students to advance the Zone of Proximal Development (ZPD), a level where learning becomes most talented (Xi & Lantolf, 2021). When support is reduced gradually, it motivates the students to work independently. When scaffolding is combined with a CLT-based design, it may help produce valuable results.

2.8 Synthesis of Literature and Study Rationale

All the reviewed literature confirms that writing is a complex task and that LD students have ongoing challenges developing effective writing skills based on deficits in working memory, language processing, motor coordination, and self-regulation. Past research has demonstrated that structured instructional practices, such as CLT-inspired instructional designs and scaffolded instruction, can enhance students' academic achievement by lowering unnecessary cognitive load and offering a graduated instructional support. Explicit writing instruction, systematic feedback, and scaffolded writing contexts are also empirically correlated with positive outcomes in the writing development of LD students. Together, these results suggest that cognitive and educational theory-based instructional practices are promising for writing success in special education. However, these recent developments have been

accompanied by several significant shortcomings that are highlighted in the literature. Most of the evidence that has been produced has been in English-language or other alphabetic writing systems, and comparatively little research has been conducted with Urdu writing, especially the cognitively challenging Nastalique script. Further, previous intervention studies have largely focused on the CLT and scaffolding as separate intervention techniques from each other and have not combined the complementary principles of these two approaches in a comprehensive intervention package. Previous research also offers scant experimental evidence on interventions for LD students in the context of Urdu writing instruction. The generalizability of existing evidence across linguistically and educationally diverse settings, however, is still unclear and requires context-specific interventions that are backed by a strong body of empirical evidence.

The aim of this systematic integration, therefore, was to develop and test the CLASP-W that would optimize cognitive processing while also offering structured instructional support, which would, in turn, gradually promote independence in writing. At the same time, this study offers practical support for the application of these theoretical frameworks in Urdu writing instruction for LD students and empirical evidence on the effectiveness of an integrated instructional framework in an under-researched linguistic and special education environment.

2.9 Theoretical Framework

The present study is based on the complementary framework of Cognitive Load Theory (CLT) and Scaffolding Theory for designing cognitively efficient and pedagogically supportive instruction. CLT is based on the idea of optimizing the cognitive processing of learners while scaffolding theory is about providing temporary instructional support that gradually and systematically shifts to independent performance. CLASP-W combines these complementary principles to overcome the cognitive and instructional difficulties that students with LD might face while writing Urdu.

The CLT (Sweller, 1988; Paas et al., 2003; Sweller et al., 2019) argues that learning can be enhanced if instructional design reduces the unnecessary cognitive load and supports the construction of schemas. Cognitive load management is especially important for LD students, who might be affected by limited working memory, which can affect writing. CLASP-W thus uses the principles of CLT in three ways: it sequences writing tasks from simple to complex, it lessens unnecessary cognitive strain by explicitly teaching writing skills, and it facilitates meaningful learning through structured practice.

Scaffolding theory, which is based on Vygotsky's (1978) theory of the Zone of Proximal Development (ZPD) and further developed by Wood et al. (1976), focuses on guided learning by providing temporary support for learning in a form that can be gradually withdrawn as the learner becomes more competent. In CLASP-W, scaffolded instruction is realized by providing models, practicing with guidance,

providing feedback, prompting, and gradually releasing responsibility, allowing students to become independent writers in Urdu.

Both theories have been applied to the field of education to a large extent, but so far, they have mostly been studied separately. CLASP-W, on the other hand, brings together their complementary work in a single instructional framework. The cognitive design of learning activities is implemented using CLT and the pedagogical delivery of learning activities is implemented using scaffolding theory. This integration allows for cognitively and developmentally appropriate teaching that meets the learning needs of LD students.

The theoretical contribution of this study is that these complementary theories can be systematically combined and practiced in an intervention specially developed for Urdu writing instruction. The study presents empirical evidence for an integrated instructional framework and extends the application of CLT and scaffolding theory to an under-researched linguistic and special education context by experimentally evaluating CLASP-W.

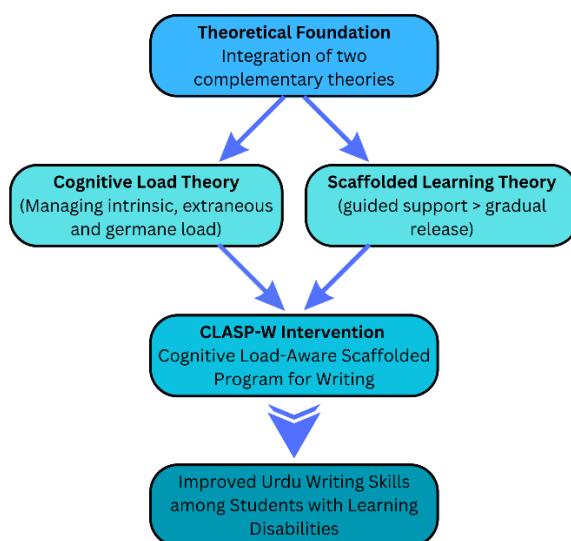


Figure 1. Theoretical Framework of the Study

2.10 Study Variables

There are two primary variables of the study. The independent variable of the study is the writing instruction, i.e., the CLASP-W intervention for the experimental group, while traditional classroom instructions are used for the control group. Urdu writing performance of LD students is the dependent variable, which includes respective aspects such as accuracy, articulateness, and placement of written work.

UWAR is the instrument to measure the Urdu writing attainment among LD students across tests.

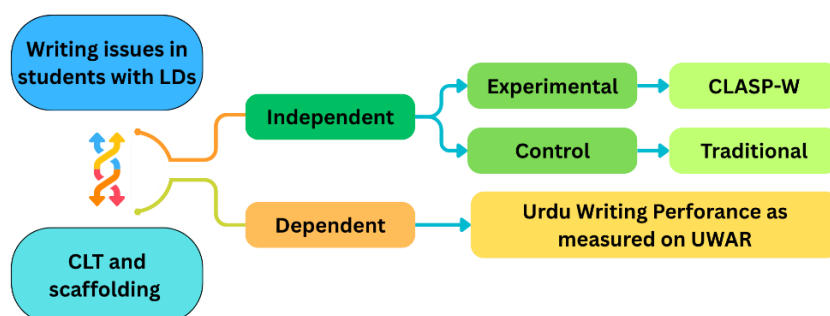


Figure 2. Conceptual Framework of the Study

3. METHODOLOGY

3.1 Research Designs

The study was quantitative in nature, and a pre-test-post-test control group experimental design was used to inquire the effectiveness of CLASP-W intervention on the Urdu writing skills of LD students. The design was selected to ensure the effectiveness of CLASP-W intervention by comparing the pre-test and post-test scores of those who participate in the intervention (experimental group) and those who retain with traditional instructions in the customary classroom (control group). The whole intervention was implemented by the researcher himself so that the consistency and fidelity could be ensured.

3.2 Population and Sample

The population of the study consisted of LD students presently pursuing at public special education schools of Rawalpindi District, Pakistan, who face wretchedness in writing tasks and indicate various symptoms like spelling errors, terrible sentence formation, and amorphous written expression. The participants were selected from the only special school in the city serving LD students. Initially students were identified from the school's official records of LD students, and later those who had difficulties in writing Urdu language were recommended by class teachers.

40 LD students (Grade IV and V; age ranging 11-15 years) were selected from the communicative population, using purposive sampling technique and then randomly assigned to a control group and an experimental group. Only those students were included who suit the inclusion criteria, i.e., they have diagnosed learning disabilities as per school record and exhibit challenges in writing tasks, peculiarly in Urdu language. The selection was made without gender discrimination, and both male ($n = 24$) and female ($n = 16$) participated in the study. The exclusion criteria were likewise set, and those students were excluded from study that either; have some comorbid condition like physical, ocular, or hearing impairment; have some major

intellectual or cognitive disability; or are unattended school during the intervention period.

Immediately after the selection of the participants, students were assigned unique identification codes and randomly split into the experimental and control groups with an online randomizer service (Randomizer.org) to ensure an unbiased process of splitting the groups of students. The experimental group ($n = 20$) received the CLASP-W intervention for the period of 8 weeks; and the control group ($n = 20$) continued their studies in the customary classroom using traditional instructional methods.

An a priori power analysis was not performed, but a post hoc power analysis using G*Power 3.1 was conducted, which showed that the achieved statistical power for the study was higher than the recommended level, indicating that the study had adequate statistical power to detect the observed intervention effects.

Table 1. Power Analysis

<i>Analysis</i>			<i>Test</i>	<i>n</i>	<i>Effect Size</i>	<i>Critical t</i>	<i>1 – β</i>
Post-test	Control	vs.	Post Hoc	20	$d = 1.37$	1.73	0.99
Experimental							
Experimental	Pre-test	vs.	Post Hoc	20+20	$d = 1.35$	1.69	0.99
Post-test							

A pre-test was conducted before the intervention. Once the intervention was completed, a post-test was conducted on both groups. Participants of both groups were from the same school, which ensured the contextual similitude. The researcher, who is, moreover, a teacher in the same school from where the sample was taken and the intervention was conducted, conducted the intervention himself.

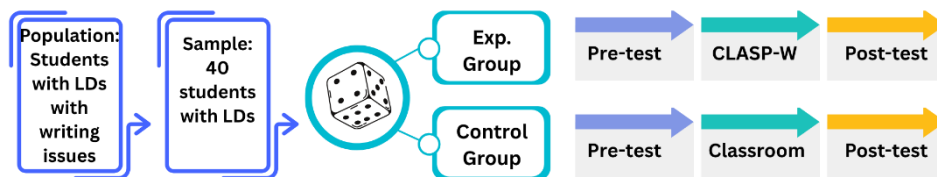


Figure 3. Study Plan

3.3 Instrumentation

This study developed and used an Urdu Writing Assessment Rubric (UWAR) for data collection. UWAR was used to appraise the performance of participants of both groups at pre-test and post-test. The instrument was developed specifically for the needs of LD students and was based on established writing assessment frameworks, while taking the objectives of CLASP-W into account.

UWAR was developed in a way to assess five basic domains of Urdu writing, i.e., (1) content relevance; (2) vocabulary and word choice; (3) sentence structure; (4) organization and coherence; and (5) mechanics of writing (e.g., spelling, punctuation, and clarity). Each domain was rated on a five-point scale where 1 was very poor and 5 was excellent. The total score was calculated by summing the scores from all domains, which ranged from 5 to 25, yielding a composite score treated as continuous. The instrument's reliability and validity were established through inter-rater reliability and content validation by experts.

Three experts from the domains of Urdu language, special education, and research reviewed the instrument and validated its content after some suggestions/revisions. After that, a pilot study was conducted where the instrument was used on a small sample of LD students with the same characteristics used in the inclusion and exclusion criteria for sample selection. Then this score was used to establish the internal consistency of the tool. Cronbach's alpha (α) coefficient was calculated, which gave the results of $\alpha = 0.82$; which indicates good internal consistency of the instrument (Agbo, 2010). Then their writing was assessed by three independent teachers (raters).

The scores obtained from the raters were used for analysis of inter-rater agreement. Intraclass Correlation Coefficient (ICC) was used to analyze the scores of raters. The obtained value of the coefficient was $ICC(3,3) = 0.77$, which indicates good agreement among raters (Koo & Li, 2016) and confirms UWAR's reliability.

3.4 Intervention Plan

The study designed the intervention, named Cognitive Load-Aware Scaffolded Program for Writing (CLASP-W). CLASP-W was particularly designed to improve Urdu writing skills of LD students. It is a consolidation of principles of CLT (Sweller, 1988) and Vygotsky's concept of scaffolding. It is a unified program that focuses on the dispensation of cognitive loads of working memory of LD students as suggested in CLT while using scaffolding as a technique. CLASP-W is designed in a way that it minimizes the unneeded cognitive burden which LD students face while developing their writing skills.

The intervention was applied for a period of 8 weeks; with four 45–60-minute sessions per week; totaling 32 sessions. The participants of the experimental group received CLASP-W intervention during this period, while the control group continued with regular classroom instructions using the traditional instructional methods without cognitive administration modifications. The researcher himself conducted all the sessions so that the fidelity could be ensured.

The CLASP-W program was organized into four phases, where each phase continued for 2 weeks (8 sessions). Each phase had its own allied stage of writing development:

- Phase I was the “Word Formation and Vocabulary Building”, which continued for the first two weeks (Sessions 1-8). In this phase, students learned to recognize the words and spellings. “Modality Effect” technique of CLT was applied during this phase, where optical tools were used. Various teaching techniques were used in this phase, e.g., visual aids and phonetic drills. Then these techniques were incorporated with scaffolding to gradually abatement the support.
- Phase II was the “Word to Sentence Construction”, which continued in week 3 and 4 (Sessions 9-16). In this phase students used to originate sentences while using accurate grammar and conjunctions (e.g., اور, لیکن, کیونکہ). The "Worked Examples" technique from CLT was used in this phase, where the teacher provided support in the form of simulation. Teaching techniques were incorporated with the scaffolding principle, and support was faded with the time.
- Phase III was “Sentence to Paragraph Development”, which continued over week 5 and 6 (Sessions 17-24). During this phase the students learned to write paragraphs while sequencing the sentences logically. “Graphic Organizers” and “Focussed Feedback” strategies of CLT were employed in this phase. These supports were gradually withdrawn to develop the habits to self-existent writing.
- Phase IV was “Independent Composition” which continued for the last two weeks (Sessions 25-32). In this final phase, students learned to plan and write a full part of composition on the topics they are accustomed with. (e.g., “میرا گھر”, “میرا دوست”, “چھٹی کا دن”). Scaffolding technique was applied in this phase. Initially the teacher support was given to the students in the form of instant feedback and modeling, but then this support was gradually reduced so that the student could learn to write independently.

Each session was structured and designed in a way that a routine could be followed: (1) On the start of each session, students had to perform a short warm-up activity so that their prior cognition could be activated; (2) then, the teacher modelled the target skill of the session; (3) after that, students had to practice the task, and teacher used scaffolding technique, and if necessary straightaway feedback was provided; (4) at the end, student had to apply the conditioned skills independently; (5) at the end, a short discussion session was held about for reflection and feedback.

Instructional techniques used during this intervention were grounded in the principles of CLT. Several CLT-based principles were applied, i.e., worked examples, task segmentation, multimodal supports, and dual coding. Scaffolding remained the main principle that was used in the intervention, and other techniques were used in the form of scaffolds so that they were provided as a support ab initio and then faded out stepwise.

Table 2: Summary of the CLASP-W Intervention for Replication

<i>Phase</i>	<i>Sessions</i>	<i>Learning Focus</i>	<i>Key Instructional Activities</i>	<i>Cognitive Load Strategy</i>	<i>Scaffolds/Materials</i>	<i>Expected Outcome</i>
I. Word Formation & Vocabulary	1–8	Vocabulary, spelling, word recognition	Picture-word matching, word formation, vocabulary games, dictation	Reduce intrinsic load through mastery of basic units	Word cards, visuals, morpheme charts	Automatic word recognition and vocabulary development
II. Word-to-Sentence Construction	9–16	Sentence construction	Sentence frames, jumbled words, picture description, guided sentence writing	Manage intrinsic load using structured sentence templates	Sentence templates, word banks, connector cue cards	Accurate and meaningful sentence construction
III. Sentence-to-Paragraph Development	17–24	Paragraph organization	Paragraph templates, sequencing activities, descriptive and narrative paragraph writing	Reduce extraneous load through visual organization	Graphic organizers, colour-coded paragraph maps	Coherent paragraph writing
IV. Independent Composition	25–32	Independent composition writing	Brainstorming, composition writing, peer review, self-reflection	Promote germane load through independent schema construction	Minimal prompts, self-reflection checklist	Independent and coherent Urdu composition writing

A detailed session-by-session intervention manual that outlines instructional objectives, classroom activities, and scaffolds, as well as learning materials, was created for CLASP-W and is summarized in Table 2; the full manual can be obtained upon reasonable request from the corresponding author.

In the intervention period, students in the control group continued to receive the school's normal Urdu writing instruction as per regular classroom practice as followed by the participating school. During the study period, they did not receive any of the CLASP-W components. Instructional content and intervention supports were shared with the school following completion of the study to promote ethical fairness.

3.5 Ethical Considerations

Ethical standards were followed throughout the study, from selection of the sample to the report writing. Before the study started, formal approval was obtained from the administration of the school. Parents of students were contacted and briefed about the objectives and length of the intervention. The parents/guardians provided informed consent for the engagement of their children in the intervention. Involvement in the intervention was voluntary, and only those students were added who were willing to take part in the intervention. No pressure was exerted on the students at any stage. Participants were given the right to withdraw at any stage of the study without any loss or distress. No physical, psychological or emotional damage was caused to participating students. Since these participants were LD students, additional care was given, and the research morality of both the children's participation and of the persons with disabilities was considered. The intervention (CLASP-W) was developed to be helpful for the improvement in academics and not distracting; and it abreast with the syllabus. Participants of the control group continued with the regular classroom so that their performance would not be lacking. Respect and dignity of the participants was retained throughout the process.

Confidentiality and anonymity of the participants and their involvement was ensured. All the data was stored safely, and no one other than the researcher could access it. The data was used only for intend of the study. Codes were used instead of the identities of the participating students, and only aggregate analysis was reported instead of case-by-case scores. Names and identities of participants have not been revealed in data analysis or report.

3.6 Measures to Minimize Researcher Bias.

The researcher conducted the intervention, and to minimize the potential for researcher bias, several measures were implemented. A standardized approach to lesson plans and instructional procedures were implemented to ensure consistency across sessions throughout the intervention. Participants were randomly assigned to experimental and control groups, and outcome assessment was carried out with the standardized UWAR. Writing samples of the students were independently judged by three trained judges and inter-rater reliability was checked before data analysis.

Furthermore, during data analysis, names of the participants were replaced by identification codes to minimize the chances of assessment bias.

3.7 Intervention Fidelity.

To ensure intervention fidelity, CLASP-W was implemented using a four-phase sequence of interventions over 32 sessions as outlined in the instructional sequence. The same researcher performed all sessions with the same lesson procedures, instructional materials, and session objectives. All sessions had a similar structure starting with a warm-up activity, teacher modeling, guided practice, scaffolded practice, independent practice, and feedback. The planned instructional sequence was followed across the intervention to ensure consistency of program implementation.

4. DATA ANALYSIS

4.1 Descriptive Statistics

Pre-test and post-test scores of both groups were summarized through descriptive statistics.

Table 3. Descriptive Statistics

<i>Group / Test</i>	<i>n</i>	<i>Mean</i>	<i>Median</i>	<i>SD</i>	<i>Var</i>
Control: Pre-test	20	10.10	10.0	1.74	3.04
Control: Post-test	20	11.05	11.0	1.57	2.47
Experimental: Pre-test	20	9.65	10.0	1.84	3.40
Experimental: Post-test	20	13.90	14.0	1.92	3.67

The results of descriptive statistics indicate that both groups were at the same stage before the intervention. At post-test, the experimental group showed a sizable increase in score ($M + 4.25$ gain) as compared to the control group ($M + 0.95$ gain). Variance remained moderate, which indicates that the scoring was coherent.

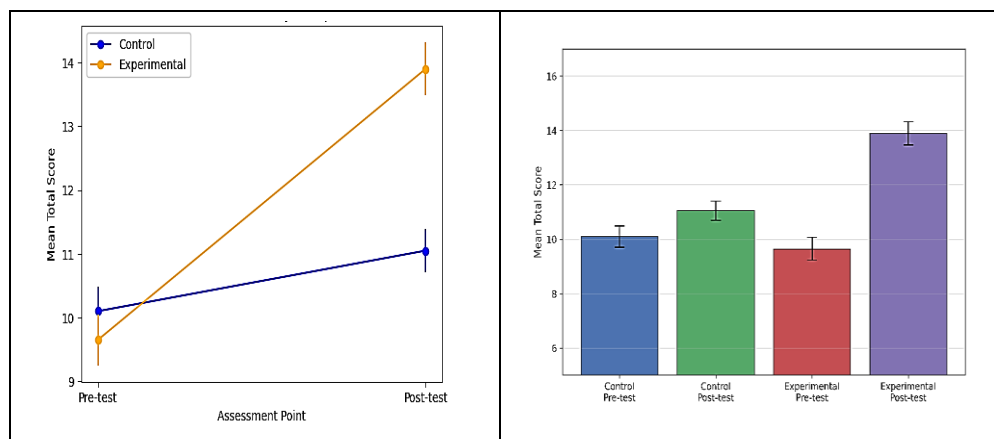


Figure 4. Mean Scores with Standard Error Bars.

Figure 4 shows the mean scores of both groups across tests with error bars (± 1 standard error of the mean). A steeper increase in the experimental group can be ascertained which indicates greater progression than the control group.

4.2 Normality Test

The Shapiro–Wilk test was conducted to examine the normal distribution of data to establish the assumptions required for parametric tests.

Table 4. Shapiro–Wilk Test for Normality

<i>Group / Test</i>	<i>W</i>	<i>p</i>	<i>Normality ($\alpha = .05$)</i>
Control (pre-test)	0.9447	0.2935	Normally distributed
Control (post-test)	0.9549	0.4469	Normally distributed
Experimental (pre-test)	0.9315	0.1649	Normally distributed
Experimental (post-test)	0.9643	0.6328	Normally distributed

Results of the Shapiro-Wilk test reveal that all datasets are normally distributed (all $p > .05$). It allows utilizing the parametric tests for hypothesis testing.

4.3 Homogeneity of Variances

Levene's test was conducted to determine equality of variances (mean-centered), which is the standard assumption check for the independent-samples t-test.

Table 5. Levene's Test for Equality of Variances

<i>Comparison</i>	<i>F</i>	<i>p</i>	<i>Interpretation</i>
Pre-test (Control vs. Experimental)	0.175	.678	Homogeneity of variances assumed
Post-test (Control vs. Experimental)	1.104	.300	Homogeneity of variances assumed

Levene's test indicated that the assumption of homogeneity of variances was satisfied for both the pre-test and post-test group comparisons (both $p > .05$), supporting the use of independent-samples t-tests.

4.4 Pre-test Group Comparison

An independent-samples *t*-test was performed to equate the pre-test scores of both groups to establish baseline comparability.

Table 6. Independent Samples t-test for Pre-test Scores

<i>Group</i>	<i>n</i>	<i>M</i>	<i>ΔM</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>95% CI</i>
Control	20	10.10	0.45	0.78	38	0.44	[-0.70, 1.60]

Experimental 20 9.65
1

The results present that the dissimilarity between groups at pre-test was not statistically significant, $t(38) = 0.78, p = 0.44$. It justifies the baseline comparability. The 95% CI included zero, indicating no significant baseline difference between the experimental and control groups.

4.5 Within-Group Comparison (Control Group)

A paired samples t -test was conducted for the control group to measure the progress of accomplishment.

Table 7. Paired Samples t -test for Control Group

<i>Test</i>	<i>n</i>	<i>M</i>	<i>ΔM</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>95% CI</i>
Pre-test	20	10.10	0.95	-1.79	19	0.089	[-0.16, 2.06]
Post-test	20	11.05					

The results revealed that the progression in the score of the control group across tests was not statistically significant, $t(19) = -1.79, p = .089$. It indicates that traditional classroom instruction did not yield meaningful results. The 95% CI included zero, indicating no significant pre-post improvement in the control group.

4.6 Within-Group Comparison (Experimental Group)

A paired samples t -test was also conducted for the experimental group to evaluate the progress of accomplishment.

Table 8. Paired Samples t -test for Experimental Group

<i>Test</i>	<i>n</i>	<i>M</i>	<i>ΔM</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>95% CI</i>
Pre-test	20	9.65	4.25	-6.15	19	< .001	[2.80, 5.70]
Post-test	20	13.90					

The results exhibit a significant progression in the score of the experimental group across tests, $t(19) = -6.15, p < .001$. It indicates that CLASP-W intervention produced significant gains in the accomplishment of LD students. The 95% CI excluded zero, indicating a significant improvement following the CLASP-W intervention.

4.7 Post-test Between-Groups Comparison

An independent samples t -test was conducted to equate post-test performance between the groups to evaluate the overall improvement.

Table 9. Independent Samples t -test for Post-test Scores

<i>Group</i>	<i>n</i>	<i>M</i>	<i>ΔM</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>95% CI</i>
Control	20	11.05	2.85	-5.14	38	< .001	[1.73, 3.97]
Experimental	20	13.90					

The results revealed a significant difference between groups, $t(38) = -5.14$, $p < .001$. It confirms that the CLASP-W intervention is a clever scheme to promote Urdu writing skills among the LD students. The 95% CI excluded zero, indicating a significant post-test difference in favor of the experimental group.

4.8 Effect Size

Cohen's d values were measured to establish the magnitude of advancement.

Table 10. Cohen's d Values Effect Size

<i>Comparison</i>	<i>Test Type</i>	<i>d</i>	<i>Interpretation</i>
Post-test (Control vs. Experimental)	Independent sample	1.35	Large Effect Size
Experimental Group (Pre-test vs. Post-test)	Paired sample	1.37	Large Effect Size

The intervention effect was large ($d = 1.35$; $d = 1.37$), meaning that the result was statistically significant and educationally meaningful. The significant effect implies that students who were instructed by CLASP-W achieved significantly better improvement in Urdu writing when compared to students being taught through conventional teaching. It is found that CLASP-W is practicable as an instructional strategy to enhance the Urdu writing skills of LD students.

4.9 Homogeneity of Regression Slopes

The assumption of homogeneity of regression slopes for ANCOVA was investigated by testing for an interaction between the covariate (pre-test scores) and the grouping variable.

Table 11. Test of Homogeneity of Regression Slopes

<i>Source</i>	<i>F</i>	<i>p</i>	<i>Interpretation</i>
Pre-test $\times$ Group	1.23	.274	Homogeneity of regression slopes satisfied

The covariate by group interaction was not significant ($p > .05$); this indicates that the relationship between pre-test and post-test scores was consistent across both groups. Therefore, the assumption of homogeneity of regression slopes for ANCOVA was satisfied.

4.10 Analysis of Covariance

An analysis of covariance (ANCOVA) was likewise conducted to equate post-test performance between the groups while controlling for pre-test scores.

Table 12. ANCOVA for Post-test Scores Controlling Pre-test Scores

<i>Source of Variation</i>	<i>df</i>	<i>F</i>	<i>p</i>	<i>Partial η^2</i>
Pre-test (Covariate)	1	1.66	.205	.04
Group (Control vs. Experimental)	1	24.80	< .001	.40
Error	37			

The results showed a statistically significant group effect, $F(1, 37) = 24.80$, $p < .001$. The covariate was not a significant predictor for post-test performance, $F(1, 37) = 1.66$, $p = .205$. The large partial eta squared ($\eta^2_p = .40$) suggests that group membership explained approximately 40% of adjusted variance in post-test Urdu writing scores that remained after controlling for pre-test scores, which further demonstrates the practical educational utility of the CLASP-W intervention.

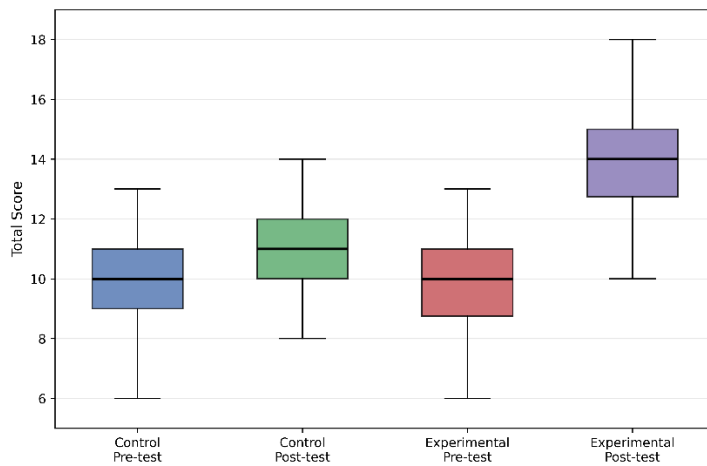


Figure 5.Boxplot of Pre-test and Post-test Scores

Figure 5 shows the boxplot distribution of median and variability of scores of both groups across tests. The distribution of scores of the experimental group shifts upward as compared to the control group. It indicates that participation in CLASP-W significantly improved the Urdu writing skills among participants.

5. DISCUSSION

The results indicate that CLASP-W is an effective instructional program for enhancing the writing skills of Urdu language among LD students. There was also a significantly higher overall increase in the students who were assigned to the intervention and the effects of the intervention were still observed when baseline scores were taken into account. The results of this study suggest that when cognitive load management is combined with scaffolded instruction, it is a strong instructional method that can be used to help teach writing to LD students.

The effectiveness of CLASP-W can be attributed to the combination of CLT and scaffolding. The intervention was planned in a manner consistent with the tenets of CLT, namely by breaking down overlearned cognitive demands by presenting students with the writing task in sequential steps, layering difficulty, and breaking down learning materials into manageable units of instruction. This instructional design may have minimized the unnecessary mental workload and allowed students to allocate more of their working memory to schema construction and to writing, which positively influence learning outcomes (Choi et al., 2014). Similarly, the gradual introduction and removal of teaching support is consistent with the principles of scaffolding, which are the principles of allowing students to perform beyond their current level of competence and then slowly getting the students to perform independently (Larkin, 2001). The use of worked examples, guided practice, immediate feedback, and progressive fading of support in CLASP-W likely facilitated the transition from assisted to independent writing.

The current results are compatible with earlier international studies showing how effective cognitively informed and scaffolded instructional interventions are for education. In studies that used CLT to improve writing performance, similar improvement has been reported (Silva et al., 2024); studies that used integrated interventions to support LD students, similar improvement was reported (Kim & Zagata, 2024); studies that used scaffolded approaches to instruction, similar improvement was reported (Puntambekar, 2022); and studies that used cognitively aware intervention in special education, similar improvement was reported (Babulicova & Polackova, 2024). A similar finding was observed by Jiang and Kalyuga (2022), who found that instructional methods that manage cognitive demands of the learners had significant effects on writing outcomes, and by Tai et al. (2021) who noted that structured scaffolding enhanced learner independence and writing quality. These results were consistent across all educational environments, indicating that scaffolding and cognitive load management is an effective pedagogical strategy for supporting LD students.

The study also makes a theoretical contribution to the field of instructional design in special education. CLT and scaffolding have often been explored separately, but CLASP-W is one example of how CLT and scaffolding could work together to create a unified framework for designing writing interventions for LD students. CLT provides a framework for structuring materials to maximize the

amount of information available for processing in a learner's limited working memory, while scaffolding gives a structure to the instructional method by which the support is transferred from the instructor to the learner. Combining these complementary views, however, extends the scope of both theories to Urdu writing instruction in special education and provides a theoretical base for future intervention development with evidence.

The results also have vital implications for inclusive education and classroom practice. CLASP-W offers teachers a systematic model for managing the cognitive demands of learning, promoting progressive independence in writing. The intervention can be utilized in special education schools and in classrooms where LD students need individualized instructional support, since it focuses mainly on instructional organization and does not depend on high-tech or costly materials. The intervention, therefore, is a practical, cost-effective, and evidence-based method to enhance Urdu writing instruction in resource-limited learning environments. In addition, the UWAR, developed and validated in the current study, offers a usable instrument for teachers to track student writing and to guide instructional decisions.

6. CONCLUSION

The present study has shown that CLASP-W is an effective instructional intervention to enhance Urdu writing among LD students. This CLT-based scaffolding practice minimized cognitive load, and systematic instructional scaffolding encouraged independent writing gradually. In addition to the statistically significant results, the results of the study reveal the importance of using cognitively informed instructional design in special and inclusive education. Overall, the findings advocate for CLASP-W as an evidence-based approach for improving Urdu writing instruction of LD students.

7. RECOMMENDATIONS

Pursuit the findings of the study, various recommendations are being proposed:

1. Since in this study it has already been accomplished that consolidation of the principles of CLT and scaffolding can heighten the learning outcomes among LD students, teachers may annex these principles in lesson preparation for LD students.
2. Being an evidence-based strategy, CLASP-W or other related programs may be adopted in schools for Urdu and other subjects to encourage LD students.
3. Teacher education programs may be designed in a way that teachers can carry out the principles of CLT and scaffolded learning in their classrooms.
4. Policymakers may include CLT-based material in the syllabus of LD students.
5. Researchers may replicate the CLASP-W intervention and examine its effectiveness in larger samples for the generalizability of the results.

Effectiveness of the intervention may also be investigated across age groups, grades, impairment type and languages. Longitudinal studies may be conducted to measure the retention and transferability of the results.

8. LIMITATIONS OF THE STUDY

Although the findings of the study are vivid and significant, the study has some limitations: First, the sample size was small ($n = 40$), and the sample was taken from one school alone. This may limit the generalizability. Second, an experimental design was used. Although random assignment was employed, it may have introduced contextual or instructional factors. Third, the period of the intervention was limited (8 weeks). As a result, long-term retention and transferability of results could not be investigated. Fourth, UWAR was used as a data collection instrument. It is a teacher-rated scale. Although it yields good inter-rater reliability, it may have gone through subjective judgment. Fifth, the researcher was a teacher at the same school. Although it increased the fidelity, it may have caused expectancy effects.

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