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Development and Content Validation of an Expert-Informed Cognitive Performance Intervention Protocol for Children With Specific Learning Disorder: A Qualitative Protocol-Development Study

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A B S T R A C T

Specific learning disorder is frequently accompanied by weaknesses in executive functioning, sustained attention, inhibitory control, working memory, and cognitive organization. These cognitive vulnerabilities can interfere with academic participation and everyday learning demands, yet many available interventions target isolated skills rather than integrated cognitive needs. This study aimed to develop and examine the content validity of an expert-informed cognitive performance intervention protocol for children with specific learning disorder. A developmental qualitative protocol-development design was used. Semi-structured interviews were conducted with 10 specialists working in specific learning disorder assessment and intervention centers in Qom, Iran. Interview data were analyzed using inductive thematic analysis following Braun and Clarke's six-phase approach. Trustworthiness was supported through triangulation, participant review, and independent coding; intercoder agreement was 0.83. The extracted evidence was then used to construct a 10-session, 45-minute cognitive performance protocol targeting sustained attention, response inhibition, working memory, visual and auditory memory, simultaneous processing, cognitive organization, and emotion regulation. Expert review indicated acceptable content validity, with an overall agreement coefficient of 0.84. The findings support the protocol as a preliminary, content-validated, expert-informed intervention framework rather than evidence of clinical effectiveness. Future studies should examine feasibility, acceptability, and outcome effects through pilot and controlled implementation studies.

Keywords: *specific learning disorder; cognitive rehabilitation; working memory; effortful control; thematic analysis; content validity; protocol development*

1. Introduction

Specific learning disorder (SLD) is a neurodevelopmental condition characterized by persistent difficulties in academic skills such as reading, written expression, or mathematics, despite adequate educational opportunity and instruction (American Psychiatric, 2022). Beyond its academic manifestations, SLD is frequently associated with weaknesses in cognitive processes that support learning, including attention control, working memory, inhibitory control, processing speed, planning, and cognitive flexibility (Flogie et al., 2020; Giofrè et al., 2017; Toffalini et al., 2017). These cognitive difficulties can affect the child's capacity to follow instructions, sustain effort, organize information, inhibit premature responses, and use effective strategies during classroom tasks.

Working memory is particularly important because it allows children to temporarily maintain and manipulate information while performing complex learning activities. Evidence indicates that children with poor working memory often show difficulty in multi-step instructions, reading comprehension, arithmetic reasoning, and the integration of visual and verbal information (Baddeley, 2003; Gathercole et al., 2008; Kyttälä et al., 2019). Similarly, effortful control and response inhibition support the regulation of attention, behavior, and emotional reactivity during demanding cognitive tasks (Putnam & Rothbart, 2006; Rothbart et al., 2003). When working memory and effortful control are both weak, children may experience a mutually reinforcing cycle of cognitive overload, impulsive responding, task avoidance, and reduced academic confidence.

Although several intervention approaches have been used for children with SLD, many programs focus on isolated academic skills or single cognitive domains. Such approaches may produce limited transfer if they do not address the integrated nature of attention, inhibition, working memory, processing, emotional regulation, and environmental support. Recent work on cognitive training and technology-supported learning environments suggests that structured, interactive, and developmentally responsive activities may strengthen executive functioning and increase children's engagement, particularly when activities are embedded in meaningful educational routines (Di Lieto et al., 2020; Flogie et al., 2020; Wiest et al., 2022). However, the design of such programs should be grounded not only in theoretical models but also in the needs observed by practitioners who work directly with children with SLD.

In the Iranian educational and clinical context, there remains a need for a coherent, culturally adaptable cognitive performance protocol that integrates executive functioning, working memory, emotional regulation, and classroom applicability. Accordingly, the present study aimed to develop an expert-informed cognitive performance intervention protocol for children with SLD and to examine its preliminary content validity through specialist evaluation. The study did not test clinical effectiveness; rather, it focused on protocol development, thematic grounding, and expert-rated content adequacy.

2. Methods and Materials

2.1. Design

This developmental-applied study used a qualitative protocol-development design followed by expert-based content validation. The qualitative phase identified cognitive, emotional, educational, and intervention-related needs from specialist interviews. These findings were then translated into a structured intervention protocol and reviewed by experts for content relevance, coherence, and practical applicability. Because no child-level cognitive assessment, intervention implementation, or outcome testing was conducted, the study should be interpreted as a preliminary protocol-development and content-validation study rather than a full protocol-development effectiveness study.

2.2. Participants and Sampling

Participants were specialists in the assessment or intervention of children with SLD working in assessment, education, rehabilitation, and early developmental intervention centers in Qom, Iran. The empirical data were obtained from specialists, not directly from children or parents. Participants were selected using purposive sampling based on professional experience with primary-school-age children with learning difficulties. Interviews continued until information saturation was reached, resulting in 10 participants.

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Table 1

Characteristics of qualitative-phase participants.

Participant	Gender	Degree	Field	Professional experience (years)
E1	Female	M.A.	Psychology	26
E2	Female	Ph.D.	Psychology	30
E3	Female	M.A.	Psychology	20
E4	Male	M.A.	Educational psychology	29
E5	Female	M.A.	Psychology	16
E6	Female	B.A.	Psychology	18
E7	Female	Ph.D. student	Psychology	26
E8	Female	M.A.	Educational psychology	15
E9	Female	Ph.D.	Psychology	30
E10	Female	Ph.D.	Exceptional children psychology	20

2.3. Data Collection

Data were collected through semi-structured interviews. Interview questions were designed using three sources: existing protocols and interventions related to SLD, the clinical and educational experience of specialists, and the theoretical and empirical literature on cognitive functioning. The interviews focused on cognitive needs, behavioral and emotional difficulties, intervention priorities, feasibility of implementation, and conditions required for home and classroom transfer. In addition to interviews, a targeted document analysis was conducted to extract intervention techniques and session activities relevant to attention, response inhibition, working memory, visual-auditory processing, organization, and emotion regulation.

2.4. Data Analysis and Trustworthiness

Interview data were analyzed using inductive thematic analysis following Braun and Clarke's (2006) six phases (Braun & Clarke, 2006): familiarization with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Coding was inductive and was not forced into a pre-existing category system. Trustworthiness was strengthened through data-source triangulation, comparison of coding decisions, participant review, and application of the credibility, transferability, dependability, and confirmability criteria proposed by Lincoln and Guba (1985) (Guba & Lincoln, 1985). A second coder independently coded part of the interview material. Intercoder agreement was calculated from 15 agreements and 3 disagreements, yielding an agreement coefficient of 0.83, which indicated acceptable coding reliability.

2.5. Protocol Development and Content Validation

After the thematic analysis, the extracted themes were translated into intervention components and organized into a 10-session cognitive performance protocol. Each session was designed to address a clearly defined cognitive or behavioral target. The preliminary protocol was reviewed by specialists in cognitive psychology, learning disorders, and cognitive rehabilitation. Reviewers evaluated the session sequence, conceptual coherence, developmental appropriateness, intervention techniques, and applicability in educational and clinical settings. The overall expert agreement coefficient was 0.84, supporting acceptable content validity. This coefficient should be interpreted as evidence of expert-rated content adequacy only; it does not establish feasibility, efficacy, or clinical effectiveness.

3. Findings and Results

The qualitative analysis produced 12 final integrated codes. These codes reflected the cognitive, emotional, educational, and intervention-design needs identified by specialists. Table 2 summarizes the final codes and subthemes

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Table 2

Final integrated codes and subthemes extracted from specialist interviews.

No.	Final integrated code	Subthemes
1	Sustained attention deficit	Reduced attention persistence; difficulty maintaining focus; inefficient selective attention; rapid distractibility
2	Response inhibition deficit and impulsivity	Cognitive impulsivity; behavioral impulsivity; difficulty stopping responses; weak emotion-related inhibitory control
3	Working memory weakness: maintenance	Poor retention of instructions; step-by-step forgetting; difficulty holding multi-part information
4	Working memory weakness: processing	Inefficient information processing; weak integration of new and prior information; difficulty manipulating information mentally
5	Simultaneous processing weakness	Difficulty with multisensory processing; weak visual-auditory coordination; difficulty performing simultaneous activities
6	Visual memory weakness	Difficulty memorizing visual information; difficulty following visual sequences; weak retention of images and shapes
7	Auditory memory weakness	Poor retention of auditory stimuli; forgetting oral instructions; inefficient auditory rehearsal
8	Cognitive organization weakness	Inefficient planning; weak sorting/classification; weak semantic organization; difficulty sequencing steps
9	Emotion and impulse regulation weakness	Performance anxiety; lack of relaxation skills; emotional fluctuation; insufficient emotional control
10	Environmental and educational influences	Limited teacher skills; inappropriate classroom structure or density; weak parental participation; lack of suitable resources
11	Features of a desirable protocol	Flexibility; usability at home and school; game-based and engaging format; gradual sequencing; generalizability
12	Use of technology in intervention	Digital attention tools; Go/No-Go activities; digital Stroop-like tasks; cognitive games; staged applications

Further analysis organized these 12 codes into four overarching themes. The first theme, cognitive-executive challenges, included deficits in attention, inhibition, working memory, simultaneous processing, visual and auditory memory, and cognitive organization. The second theme, emotional-behavioral difficulties, captured problems in emotion regulation and impulsive reactions during demanding learning tasks. The third theme emphasized environmental and educational factors, including teacher preparation, classroom structure, parental involvement, and access to suitable resources. The fourth theme concerned features of effective intervention, including flexibility, gradual progression, game-based activities, technology support, and transfer to home and classroom contexts.

Table 3

Main themes derived from the qualitative analysis.

No.	Main theme	Level	Related codes	Interpretive summary
1	Cognitive-executive challenges	Individual-cognitive	Sustained attention, response inhibition, working memory, simultaneous processing, visual/auditory memory, cognitive organization	Core difficulties in executive functions and information processing that affect academic and behavioral performance.
2	Emotional-behavioral difficulties	Emotional	Emotion and impulse regulation weakness	Emotional challenges such as anxiety, impulsivity, and affective fluctuation that interact with cognitive functioning.
3	Environmental and educational influences	Contextual	School, teacher, parent, and resource factors	Home and school conditions that may intensify or reduce learning problems and determine implementation feasibility.
4	Features of an effective intervention	Intervention-related	Protocol characteristics and technology use	Design requirements such as gradual structure, game-based activities, flexibility, and technology-supported practice.

The conceptual model developed from the analysis is presented in Figure 1. The model indicates that cognitive-executive challenges, emotional-behavioral difficulties, and educational-environmental factors jointly informed the design of the intervention. The intervention pathway was organized around game-based, stepwise, flexible, technology-supported, and home/school-applicable activities, with the intended aim of improving underlying cognitive functions. The model is conceptual and requires empirical testing in future implementation studies.

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Figure 1

Conceptual model linking identified needs, intervention design, and expected cognitive outcomes.

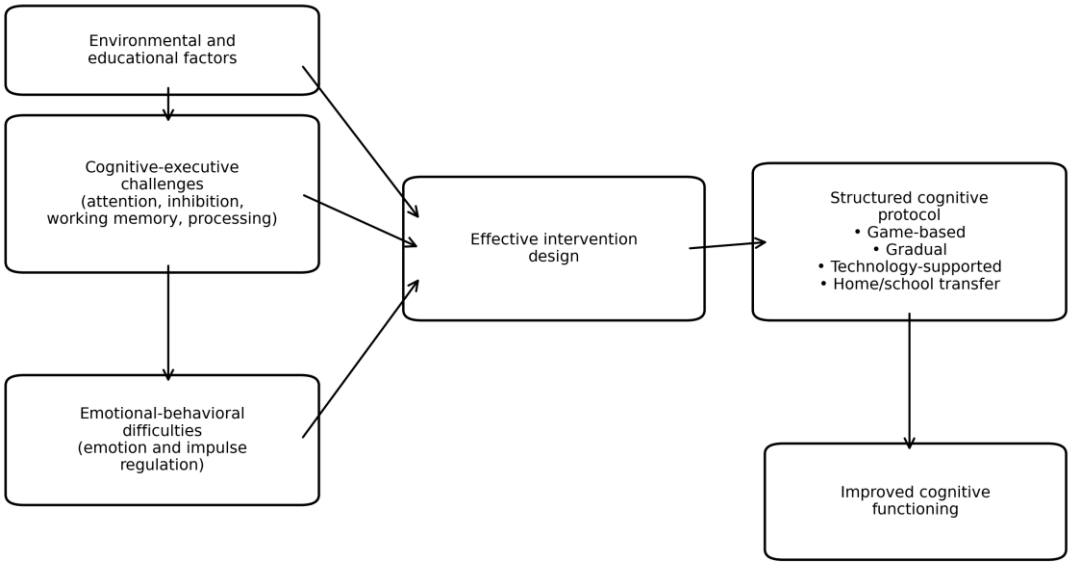

Table 4

Ten-session cognitive performance intervention protocol for children with SLD.

Session	Target component	Intervention objectives	Suggested between-session tasks
1	Orientation, parent education, and motivation	Explain the intervention model and the role of executive functions; educate parents about SLD and environmental support; build rapport and motivation; assess child preferences and strengths.	Parent observation of daily challenges; simple motivational activity with the child.
2	Sustained attention	Increase capacity to maintain focus on a stimulus or task; reduce internal and external distractibility; extend duration of focused activity.	Brief sustained-attention exercises; concentration games such as finding differences.
3	Selective attention and response inhibition	Improve filtering of irrelevant information; increase accuracy under competing stimuli; support divided attention in simple tasks.	Timed search activities; simple dual-task practice such as listening while drawing.
4	Impulsivity reduction and response inhibition	Strengthen control of automatic responses; increase reflective pause before responding; reduce errors caused by hasty responses.	Stop-signal games such as Go-Stop; counting before responding.
5	Advanced cognitive inhibition and interference control	Improve inhibition of distracting information; practice Stroop-like conflict control; increase cognitive flexibility when rules change.	Simplified Stroop activities; card-sorting tasks with rule changes.
6	Basic verbal and visual working memory	Increase retention and manipulation of verbal and numeric information; improve retention of nonverbal visual information; follow simple multi-step instructions.	Repeat sentences or digits forward and backward; “what is missing?” visual memory games.
7	Complex working memory and cognitive organization	Improve simultaneous processing and maintenance of multiple information types; support planning and multi-step problem solving; strengthen organizational strategies.	Logical puzzles with multiple rules; sorting objects by color, shape, and size.
8	Visual memory and spatial processing	Improve memory for shapes, patterns, and spatial locations; strengthen visual encoding and retrieval; support spatial perception.	Visual memory games; reconstructing visual patterns after removal of the model.
9	Auditory memory and simultaneous processing	Improve memory for words, sentences, and oral instructions; increase speed of auditory processing; integrate auditory and visual information.	Repeat word or sentence sequences; true/false auditory games; simple visual-auditory dual tasks.
10	Emotion regulation, consolidation, and transfer	Teach simple strategies for managing learning-related emotions; review and consolidate learned cognitive skills; plan transfer to school and home.	Personal strategy map; parent-child discussion about continued support and practice.

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4. Discussion

The present study developed a preliminary, content-validated cognitive performance intervention protocol for children with SLD through qualitative analysis of specialist interviews and expert review. The findings identified four broad domains that should guide cognitive intervention design: cognitive-executive challenges, emotional-behavioral difficulties, educational-environmental conditions, and features of an effective intervention. These domains suggest that intervention for children with SLD should not be limited to isolated academic remediation. Instead, it should address the cognitive systems that support learning, including sustained attention, response inhibition, working memory, visual and auditory processing, cognitive organization, and emotional self-regulation.

A central contribution of the study is the integration of cognitive-executive and emotional-behavioral needs within a single structured protocol. The expert interviews indicated that learning difficulties are often intensified when weaknesses in attention, inhibition, and working memory interact with frustration, anxiety, impulsive responding, or low persistence. This finding is consistent with executive-function accounts of learning difficulties, which emphasize the role of inhibition, working memory, and self-regulation in academic task performance. Accordingly, the protocol combines cognitive exercises with activities that support emotional regulation and controlled responding.

The protocol also reflects the importance of intervention design. Experts favored activities that are game-based, flexible, stepwise, and applicable across home and school contexts. This is relevant because children with SLD may show limited engagement with repetitive or decontextualized training tasks. The inclusion of technology-supported activities may increase motivation and provide structured feedback, but the manuscript avoids claiming that technology itself guarantees effectiveness. Instead, technology is treated as a delivery aid that should be embedded within a theoretically coherent and developmentally appropriate intervention framework.

The expert agreement coefficient of 0.84 suggests that the protocol has acceptable content validity and practical coherence. However, the findings should be interpreted cautiously. The study did not include direct assessment of children, parent interviews, feasibility testing, pilot implementation, pretest-posttest measurement, or clinical outcome evaluation. Therefore, the protocol should be described as a preliminary content-validated framework, not as a proven intervention. Future research should examine acceptability among children, parents, and teachers; evaluate feasibility in real educational and clinical settings; and test effectiveness using controlled designs with cognitive and academic outcome measures. Additional studies in diverse cultural and educational contexts are also needed to determine whether the protocol can be generalized beyond the specialist sample used in this study.

5. Conclusion

This study produced a 10-session expert-informed cognitive performance intervention protocol for children with SLD and provided preliminary evidence of content validity based on specialist review. The protocol was grounded in qualitative evidence from specialists and organized around cognitive-executive, emotional-behavioral, environmental, and intervention-design domains. Its main value lies in offering a structured framework for future feasibility and effectiveness testing. Claims about clinical impact should be deferred until the protocol is implemented and evaluated with child-level outcome data.

Authors' Contributions

Fatemeh Mehrjardi contributed to study conception, data collection, analysis, and manuscript drafting. Hamdollah Jayervand contributed to methodological supervision, protocol development, and critical revision. Mohammadreza Bayat contributed to conceptual supervision, interpretation of findings, and manuscript revision. All authors approved the final version of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

The qualitative data supporting the findings are not publicly available because they contain participant-level interview information. De-identified data may be made available from the corresponding author upon reasonable request and subject to ethical restrictions.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and applicable institutional and national regulations for research involving human participants. Participation was voluntary, and specialists were informed about the study aims, interview procedures, confidentiality protections, and their right to withdraw. Informed consent was obtained before data collection. Interview data were anonymized and used only for research purposes. Ethical approval was obtained from the Islamic Azad University, Arak Branch Ethics Committee (Ethics code: IR.IAU.ARAK.REC.1404.291).

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