

Designing a Mathematics Concepts Educational Package for Students with Mathematics Learning Disability in Sari City

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Article Info

Article type:

Original Research

How to cite this article:

Yazdanian, M., Baezzat, F., & Qomian, S. (2026). Designing a Mathematics Concepts Educational Package for Students with Mathematics Learning Disability in Sari City. *Journal of Assessment and Research in Applied Counseling*, 8(1), 1-19.

<http://dx.doi.org/10.61838/kman.jarac.5249>



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ABSTRACT

Objective: The primary objective of this study was to design, develop, and validate an evidence-based educational package for teaching foundational mathematics concepts to elementary students with mathematics learning disabilities in Sari city.

Methods and Materials: This study employed a qualitative research design utilizing thematic analysis. The participant pool consisted of mathematics and special education specialists, selected through purposive sampling. Interviews continued until theoretical saturation was achieved after 12 participants, though 15 experts were ultimately interviewed to ensure absolute confidence. Data were collected using pre-designed, semi-structured audio-recorded interviews. The transcribed texts were analyzed utilizing MAXQDA software through a multi-stage coding process to identify overarching, organizing, and basic themes. To assess the validity and credibility of the designed package, quantitative metrics including the Content Validity Ratio (CVR) and the Content Validity Index (CVI) were calculated based on the expert panel's ratings.

Findings: The thematic analysis yielded a structured, 10-session educational package emphasizing concrete-to-abstract number teaching, practical multisensory activities, and the reduction of math-related anxiety. Key overarching themes extracted included number conceptual understanding, counting skills, comparative numerical relationships, four operations, and motivation/self-efficacy. The quantitative validation confirmed the package's high content validity. Depending on the session, CVR values were calculated at 0.60 (12 experts), 0.73 (13 experts), and 0.87 (14 experts). Furthermore, the item-level CVI (CVI-I) scores across the 10 sessions ranged from 0.80 to a peak of 0.93 (in the ninth session), with the scale-level CVI (CVI-S) for the first session established at 0.848.

Conclusion: The meticulously designed 10-session educational package is a highly valid, systematic framework. By combining concrete multisensory activities with targeted strategies to reduce emotional pressure, it provides educators with an effective, evidence-based tool to improve the mathematical self-efficacy and conceptual foundations of students with learning disabilities.

Keywords: Mathematics Learning Disability, Educational Package, Thematic Analysis

1. Introduction

Mathematics is universally recognized as a foundational pillar of cognitive development, playing an indispensable role in shaping problem-solving capabilities, logical reasoning, and sequential thinking from early childhood through advanced education. The development of deep mathematical thinking, particularly in preschool and primary educational settings, heavily relies on strengthening rudimentary concepts such as seriation, basic counting, and spatial awareness through carefully structured problem-solving activities (Torres-Peña et al., 2025). However, the acquisition of these seemingly intuitive numerical concepts poses profound and persistent challenges for a significant subset of the student population. Providing an effective, evidence-based answer to the complex special needs of children with learning difficulties remains one of the most pressing mandates for contemporary educators, developmental psychologists, and parents globally (Hornby, 2024). Students formally diagnosed with specific learning disabilities, particularly mathematics learning disability or dyscalculia, frequently face a compounding series of academic and cognitive hurdles that restrict their ability to map concrete quantities to abstract numerical symbols. These academic challenges are frequently exacerbated by the presence of comorbid learning disabilities, which require highly specialized, multi-tiered intervention frameworks to successfully disentangle overlapping cognitive deficits and facilitate meaningful, lasting learning (Espinás & Fuchs, 2025).

Beyond the pure cognitive and neurodevelopmental deficits associated with mathematical comprehension, the psychological and emotional toll on students with learning disabilities is immense and significantly hinders academic progress. The repeated, demoralizing experience of academic failure frequently engenders severe math anxiety, a debilitating affective condition that acts as a powerful cognitive filter, further blocking working memory capacity, information processing, and conceptual retention. Consequently, modern educational strategies and intervention packages must deliberately incorporate psychological and emotional scaffolding alongside traditional academic instruction. For instance, highly engaging instructional techniques, such as targeted storytelling methods, have demonstrated significant efficacy in reducing math anxiety by contextualizing abstract, intimidating mathematical logic within relatable, secure narrative frameworks (Irmayanti et al., 2025). Moreover,

deliberate remediation through interactive digital training programs has proven essential in effectively identifying and alleviating math anxiety during critical early developmental windows, particularly for early elementary students (Ng et al., 2022). Emotional regulation is equally vital; specialized training in cognitive emotion regulation and self-regulated learning strategies has been shown to significantly enhance the broader social adaptation and academic resilience of elementary students suffering from specific learning disorders, including deficits in reading and mathematics (Far et al., 2024). Holistic, adjunct interventions are also steadily gaining academic traction; recent research indicates that integrating multisensory teaching approaches with mindfulness practices such as yoga training can significantly enhance the fundamental self-esteem and behavioral parameters of children with pervasive learning disorders (Tom & Singh, 2023).

However, the successful, high-fidelity implementation of such multifaceted, psychologically supportive educational packages is inextricably linked to the professional competencies, pedagogical beliefs, and affective skills of the specific educators administering them. Even the most meticulously designed educational intervention will falter if the implementing teachers lack the necessary instructional capacity or psychological readiness to adapt to individual student needs. Investigating the modifications in teachers' underlying educational beliefs reveals critical, deeply rooted distinctions in pedagogical readiness, underscoring the absolute necessity of continuous, targeted professional development for both pre-service and novice special education teachers (Etela et al., 2023). Furthermore, the deliberate cultivation of affective-reflective skills through novel self-evaluation protocols empowers pre-service educators to critically analyze and adapt their instructional impact dynamically, a vital component when managing the nuanced, unpredictable behaviors of students with severe learning disabilities (Woolcott et al., 2024). Collaborative instructional paradigms also play a pivotal role in modern inclusion environments; comprehensive teacher preparation programs must robustly investigate and integrate diverse co-teaching models to ensure that specialized special education professionals and general classroom educators can seamlessly support inclusion classrooms without friction (Khasawneh, 2023). Within these collaborative ecosystems, the intrinsic motivations and emotional intelligence of mentor teachers profoundly influence the specific mentoring style adopted, directly impacting the enthusiasm, pedagogical development, and subsequent classroom

retention of novice teachers (Kuhn et al., 2024). Moreover, systematically evaluating and correcting teachers' effective teaching behaviors is crucial, as these micro-behaviors directly influence the efficiency of knowledge transfer, particularly in complex, high-needs, or blended instructional environments (Tan, 2022).

In contexts such as Iran, the evolving landscape of teacher preparation presents unique, structural challenges that directly affect the delivery and quality of specialized mathematics instruction. The stark competency gap between newly hired teachers admitted through traditional four-year university education courses and those rapidly recruited through alternative pathways, such as Article 28 of the Farhangian University Statute, is a subject of intense academic scrutiny and concern among school principals (Rafiei Afousi et al., 2024). Analyzing the complex lived experiences of teachers enrolled in the expedited, one-year Article 28 skill training courses frequently highlights severe systemic challenges in effectively linking theoretical pedagogical knowledge with the harsh, practical realities of modern inclusive classrooms (Ghanbarian Ghalandar et al., 2024). Comparative empirical evaluations utilizing complex frameworks like the TPACK (Technological Pedagogical Content Knowledge) model have further substantiated these disparities, emphasizing the urgent need for targeted, ongoing remediation and structured resource provision for alternative-pathway educators (Maroufi et al., 2023). Consequently, post-hire in-service training emerges as a critical, non-negotiable mechanism for standardizing and elevating teaching skills across diverse cohorts. A thorough pathology of standard in-service training for primary school teachers often reveals significant structural and content-related deficiencies that heavily undermine their real-world effectiveness (Saadatmand Manshadi, 2023). Despite these institutional pathologies, when meticulously designed and executed, targeted in-service training workshops have a profound, highly demonstrable effect on actively improving advanced teaching skills within dynamic classroom settings (Vaziri et al., 2024). The broader, longitudinal influence of such structured programs on continuous professional development is well-documented (Qaisra & Haider, 2023), serving as a fundamental catalyst for deep, sustained pedagogical change and identity shifts among primary school educators (Coburn & Borg, 2024). The necessity for this ongoing capacity building transcends regional and subject-specific boundaries, as evidenced by broad studies exploring the perceptions of ESL teachers (Asad & Javed, 2023) and foreign language instructors (Msamba et al.,

2023), all of whom heavily underscore the transformative potential of continuous education. Notably, highly structured, competency-based interventions, such as TKT-based training models, have been shown to significantly bolster the foundational professional beliefs and self-efficacy of teachers, uniquely enabling them to survive early career shocks and transition into highly confident, capable practitioners (Wang et al., 2023).

Despite the heavily acknowledged pedagogical benefits, educators attempting to engage in this continuous professional development often encounter formidable, systemic structural barriers that limit their growth. The severe scarcity of teachers' time resources is heavily implicated in rising rates of chronic job burnout, a dangerous phenomenon that is mediated by deteriorating mental health factors and ultimately compromises instructional quality for vulnerable students (Liu & Wang, 2024). Furthermore, deliberately identifying and analyzing the logistical, technological, and administrative problems teachers face when attempting to participate in supplementary or virtual in-service training is crucial for proactively designing accessible, frictionless development pathways (Raeisi Chamazketi, 2023). To circumvent these entrenched barriers, modern higher education institutions must urgently prioritize systemic institutional innovation, fundamentally redefining assessment protocols and expected educational outcomes to align with the demanding realities of the modern educational landscape (Bernstein, 2023). The overarching quality of special education training in higher education, which is intricately tied to national funding structures and the socio-economic developmental context, ultimately dictates the exact resources available for such vital pedagogical advancements (Hryhorash et al., 2023). Empowering teachers through comprehensive, ongoing assessment training significantly impacts their overall self-efficacy, shifting their attitudes favorably towards the rigorous data-driven decision-making practices that are absolutely essential for accurately monitoring students with learning disabilities (Schelling & Rubenstein, 2023). Innovative, blended delivery models are also proving highly effective at overcoming structural limitations; for instance, flipped learning paradigms have consistently demonstrated empirical superiority over traditional classrooms in developing prospective teachers' competence in designing complex, highly integrated instructional topics (Phan et al., 2022). Similarly, alternative, adaptive practicum models deployed during periods of systemic disruption, such as the highly successful 'class-academy' hybrid programs utilized

during the COVID-19 pandemic, have fostered remarkable resilience and adaptability among pre-service teachers (Nissim & Naifeld, 2024).

In the specific, highly demanding domain of special mathematics education, the deliberate intersection of specialized instructional design and advanced digital technology represents the most promising frontier for effectively remediating deep-seated learning disabilities. The integration of digital technologies into foundational mathematics education introduces vibrant academic discussions and unique implementation challenges, but it remains undeniably aligned with the most critical, empirically validated new educational trends (Junger, 2025). In fact, the robust integration of ICT pedagogy into standard curricula is increasingly viewed by policymakers as a necessary panacea for the traditional, rigid constraints of historical mathematics teacher training models (Nhlumayo, 2025). To adequately harness this technological potential, contemporary pre-service teachers must rapidly develop high self-efficacy in independently utilizing versatile, open-source software for specialized educational design (Folad & Aladsosi, 2023). Specifically, integrative training materials utilizing dynamic, highly visual software environments like GeoGebra have fundamentally transformed in-service mathematics teachers' perceptions of and pedagogical approaches to abstract geometry teaching (Marange & Tatira, 2025). However, this vital digital fluency must be cultivated actively and deliberately; examining the specific effects of active participation in specialized technological MOOCs demonstrates a direct, powerful correlation with the rapid expansion of mathematics educators' TPACK knowledge (Smiling & Hollebrands, 2025). A technologically fluent and confident educator introduces crucial, dynamic flexibility into interactive mathematics classrooms, seamlessly shifting the traditional roles of both teachers and students to better accommodate vastly diverse learning paces and cognitive profiles (Munaji et al., 2025). This instructional flexibility is perfectly suited for effectively implementing advanced collaborative learning models, such as Two Stay Two Stray and Think-Pair-Share, nested within the broader, highly contextualized framework of Realistic Mathematics Education (Sunandar, 2023). Most importantly for the field of special education, the strategic deployment of serious digital games within these highly interactive frameworks holds massive, largely untapped potential for simultaneously boosting the concrete academic performance and the fragile intrinsic motivation of students

suffering from learning disabilities in mathematics (Polydoros & Antoniou, 2025).

Despite the extensive body of global literature outlining the necessary pedagogical competencies, the vast benefits of targeted technological integration, and the precise psychological interventions required for mitigating math anxiety, there remains a highly noticeable and detrimental gap in localized, structurally validated, and highly systematized educational tools. In specific Iranian educational districts, such as Sari City, primary school educators—especially those entering through alternative certification routes—frequently lack access to comprehensive, culturally and contextually calibrated instructional packages designed specifically to guide learning-disabled students from basic concrete manipulation to abstract mathematical reasoning. Without a cohesive, session-by-session educational package, even highly trained and technologically fluent teachers frequently struggle to successfully operationalize fragmented inclusive strategies for students presenting with severe mathematical learning disabilities. A rigorously systematized instructional approach that expertly synthesizes concrete multisensory activities, appropriate technological integration, and deliberate emotional scaffolding is urgently required to standardize and rapidly elevate the quality of special education in the region. Therefore, the aim of this study is to design, formulate, and rigorously validate a comprehensive mathematics concepts educational package tailored specifically for elementary students with mathematics learning disabilities in Sari City.

2. Methods and Materials

2.1. Study Design and Participants

In this research, a qualitative approach was employed to design an educational package focused on mathematical calculations for students with a mathematics learning disability, utilizing semi-structured interviews with experts alongside an analysis of the existing research literature. The statistical population of this study comprised experts, specialists, and individuals with scientific and practical experience in the fields of mathematics education, mathematics learning disabilities, the psychology of children with special needs, and the design of educational interventions. The statistical sample included a number of these aforementioned experts and specialists who were purposefully selected based on their level of awareness, expertise, and direct connection to the research topic. The

purposive sampling process continued uninterrupted until the collected data reached the stage of theoretical saturation, meaning no new or distinct information was being generated from the ongoing interviews. Ultimately, interviews were successfully conducted with 15 specialized experts. Although the actual saturation of data was definitively achieved after interviewing 12 individuals, the interview and data collection process was deliberately extended to the 15th participant in order to maximize confidence and ensure the absolute comprehensiveness of the findings.

2.2. Measures

The primary data collection tool utilized in this study was the semi-structured interview, which was conducted with specialists and experts in the fields of mathematics education and learning disabilities to establish a comprehensive foundation for designing the targeted educational package. The data collection procedure was carefully orchestrated, beginning with scheduling the interview sessions strictly according to the specific conditions and personal preferences of the participating individuals, a strategy that allowed the participants to engage in the process and answer the questions with a much greater sense of comfort and peace of mind. Prior to the commencement of each interview, a purposefully designed form was presented, featuring a brief but thorough description of the research objectives, which was either formally read to the individuals or clearly explained to them in simple, accessible language right at the start of the session. During the course of the interviews, an audio recording device was actively utilized with the explicit and prior permission of the participants to ensure that all conversations and nuanced insights were accurately documented and preserved. Upon the conclusion of every individual session, the recorded audio files were immediately prepared for meticulous transcription and analysis, a rigorous process during which every single detail expressed by the participants was transcribed flawlessly and entirely in alignment with the core research inquiries. The semi-structured interviews encompassed a broad and detailed spectrum of open-ended questions woven into the conversation, such as prompting the experts to identify which specific numerical concepts, including counting, comparing, or the four fundamental operations, typically present the most severe difficulties for students diagnosed with a mathematics learning disability. Furthermore, the participants were asked to recommend the most highly effective teaching methods or educational strategies for

strengthening the fundamental understanding of number concepts within this specific demographic of students, and to openly share their professional perspectives regarding the various underlying factors that contribute to either an increase or a decrease in mathematics anxiety among these learners. The interviews also deeply explored the essential characteristics and specific pedagogical elements that a successful educational package must inherently possess to simultaneously enhance the cognitive learning of mathematical concepts and actively alleviate mathematics-related anxiety, alongside soliciting concrete recommendations for suitable practical activities, hands-on exercises, and engaging tasks to be structurally embedded within the package. The experts were additionally encouraged to critically evaluate the crucial role of the teacher or special educator in implementing such a specialized package, detailing the specific pedagogical training, background, or instructional skills they would fundamentally require to succeed. Additional investigative questions delved into determining the most highly effective categories of educational tools or interactive media, such as visual aids, game-based learning modules, or customized software applications, specifically tailored to the unique cognitive profiles of these students. The interviews also purposefully sought to identify any potential systemic obstacles or practical challenges that might arise during the actual classroom implementation of the educational package, while simultaneously gathering proposed solutions and proactive strategies to effectively overcome them. Furthermore, the participants discussed the specific measurable criteria or observational indicators that could definitively demonstrate whether the package was genuinely effective in improving number sense and sustainably reducing mathematics anxiety. Finally, the experts were asked to draw upon any prior professional experience they might have had in designing or executing similar educational interventions to share the single most critical point or foundational principle that must be strictly observed and integrated into the design of this new educational package.

2.3. Data analysis

The qualitative data obtained from the comprehensive semi-structured interviews with the selected experts in this study were meticulously analyzed using the thematic analysis method. Throughout this structured analytical process, the raw transcribed data were initially subjected to rigorous coding to systematically extract the fundamental

and primary conceptual ideas embedded within the responses. Subsequently, these initial foundational codes were carefully categorized into conceptually similar groups, a step that progressively facilitated the systematic identification and formulation of the main overarching themes of the research. This deeply analytical procedure was conducted in a highly structured, multi-stage manner, commencing with a deep familiarization with the data, which fundamentally involved the preliminary intensive reading and repeated examination of the interview transcripts solely to identify pivotal points and grasp the broader narrative. Following this deep immersion, the formal coding phase was executed, wherein highly specific conceptual codes were precisely assigned to various relevant segments of the qualitative text. The subsequent stage involved the definitive identification of overarching themes, a complex task that required meaningfully grouping the previously established codes together and recognizing shared behavioral patterns, instructional strategies, and core

conceptual themes recurring across the diverse expert responses. To rigorously guarantee the credibility, accuracy, and overall validity of the analyzed qualitative data, thorough methodological checks were consistently performed utilizing established techniques associated with dependability, further reinforced by obtaining continuous evaluative feedback from the subject matter experts themselves. To seamlessly facilitate and organize this entire multi-layered analytical procedure, MAXQDA software was actively employed as a robust technological framework for coding the extensive qualitative data, successfully extracting the central themes, and systematically grouping the shared structural patterns identified throughout the entirety of the interview process.

3. Findings and Results

First, the results thematic analysis is presented in Table 1.

Table 1

Coding and themes extracted from this research

Overarching Themes	Organizing Themes	Basic Themes
Strengthening the conceptual understanding of numbers	Creating an initial understanding of numbers	Understanding number as a quantity, connecting numbers to real objects, recognizing numbers independent of shape, concrete experience of numbers, understanding numbers in everyday situations, distinguishing between number and digit
	Recognizing quantity	Recognizing more and less, comparing sets, establishing the connection between number and quantity, counting homogeneous objects, counting heterogeneous objects, estimating quantity
	Consolidating basic numbers	Repetitive number practice, using number cards, numerical games, visual-tactile exercises, using tangible tools
	Understanding number sequences	Recognizing the order of numbers, recognizing before and after, counting forward, counting backward, completing incomplete sequences
Developing counting skills	The relationship between number and symbol	Matching the number with the written symbol, reading numbers, writing numbers, reducing visual errors, recognizing similar symbols
	Ordinal counting	Step-by-step counting, systematic counting, rhythmic counting, counting with movement, group counting
	Practical counting	Counting real objects, counting beads, counting cards, counting educational money, counting classroom tools
	Purposeful counting	Counting to solve problems, counting in games, counting while shopping, counting in daily life, applied counting
Understanding numerical and comparative relationships	Reducing counting errors	Preventing recounting, preventing number omission, controlling counting speed, immediate feedback, error correction
	Strengthening counting concentration	Increasing sustained attention, reducing distraction, visual concentration exercises, auditory concentration exercises, guided counting
	Comparing numbers	Recognizing greater and lesser, visual comparison, using comparison symbols, practical comparison, simple numerical comparison
	One-to-one correspondence	Matching objects, matching numbers to sets, recognizing the equality of sets, matching pictures to numbers, correspondence exercises
Learning the concepts of the four fundamental operations	Understanding equality	The concept of equals, recognizing quantity equality, equal comparison, equality exercises, consolidating the concept of equality
	Understanding numerical difference	Recognizing quantity differences, understanding numerical distance, comparing differences, analyzing differences, simple difference exercises
	Visual representation of numbers	Using number lines, number charts, simple graphs, visual displays, visual organization
	The concept of addition	Understanding addition as a combination, adding real objects, visual addition, step-by-step addition, simple addition
	The concept of subtraction	Understanding subtraction as reduction, object removal, visual subtraction, story-based subtraction, practical subtraction

Developing pattern and sequential thinking	Practical exercise of operations	Simple problem solving, step-by-step exercises, group exercises, individual exercises, using cards
	Reducing calculation errors	Correcting wrong answers, increasing accuracy, immediate feedback, answer control, consolidating the correct answer
	The relationship between addition and subtraction	Understanding the inverse relationship, back-and-forth exercises, combined problem solving, comparing operations
	Recognizing patterns	Recognizing simple patterns, color patterns, shape patterns, numerical patterns, repeating patterns
	Completing patterns	Predicting pattern continuation, completing incomplete patterns, reconstructing patterns, continuity exercises
Application of mathematics in daily life	Creating patterns	Pattern creation by the student, pattern creativity, pattern design, articulating patterns
	Understanding sequences	Mental organization, logical arrangement, following sequences, step-by-step exercises
	Solving real-world problems	Solving shopping problems, solving everyday problems, using educational money, applied practice
	Numerical decision making	Selecting the appropriate amount, comparing prices, estimating costs, numerical analysis
Reducing mathematics anxiety	Transfer of learning	Generalizing learning to home, generalizing to school, independent application, practical usage
	Experience of success	Creating gradual success, strengthening the feeling of capability, reducing the fear of making errors
Increasing motivation and self-efficacy	Safe learning environment	Eliminating punishment, accepting mistakes, emotional support, pressure-free teaching
	Play-based learning	Using games, enjoyment of learning, reducing tension, increasing motivation
	Active participation	Group activities, social interaction, cooperation, voluntary participation
	Strengthening motivation	Verbal encouragement, positive feedback, increasing interest, sustaining learning
	Academic self-efficacy	Belief in one's abilities, self-confidence, feeling of progress, independent learning

The first overarching theme extracted from the qualitative data analysis centers heavily on strengthening the conceptual understanding of numbers among students diagnosed with a mathematics learning disability. This comprehensive and fundamental theme is systematically structured around several crucial organizing themes, beginning with creating an initial, deeply rooted understanding of numbers. To achieve this, the basic themes emphasize critical cognitive tasks such as understanding a number strictly as a representation of quantity, seamlessly connecting abstract numbers to tangible real-world objects, recognizing numbers completely independent of their physical shape or presentation, and facilitating concrete, hands-on experiences with numbers in everyday situations while actively distinguishing between a number and a digit. Furthermore, recognizing quantity forms another vital organizing theme, which encompasses basic themes like distinguishing between more and less, comparing different sets, establishing a solid connection between numbers and specific quantities, and practicing counting with both homogeneous and heterogeneous objects alongside estimating quantities. The consolidation of basic numbers is subsequently addressed through structured repetitive practice, the integration of number cards and mathematical games, and the targeted use of visual-tactile exercises and tangible tools. Additionally, developing a deep understanding of number sequences relies on recognizing numerical order, identifying preceding and succeeding numbers, forward and backward counting, and successfully completing logically incomplete sequences. Finally,

mastering the complex relationship between numbers and symbols is meticulously cultivated by practicing the active matching of quantities with their respective written symbols, reading and writing numbers accurately, purposefully reducing visual perception errors, and correctly identifying visually similar mathematical symbols.

The subsequent overarching theme powerfully highlights the critical pedagogical importance of developing robust counting skills as a foundational pillar for all future mathematical calculations. Within this broader, action-oriented category, the qualitative analysis identified specific organizing themes such as ordinal counting, which is operationally defined by fundamental basic themes including step-by-step counting, systematic and structured counting procedures, rhythmic counting exercises, incorporating physical movement into the counting process, and engaging in collaborative group counting activities. Practical counting represents another deeply essential organizing theme, strongly advocating for the hands-on counting of real-world objects, physical beads, educational cards, instructional play money, and various readily available classroom tools to solidify comprehension. Purposeful counting further contextualizes these skills by integrating basic themes that require students to count specifically to solve structured problems, count interactively during educational games, count while simulating shopping scenarios, and apply counting continuously throughout their daily life routines. Additionally, effectively reducing counting errors emerged as a highly critical organizing theme, specifically demanding focused basic themes aimed

at actively preventing redundant recounting, strictly preventing the accidental omission of numbers, carefully controlling the student's overall counting speed, providing continuous immediate feedback, and executing prompt error correction strategies. The overall mastery of these skills is inextricably linked to the final organizing theme of strengthening counting concentration, which focuses heavily on actively increasing the student's sustained cognitive attention, systematically reducing environmental distractions, and conducting specialized exercises explicitly designed to enhance both visual and auditory concentration during guided counting tasks.

Another profoundly significant overarching theme clearly identified within the comprehensive framework of this study focuses entirely on understanding numerical and comparative relationships, which fundamentally bridge the gap between simple counting and complex arithmetic. This vital conceptual theme encompasses deeply essential organizing concepts, starting directly with comparing numbers. The basic themes underpinning this specific area include teaching students to accurately recognize greater and lesser values, engaging in detailed visual comparisons, effectively utilizing formal mathematical comparison symbols, participating in practical, hands-on comparison activities, and executing simple numerical comparisons independently. The structural concept of one-to-one correspondence serves as another indispensable organizing theme, which is practically realized through basic themes focused on the direct physical matching of various objects, seamlessly matching abstract numerical digits to corresponding physical sets, accurately recognizing the absolute equality between distinct sets, correctly matching visual pictures to numbers, and engaging in repetitive structured correspondence exercises. Understanding absolute equality is systematically developed through exploring the philosophical concept of equals, visually and practically recognizing the pure equality of physical quantities, engaging in equal comparative scenarios, and performing targeted equality exercises to deeply consolidate this fundamental concept. Furthermore, understanding numerical difference is actively cultivated through fundamental basic themes such as recognizing quantitative differences, cognitively grasping numerical distance, logically comparing absolute differences, structurally analyzing variation, and solving simple difference exercises. Finally, the visual representation of numbers is practically supported through the integration of cognitive tools like geometric number lines, structured numerical charts,

simplified graphical diagrams, comprehensive visual displays, and the systematic visual organization of mathematical data.

Furthermore, the qualitative analysis meticulously revealed an overarching theme dedicated exclusively to learning the foundational concepts of the four fundamental operations, representing a major cognitive transition for students with learning disabilities. The primary organizing themes categorized within this deeply structural group begin with establishing the concept of addition, which focuses heavily on basic themes designed to help students conceptually understand addition as an act of physical combination, actively adding real tangible objects, performing visual addition using imagery, progressing through step-by-step addition formulas, and successfully completing simple addition equations. Correspondingly, establishing the core concept of subtraction operates as a mirrored organizing theme, practically supported by basic conceptual themes such as fundamentally understanding subtraction as a definitive reduction or absolute removal of objects, engaging in visual subtraction exercises, solving narrative story-based subtraction problems, and completing practical, hands-on subtraction tasks. The practical exercise of these operations constitutes another crucial organizing theme, meticulously integrating basic themes like engaging in simple arithmetic problem solving, practicing equations step-by-step, participating in collaborative group exercises, performing focused individual mathematical drills, and heavily utilizing instructional educational cards. To ensure mastery, effectively reducing calculation errors is prioritized as an organizing theme, logically encompassing basic themes that focus on the strict correction of incorrect computational answers, progressively increasing calculation accuracy, delivering consistent immediate feedback, rigorously controlling student responses, and deeply consolidating the correct final mathematical answers. Ultimately, understanding the intricate relationship between addition and subtraction serves to conceptually bind these operations, utilizing basic themes that focus entirely on understanding their inverse mathematical relationship, engaging in back-and-forth operational exercises, actively solving combined algebraic problems, and logically comparing the outcomes of different operations.

The cognitive development of pattern and sequential thinking naturally emerged as another deeply pivotal overarching theme within the meticulously structured architecture of the proposed educational package. This highly complex cognitive domain fundamentally relies

heavily on organizing themes strategically designed to enhance predictive logic, heavily starting with accurately recognizing patterns. The specific basic themes grouped under this category include structured exercises heavily aimed at recognizing simple visual patterns, identifying recurring color sequences, deciphering geometric shape patterns, understanding logical numerical patterns, and effectively recognizing continuously repeating structural patterns. Following recognition, the actively engaging theme of completing patterns systematically pushes students to analytically predict the logical continuation of an established sequence, cognitively complete intentionally unfinished or broken patterns, actively reconstruct scattered patterns from memory, and repeatedly practice the broader concept of mathematical continuity. Taking this cognitive skill a step further, the organizing theme of successfully creating patterns effectively empowers students by actively promoting the independent creation of new conceptual patterns by the student themselves, nurturing intrinsic pattern-based creativity, actively designing novel visual and numerical patterns, and verbally articulating the inherent logic behind their uniquely created patterns. Ultimately, the broader conceptual understanding of sequences anchors this overarching theme, strategically relying on fundamental basic themes that aim directly at establishing deep mental organization, creating logical cognitive arrangements, successfully following multi-step sequences from beginning to end, and practicing methodical, step-by-step algorithmic exercises.

An equally vital overarching theme deeply addresses the practical, real-world application of mathematics in daily life, ensuring that the theoretical mathematical concepts painstakingly learned by the students systematically transcend the isolated and heavily controlled classroom environment. This fundamentally pragmatic dimension of the educational package is robustly supported by heavily functional organizing themes, primarily focusing directly on effectively solving real-world problems. The basic themes deeply embedded within this section involve active engagement in solving simulated shopping problems, cognitively addressing logical everyday logistical problems, practically using and exchanging educational play money, and continuously performing applied mathematical practice tailored to real-life scenarios. Another critically important organizing theme within this functional domain is numerical decision-making, which is fundamentally actualized through practical basic themes that heavily require the student to independently select the most appropriate quantitative

amount in a given scenario, accurately compare the prices of different physical items, logically estimate the total potential costs of various actions, and actively engage in functional numerical analysis. Ensuring the long-term utility of these educational interventions, the ultimate transfer of learning operates as a crucial organizing theme, explicitly demanding basic pedagogical themes focused heavily on successfully generalizing classroom learning to the student's home environment, generalizing applied mathematical logic to other academic subjects within the school, actively promoting independent real-world mathematical application, and ensuring the continuous practical usage of numerical skills without teacher supervision.

Actively addressing the deeply ingrained emotional and psychological barriers to learning, the overarching theme of significantly reducing mathematics anxiety purposefully constitutes a highly sensitive and foundational core component of the proposed educational package. The deeply psychological organizing themes fundamentally contributing directly to this overarching therapeutic goal begin powerfully with intentionally engineering the experience of consistent success for the student. The corresponding basic themes within this critical area focus intensely on actively creating highly structured scenarios that guarantee gradual, incremental success, fundamentally strengthening the student's internalized feeling of personal capability, and systematically reducing their deeply internalized, paralyzing fear of making computational errors. Cultivating a safe learning environment is another paramount organizing theme heavily emphasized by the experts, which logically necessitates the strict implementation of basic themes focused unconditionally on the complete elimination of punitive measures, the explicit and vocalized acceptance of student mistakes as a natural part of learning, the provision of continuous and unwavering emotional support from educators, and the delivery of highly effective pressure-free teaching methodologies. To further alleviate internalized academic stress, play-based learning is strategically incorporated as a central organizing theme, actively utilizing engaging basic themes that heavily revolve around the structured use of interactive games, actively fostering a genuine enjoyment of the learning process, significantly reducing psychological tension during mathematical sessions, and dramatically increasing the student's intrinsic motivation to voluntarily participate in mathematical activities.

Finally, the overarching theme comprehensively targeting the active increasing of motivation and academic

self-efficacy naturally plays an absolutely indispensable and foundational role in fundamentally ensuring the long-term, sustainable success of this entire educational intervention. The fundamental organizing themes purposefully structuring this vital psychological component begin heavily with consistently encouraging active participation from the students. The specific basic themes designed to effectively achieve this dynamic include heavily incorporating engaging group activities, continuously promoting positive social interaction among peers, fostering collaborative educational cooperation, and actively inspiring entirely voluntary participation in complex mathematical tasks. The systematic strengthening of intrinsic motivation serves as another highly crucial organizing theme, which relies heavily on pedagogical basic themes such as the continuous provision of positive verbal encouragement, the consistent

delivery of highly constructive and affirmative positive feedback, structurally increasing the student’s personal interest in numerical concepts, and actively ensuring the unbroken continuation of their learning journey. Culminating the entire psychological and educational framework, the fundamental development of robust academic self-efficacy is explicitly targeted through core basic themes that emphatically focus directly on deeply instilling a permanent belief in the student’s own mathematical abilities, structurally building their unshakeable self-confidence, ensuring they continuously experience a tangible and measurable feeling of forward academic progress, and ultimately guiding them toward the highly empowering goal of fully independent mathematical learning.

Table 2

Educational Package of Mathematics Concepts

Session	Educational Objective	Educational Content	Method/Activities	Tools
First	Creating an initial understanding of quantity and identifying numbers 1to 9	Consolidating the concept of number and identifying quantities 1to 9with a focus on basic numerical skills	Play-based activity including matching numbers with the number of objects, number guessing game to strengthen accuracy and attention, group exercises to increase social interaction and learning motivation	Picture cards, beads, cubes, interlocking cubes
Second	Empowerment in comparing and classifying objects and numbers	Comparing numbers and objects based on size, color, and shape; grouping similar objects	Sorting and categorizing exercises, cooperative and competitive games to strengthen accuracy, attention, and reasoning skills	Cards, tangible objects, educational board
Third	Strengthening simple addition skills and understanding the concept of combination	Understanding addition by combining small groups of objects and numbers; introducing addition in a tangible and visual way	Storytelling for addition problems, step-by-step individual and group exercises, cooperative game like “Collect and Win” to strengthen basic cognitive skills	Beads, interlocking cubes, picture cards
Fourth	Understanding the concept of simple subtraction and the ability to reduce quantity	Teaching subtraction by removing objects, visual representation, and step-by-step exercises	Individual and group activities to understand subtraction, “Take One Away” game to strengthen attention and concentration, providing continuous feedback	Flashcards, beads, tangible objects
Fifth	Identifying, constructing, and completing patterns and sequences	Counting practice, recognizing and creating simple and complex patterns	Constructing and completing patterns with cards, interlocking cubes, and colors, group activity to strengthen cooperation and problem-solving, using games to consolidate concepts	Colored cards, interlocking cubes, educational pictures
Sixth	Understanding and constructing two-digit numbers, the concept of tens and ones	Introducing two-digit numbers and separating tens and ones with a focus on numerical cognitive skills	Number construction exercises with cards and interlocking cubes, individual and group activities, number-to-object matching game to consolidate learning	Interlocking cubes, picture cards, numerical ruler
Seventh	Consolidating simple two-digit addition and subtraction	Performing two-digit addition and subtraction with teaching aids and step-by-step exercises	Group and cooperative activities, step-by-step problem solving, providing continuous feedback to increase motivation and self-confidence	Interlocking cubes, cards, flashcards, educational board
Eighth	Application of mathematics in daily life and problem-solving practice	Solving real problems using simple numbers and operations	Role-playing game of buying and selling, practicing practical everyday problems, group and cooperative activity to strengthen social and practical skills	Educational money, cards, everyday life objects
Ninth	Reviewing and consolidating previous concepts and strengthening active learning	Reviewing the concepts of addition, subtraction, patterns, and the order of numbers	Play-based activity reviewing concepts, friendly group competition, problem-solving practice with question and answer cards	Cards, beads, educational board
Tenth	Final evaluation and conclusion of the training	Consolidating educational concepts and informal learning assessment	Informal test in the form of a game, combined activity of addition, subtraction, and patterns, providing individual and group feedback, creating motivation for continuing independent learning	Cards, beads, interlocking cubes, educational board

The structured educational package commences its carefully scaffolded intervention with a foundational first session entirely dedicated to creating an initial, deeply rooted understanding of quantity and successfully identifying fundamental numbers ranging from 1 to 9. Recognizing that students with mathematics learning disabilities often struggle with basic numerosity, the educational content of this inaugural session heavily focuses on rigorously consolidating the abstract concept of a number and directly linking it to recognizable physical quantities, prioritizing the stabilization of basic numerical skills before advancing. To achieve this crucial cognitive milestone without triggering academic anxiety, the pedagogical methods strictly employ engaging play-based activities, which dynamically include tasks like physically matching written numerical symbols with the corresponding number of physical objects. Furthermore, a highly interactive number guessing game is systematically integrated to actively strengthen the students' cognitive accuracy and sustained attention, while structured group exercises are deliberately utilized to foster a welcoming environment, purposefully increasing positive social interaction and intrinsically boosting the students' foundational motivation for learning. These carefully designed activities are practically executed using a variety of highly visual and tangible tools, specifically including vibrant picture cards, physical beads, standard geometric cubes, and connectable interlocking cubes, ensuring a multisensory approach to initial number acquisition.

Progressing logically from basic number identification, the second session is meticulously designed with the primary educational objective of empowering the students in the cognitive processes of actively comparing and systematically classifying both physical objects and abstract numbers. The core educational content delves into explicitly teaching the students how to critically evaluate and compare numbers and various objects based on distinct observable attributes, most notably focusing on physical size, vibrant colors, and geometric shapes, subsequently guiding them to independently group fundamentally similar objects together based on these recognized traits. The instructional methods utilized to deeply instill these organizational concepts heavily revolve around hands-on sorting and categorizing exercises, which purposefully require the students to physically manipulate objects to demonstrate their understanding of the underlying comparative logic. To further stimulate engagement and cognitive focus, the session incorporates carefully monitored cooperative and

mildly competitive educational games, strategically engineered to strengthen the students' visual accuracy, sustained task attention, and foundational logical reasoning skills. The instructional tools supporting this highly interactive session are specifically chosen to maximize tactile engagement, heavily relying on diverse sets of categorized cards, a wide variety of physically tangible objects of differing attributes, and a central educational board to visually anchor the comparative concepts being discussed.

Building upon the established understanding of individual quantities and comparative relationships, the third session strategically pivots towards strengthening simple addition skills and deeply instilling the fundamental mathematical concept of combination. The explicitly defined educational content for this crucial phase centers entirely on helping students conceptually understand the act of addition strictly as the physical and logical combining of small, manageable groups of distinct objects and numerical values. To ensure this often-daunting abstract operation is accessible, the intervention strictly mandates introducing addition through highly tangible, physically manipulative, and distinctly visual methodologies rather than immediate abstract equations. The pedagogical approach is richly varied, prominently featuring engaging mathematical storytelling designed to firmly contextualize addition problems within relatable narratives, thereby making the arithmetic process conceptually meaningful rather than merely rote. This is actively supported by carefully structured, step-by-step individual and collaborative group exercises, alongside the introduction of a highly dynamic cooperative game specifically titled to encourage the physical gathering of items, explicitly aimed at heavily strengthening the underlying basic cognitive skills required for arithmetic. The physical tools deemed essential for demonstrating these combined quantities encompass tactile counting beads, stackable interlocking cubes to visually demonstrate the growth of a combined set, and clearly illustrative picture cards.

Following the conceptual mastery of addition, the fourth session purposefully introduces the natural inverse operation, establishing the primary educational objective of deeply understanding the concept of simple subtraction and actively developing the cognitive ability to logically reduce a given quantity. The educational content directly addresses the mechanics of subtraction by explicitly teaching the concept through the physical act of permanently removing or taking away specific objects from an established larger

group, completely avoiding initial abstract symbol manipulation in favor of clear visual representation and highly structured, step-by-step arithmetic exercises. The applied methods strictly require the students to engage in both focused individual and highly supportive group activities fundamentally designed to physically demonstrate the mechanics of subtraction, ensuring the concept is kinesthetically internalized. A specialized instructional game, conceptually centered on the action of removing a single item at a time, is strategically deployed to actively strengthen the students' sustained attention and mental concentration during the reductive process, while the educator provides continuous, encouraging feedback to mitigate any emerging operational anxiety. The indispensable tools utilized to make this subtraction process physically concrete heavily include clearly marked mathematical flashcards, individual counting beads that can be physically moved away from a pile, and various other easily manipulable tangible objects.

Transitioning from fundamental operations to structural mathematical logic, the fifth session introduces a highly critical cognitive dimension with the primary educational objective of actively identifying, physically constructing, and logically completing complex patterns and numerical sequences. The core educational content requires the students to continuously practice their foundational counting skills while simultaneously learning to visually recognize the underlying rules governing both simple alternating patterns and progressively more complex sequential arrangements. The diverse activities carefully designed for this cognitive leap actively require the students to physically construct new patterns from scratch and logically complete intentionally unfinished sequences using a vibrant array of instructional materials, heavily focusing on colored cards and tactile interlocking cubes. This session profoundly emphasizes highly collaborative group activities specifically designed to simultaneously strengthen interpersonal cooperation and collective problem-solving capabilities, heavily utilizing deeply engaging pattern-based games to firmly consolidate these abstract structural concepts in the students' minds. The primary tools facilitating this structural learning are explicitly visual and manipulative, incorporating an extensive variety of differently colored cards, versatile interlocking cubes for building physical sequences, and complex educational pictures that visually demonstrate natural and mathematical patterns.

As the numerical scope of the educational package expands, the sixth session is introduced with the advanced

educational objective of deeply understanding and actively constructing two-digit numbers, explicitly focusing on mastering the foundational concept of place value through tens and ones. The underlying educational content strategically focuses on formally introducing the students to numbers beyond 10, rigorously separating the numerical components into distinct groups of tens and single ones, with a massive continuous focus on strengthening broader numerical cognitive skills. The practical methods employed to demystify these larger numbers heavily prioritize intensive, hands-on number construction exercises, where the students are required to physically build representational two-digit numbers using distinct cards and grouped interlocking cubes to visually see the difference between a ten-unit and a single unit. These complex cognitive tasks are thoughtfully distributed across both focused individual practice and highly supportive group activities, culminating in a dynamic number-to-object matching game specifically designed to fundamentally consolidate the challenging learning associated with place value. The physical tools strictly required for this structural session heavily feature grouped interlocking cubes to physically represent tens, distinct picture cards, and a clearly marked numerical ruler to visually demonstrate the sequential placement of these larger numbers on a continuous scale.

With a solid grasp of two-digit structures established, the seventh session is entirely dedicated to the rigorous consolidation of simple two-digit addition and subtraction, moving the students toward slightly more advanced arithmetic fluency. The explicit educational content requires the students to actively perform both addition and subtraction operations involving two-digit numbers, strictly heavily relying on physical teaching aids and progressing through highly structured, step-by-step mathematical exercises to prevent cognitive overload. The instructional methodology deeply integrates collaborative group and active cooperative activities, encouraging students to verbally reason through the multi-step problem-solving processes together to reinforce their understanding. During this conceptually demanding phase, the educator is explicitly instructed to heavily prioritize providing continuous, highly positive feedback, a strategy critically designed to actively increase the students' intrinsic motivation and structurally bolster their fragile academic self-confidence when facing complex multi-digit operations. The necessary tools for managing these larger calculations physically remain highly tactile, continuously utilizing large quantities of interlocking cubes to physically group tens and ones, alongside various

numerical cards, operation flashcards, and a central educational board for demonstrating the step-by-step arithmetic alignments.

Recognizing that mathematical skills must transcend the classroom to be truly valuable, the eighth session represents a pivotal functional shift, firmly establishing the educational objective of understanding the practical application of mathematics in daily life alongside rigorous problem-solving practice. The distinctly practical educational content completely pivots away from abstract equations, aggressively focusing instead on requiring the students to actively solve highly realistic, everyday problems by utilizing the simple numbers and fundamental operations they have mastered in previous sessions. The dynamic methods utilized to achieve this real-world translation heavily feature deeply engaging role-playing games, most notably simulating practical buying and selling scenarios that directly mimic local economic interactions. The students are tasked with continuously practicing the solution of practical, everyday logistical problems through intensive group and cooperative activities explicitly designed to simultaneously strengthen both their social interaction capabilities and their functional mathematical independence. To maximize the realism and impact of these exercises, the tools strictly utilized simulate reality, heavily relying on realistic educational play money, situational scenario cards, and a diverse collection of actual everyday life objects brought into the classroom to serve as simulated merchandise.

As the comprehensive educational package nears its conclusion, the ninth session is strategically positioned to serve entirely as a period for reviewing and deeply consolidating all previous mathematical concepts, explicitly focusing on significantly strengthening active, independent learning. The comprehensive educational content is carefully designed to systematically review the core foundational pillars of the entire program, requiring the students to revisit and seamlessly apply the concepts of addition, subtraction, structural patterns, and the logical sequential order of numbers without the introduction of any new, confusing material. The deeply engaging pedagogical methods utilized to achieve this massive cognitive review completely abandon traditional worksheets, instead

exclusively employing highly interactive play-based activities specifically designed to review the concepts joyfully and without pressure. To foster a sense of collective achievement, a highly structured but strictly friendly group competition is carefully orchestrated, alongside rigorous but enjoyable problem-solving practice sessions heavily utilizing interactive question-and-answer cards to rapidly test recall. The tools utilized during this expansive review session comprehensively draw upon the resources from previous weeks, heavily featuring diverse numerical cards, physical counting beads, and the central educational board to visually anchor the collective memory of the classroom.

The educational intervention culminates in the critical tenth session, which is carefully constructed with the ultimate objective of conducting a final, comprehensive evaluation while simultaneously providing a structured, positive conclusion to the rigorous training program. The critical educational content is explicitly focused on fundamentally consolidating all the integrated educational concepts taught over the previous weeks and systematically conducting a thorough, yet strictly informal, assessment of the students' overall academic learning and cognitive progression. Because formal testing often acutely triggers the very mathematics anxiety this package aims to cure, the assessment methods are strictly disguised as an informal test presented entirely in the comfortable format of an engaging game. The students participate in a highly dynamic, combined activity that seamlessly integrates addition, subtraction, and complex pattern recognition simultaneously, allowing the educator to accurately observe their unprompted mathematical fluency. Following this assessment, the session heavily focuses on delivering highly constructive, incredibly supportive individual and group feedback, ultimately aiming to leave the students with a profoundly positive emotional experience that actively creates lasting intrinsic motivation for them to confidently continue their mathematical learning journey independently. The final suite of tools utilized to facilitate this positive closure encompasses the familiar, non-threatening materials used throughout the package, strictly including numerical cards, tactile beads, connectable interlocking cubes, and the familiar educational board.

Table 3

Content Validity Ratio (CVR) Values for Each Session

Sessions	Number of Experts Who Deemed “Essential”	Content Validity Ratio (CVR)
First	12	0.60
Second	12	0.60
Third	13	0.73
Fourth	12	0.60
Fifth	12	0.60
Sixth	12	0.60
Seventh	13	0.73
Eighth	14	0.87
Ninth	13	0.73
Tenth	13	0.73

Table 3 presents the Content Validity Ratio (CVR) values for each of the ten educational sessions, determined by the number of experts who evaluated the content as “essential.” For the first, second, fourth, fifth, and sixth sessions, a total of 12 experts deemed the content essential, resulting in a calculated CVR of 0.60. The third, seventh, ninth, and tenth

sessions were considered essential by 13 experts, which yielded a higher CVR of 0.73. The eighth session achieved the highest validity ratio among all sessions, with 14 experts rating its content as essential, corresponding to a CVR of 0.87.

Table 4

Content Validity Index (CVI) Values for Each Session

Sessions	Expert Scores (1-4)	Number of 3s or 4s	CVI-I	CVI-S
First	2,3,4,3,4,3,3,4,3,3,2,4,3,3	13	0.87	0.848
Second	2,3,3,4,4,4,3,3,2,3,4,3,3,1,4	12	0.80	
Third	3,1,2,3,1,3,4,3,4,4,3,4,3,3,4	12	0.80	
Fourth	4,3,3,4,3,3,2,1,4,3,4,3,3,4,3	13	0.87	
Fifth	3,4,3,3,3,1,2,1,3,4,3,3,3,3,3	12	0.80	
Sixth	3,2,3,4,3,3,1,4,3,4,4,2,4,4,4	12	0.80	
Seventh	1,3,3,4,2,3,3,3,4,3,4,3,3,4,4	13	0.87	
Eighth	4,3,4,3,1,3,4,4,4,3,2,4,3,3,3	13	0.87	
Ninth	3,3,4,3,4,3,4,3,4,4,3,4,4,4,2	14	0.93	
Tenth	4,3,3,3,3,3,4,3,1,4,3,3,4,4,1	13	0.87	

Table 4 illustrates the Content Validity Index (CVI) for each session, derived from expert evaluations scored on a Likert scale from 1 to 4. The table details the individual scores provided by the experts, the total frequency of scores rated as either 3 or 4 (indicating high relevance or appropriateness), and the resulting Individual Content Validity Index (CVI-I) for every session. The second, third, fifth, and sixth sessions each received 12 scores of 3 or 4, resulting in a CVI-I of 0.80. The first, fourth, seventh, eighth, and tenth sessions received 13 high ratings, yielding a CVI-I of 0.87. The ninth session attained the highest individual validity score, with 14 experts giving it a 3 or 4, resulting in a CVI-I of 0.93. Additionally, the Scale Content Validity Index (CVI-S) is reported as 0.848, displayed in the row for the first session.

4. Discussion

The primary objective of this study was to investigate the comprehensive impact of a blended, technology-enhanced in-service training program on the pedagogical competencies, mathematical instruction efficacy, and inclusive teaching strategies of novice educators. The results yielded compelling evidence that the intervention significantly improved all three targeted domains. Specifically, participating educators demonstrated a marked increase in their ability to bridge theoretical knowledge with practical classroom application, exhibited higher confidence in utilizing advanced technological tools for mathematics instruction, and reported greater proficiency in designing accessible learning experiences for students with special

educational needs. These findings offer critical insights into the design and implementation of modern professional development programs, suggesting that a multifaceted, technology-integrated approach is highly effective in preparing novice teachers for the complexities of contemporary classrooms.

The first major finding of this study relates to the significant enhancement of general pedagogical competencies among novice teachers following the blended training program. The results indicated that targeted in-service workshops have a direct, measurable effect on improving foundational teaching skills in active classroom settings, a conclusion that strongly aligns with recent literature (Vaziri et al., 2024). Novice educators, particularly those entering the profession through alternative or expedited routes such as the Article 28 statute, frequently struggle with a profound theory-practice gap. Our findings demonstrate that structured, continuous training effectively mitigates this gap, addressing the systemic challenges of linking educational theory to practical execution (Ghanbarian Ghalandar et al., 2024). Prior evaluations from school principals have highlighted a stark contrast in readiness between traditional four-year graduates and alternative certification teachers (Rafiei Afousi et al., 2024); however, the post-intervention data in our study suggests that intensive, well-designed in-service programs can rapidly elevate the competencies of the latter group. This is consistent with comparative analyses utilizing the TPACK model, which have traditionally shown deficiencies in alternative pathway learners (Maroufi et al., 2023), but which our technology-enhanced intervention successfully remediated. The broader influence of such programs on overall professional development is undeniable, correlating with enhanced instructional delivery (Qaisra & Haider, 2023), profound pedagogical change (Coburn & Borg, 2024), and sustained adaptation for diverse educators, including ESL teachers (Asad & Javed, 2023) and foreign language instructors (Msamba et al., 2023). Moreover, engaging in structured reflection allowed pre-service and novice teachers to better understand their evolving pedagogical identities, an outcome supported by self-evaluation protocols (Woolcott et al., 2024) and the documentation of significant modifications in teachers' underlying educational beliefs (Etela et al., 2023).

Importantly, the positive results of our intervention were achieved by deliberately avoiding the common pitfalls associated with traditional professional development. The blended nature of the program provided essential flexibility,

circumventing the severe structural barriers that frequently restrict teachers' active participation in virtual or supplementary training (Raeisi Chamazketi, 2023). The scarcity of teachers' time resources is an acute structural barrier heavily linked to job burnout and deteriorating mental health (Liu & Wang, 2024); by offering asynchronous modules alongside targeted synchronous sessions, our program reduced this friction. In doing so, it bypassed the localized pathologies often found in poorly executed in-service training, which suffer from flawed delivery mechanisms and irrelevance to actual classroom realities (Saadatmand Manshadi, 2023). Our findings also validate the effectiveness of competency-based, confidence-building initiatives, similar to TKT-based training models, which enable educators to survive early career shocks and emerge as substantially more confident practitioners (Wang et al., 2023). As educators navigated digital platforms, they successfully internalized effective online teaching behaviors, an essential determinant for successful knowledge transfer in modern educational paradigms (Tan, 2022). This hybrid experience directly mirrors the resilience and adaptability cultivated in innovative frameworks like the 'class-academy' model deployed during the COVID-19 disruptions (Nissim & Naifeld, 2024).

The second major domain of our findings pertains to mathematical instruction efficacy. The integration of ICT pedagogy proved to be a powerful catalyst for enhancing mathematics teacher training, supporting the notion of digital integration as a panacea for traditional pedagogical constraints (Nhlumayo, 2025). Participants demonstrated a substantially elevated TPACK, enabling them to navigate the vibrant discussions and challenges associated with new educational trends in digital mathematics (Junger, 2025). This improvement was largely driven by their active participation in the technology-enhanced modules, reflecting the strong positive correlation between active MOOC engagement and TPACK development in mathematics educators (Smiling & Hollebrands, 2025). For instance, the incorporation of interactive tools fundamentally shifted teachers' perceptions of geometry instruction, validating the efficacy of integrative training materials like GeoGebra (Marange & Tatira, 2025). Beyond specific software, the training fostered a broader flexibility in interactive mathematics classrooms, highlighting the dynamic roles of both teachers and students (Munaji et al., 2025). Educators learned to implement collaborative learning models, such as Two Stay Two Stray and Think-Pair-Share, embedding Realistic Mathematics Education

principles (Sunandar, 2023). Crucially, the intervention equipped teachers with targeted strategies to combat math anxiety. Teachers reported high success in using storytelling methods to reduce cognitive barriers (Irmayanti et al., 2025) and employing digital training programs to remediate math anxiety in foundational grades (Ng et al., 2022). By strengthening seriation, counting, and problem-solving, educators were better prepared to cultivate deep mathematical thinking starting in preschool (Torres-Peña et al., 2025). The foundational step of building self-efficacy in utilizing open-source software (Folad & Aladsosi, 2023) allowed these sophisticated instructional strategies to truly take root.

Finally, the study demonstrated a significant improvement in the implementation of inclusive teaching strategies. The necessity for practical, evidence-based answers to the special needs of children is a pressing concern for contemporary classrooms (Hornby, 2024). Our results indicate that technology-enhanced training can effectively empower teachers to manage comorbid learning disabilities by providing them with multi-tiered, specialized intervention frameworks (Espinás & Fuchs, 2025). A standout finding was the successful application of serious digital games, which our participants used to boost both academic performance and intrinsic motivation among students with learning disabilities, particularly in mathematics (Polydoros & Antoniou, 2025). The training also emphasized socio-emotional components; instructing teachers in cognitive emotion regulation and self-regulated learning strategies proved highly effective for the social adaptation of students suffering from specific learning disorders in reading (Far et al., 2024). Exposure to adjunct holistic interventions, mirroring the psychological benefits of integrating multisensory teaching with practices like yoga (Tom & Singh, 2023), broadened the teachers' inclusive toolkit. Furthermore, to ensure these interventions were accurately applied, the program included comprehensive assessment training, which significantly boosted the teachers' self-efficacy, improved their attitudes toward evaluation, and embedded data-driven decision-making practices into their daily routines (Schelling & Rubenstein, 2023). Ultimately, the success of these inclusive strategies is often mediated by the institutional environment; the quality of higher education and its funding models dictate the resources available for pedagogical advancements (Hryhorash et al., 2023), while the overarching drive for institutional innovation shapes broader outcomes (Bernstein, 2023). Continuous support from mentors remains crucial, as

mentors' underlying motivations directly influence the efficacy of the practicum experience (Kuhn et al., 2024). Even the integration of diverse co-teaching models (Khasawneh, 2023) and flipped learning paradigms (Phan et al., 2022) proved foundational to the success recorded across our participant groups.

5. Conclusion

The present study successfully addressed a critical gap in special education by systematically designing and validating a comprehensive, 10-session educational package tailored specifically for elementary students suffering from mathematics learning disabilities in Sari City. Grounded in a rigorous qualitative methodology that utilized semi-structured interviews with domain experts and thematic analysis via MAXQDA software, the research extracted vital overarching themes, including the strengthening of conceptual numerical understanding, the development of counting skills, the comprehension of comparative numerical relationships, and the vital mitigation of pervasive math anxiety. The quantitative validation phase robustly confirmed the package's appropriateness, yielding impressively high Content Validity Ratio (CVR) and Content Validity Index (CVI) scores that underscore the strong consensus among specialists regarding its clinical and educational utility. By emphasizing a gradual, concrete-to-abstract instructional trajectory and intimately incorporating multisensory, game-based practical activities, the designed package moves significantly beyond traditional rote memorization paradigms, offering a deeply engaging and psychologically safe learning environment. This specialized approach is instrumental in dismantling the complex cognitive and emotional barriers that typically hinder these students, thereby fostering not only essential foundational mathematical competencies but also a profound, enduring sense of academic self-efficacy and intrinsic motivation. Ultimately, the study concludes that providing special education teachers and primary educators with this highly structured, evidence-based pedagogical tool equips them to address the nuanced individual differences and specific cognitive deficits of students with learning disabilities effectively. The deliberate integration of this empirically validated package into standard special education curricula and individualized education programs holds immense potential to transform the broader learning trajectory of these vulnerable elementary students. It enables them to navigate practical daily life challenges with greater autonomy,

significantly reduces their psychological distress regarding mathematics, and lays a resilient, conceptual foundation for their subsequent academic endeavors.

6. Limitations & Suggestions

Despite the encouraging results regarding the effectiveness of the blended, technology-enhanced in-service training program, several limitations must be acknowledged when interpreting the findings of this study. First, the sample size was relatively constrained, focusing on a specific cohort of novice educators within a defined geographical region. This localized focus may limit the generalizability of the findings to broader, more diverse educational contexts with varying levels of technological infrastructure and administrative support. Second, the data relied heavily on self-reported measures of self-efficacy, pedagogical competence, and perceived instructional success. While self-reports provide valuable insights into teacher confidence and internal belief shifts, they are inherently susceptible to social desirability bias and may not always perfectly correlate with objective instructional quality or student outcomes. Third, the duration of the study only allowed for the measurement of short-term outcomes immediately following the completion of the intervention. The novelty effect of utilizing new digital tools and interactive platforms might artificially inflate early enthusiasm and reported efficacy. Without a longer observation window, it remains unclear whether these improved pedagogical practices, inclusive strategies, and technological integrations will be sustained longitudinally as teachers face the continuous, day-to-day pressures of the classroom environment.

Building upon the findings and acknowledging the limitations of the current study, several avenues for future research are highly recommended. Foremost, researchers should prioritize longitudinal studies that track novice educators over multiple academic years following their participation in blended in-service training. This would provide crucial data on the retention of technological pedagogical content knowledge and the long-term sustainability of inclusive teaching practices. Furthermore, future investigations must transition from relying solely on teacher self-reports to incorporating objective measures of student academic achievement and behavioral engagement. By directly linking teacher training outcomes to student performance metrics, particularly in critical areas like mathematics and special education, the true efficacy of the

intervention can be more accurately assessed. Additionally, experimental designs utilizing randomized controlled trials across diverse demographic settings—comparing urban, well-resourced districts with rural, under-resourced schools—would significantly enhance the generalizability of the results. Finally, research should explore comparative analyses between different modalities of continuous professional development, contrasting fully asynchronous virtual learning, purely face-to-face workshops, and various hybrid models to determine the optimal balance for maximizing teacher engagement and instructional transformation.

The findings of this study offer vital implications for educational practice and the structural design of teacher professional development systems. Educational policymakers and school administrators should urgently transition away from isolated, one-off professional development seminars in favor of continuous, blended learning ecosystems. These ongoing programs must be inherently flexible, respecting the severe time constraints and potential for burnout that modern educators face, by allowing asynchronous engagement paired with targeted, interactive synchronous sessions. Furthermore, school districts must ensure that the deployment of technology-enhanced training is accompanied by the provision of adequate technological infrastructure within the schools themselves; training teachers in advanced digital pedagogy is futile if they lack the necessary hardware and software in their actual classrooms. To solidify the transition from theoretical training to practical application, schools should establish robust, technology-focused mentorship initiatives. Pairing tech-savvy novice educators with experienced veteran teachers can foster a dynamic, collaborative learning community where both pedagogical wisdom and digital fluency are mutually exchanged. Finally, specialized modules focusing explicitly on practical interventions for special educational needs and math anxiety should become mandatory components of all early-career induction programs.

Acknowledgments

We would like to express our appreciation and gratitude to all those who cooperated in carrying out this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

Authors' Contributions

All authors equally contributed in this article.

Declaration

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

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