

Designing a Cognitive Apprenticeship Training Package Based on Vygotsky's and Montessori's Theories and Evaluating Its Effectiveness on Writing Skills in Five-Year-Old Children

Hassan. Ghader Zeynabi¹, Ozra. Ghaffari Nouran^{1*}, Touraj. Hashemi²

¹ Department of Educational and Psychological Services, Ard.C., Islamic Azad University, Ardabil, Iran

² Professor, Faculty of Psychology and Education, University of Tabriz, Tabriz, Iran

* Corresponding author email address: o.ghaffari@iauardabil.ac.ir

Article Info

Article type:

Original Research

How to cite this article:

Ghader Zeynabi, H., Ghaffari Nouran, O., & Hashemi, T. (2027). Designing a Cognitive Apprenticeship Training Package Based on Vygotsky's and Montessori's Theories and Evaluating Its Effectiveness on Writing Skills in Five-Year-Old Children. *International Journal of Education and Cognitive Sciences*, 8(4), 1-16.

<https://doi.org/10.61838/kman.ijecs.468>



© 2027 the authors. Published by Iranian Association for Intelligence and Talent Studies, Tehran, Iran. This is an open access article under the terms of the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License.

ABSTRACT

Purpose: This study aimed to design and validate a cognitive apprenticeship training package based on Vygotsky's and Montessori's theories and to evaluate its effectiveness in improving writing skills among five-year-old children.

Methods and Materials: The study was conducted in two stages using a developmental and experimental approach. First, the cognitive apprenticeship training package was developed based on Vygotsky's and Montessori's theoretical principles, relevant literature, and expert evaluations. Its face and content validity were assessed by 10 university experts in elementary education and educational management. In the second stage, a pretest-posttest experimental design with a control group was employed. The statistical population comprised five-year-old preschool children in Bukan during the 2021–2022 academic year. Thirty-four eligible children were purposively recruited and randomly assigned to experimental and control groups; following attrition, data from 30 children (15 per group) were analyzed. The experimental group received the developed cognitive apprenticeship program in 20 45-minute sessions, while the control group received no intervention. Writing skills were assessed using the Ragheb and Hadian Writing Skills Test. Data were analyzed using independent-samples t-tests and analysis of covariance.

Findings: After controlling for pretest scores, the intervention had a significant effect on overall writing skills ($F = 162.268$, $p < .001$, $\eta^2 = .84$). Significant intervention effects were also found for word writing ($F = 27.784$, $p < .001$, $\eta^2 = .50$), sentence writing ($F = 6.072$, $p < .05$, $\eta^2 = .18$), writing picture names ($F = 40.093$, $p < .001$, $\eta^2 = .58$), and writing picture names in incomplete sentences ($F = 70.238$, $p < .001$, $\eta^2 = .71$). Thus, the intervention explained 84% of the variance in overall posttest writing performance.

Conclusion: Cognitive apprenticeship grounded in Vygotskian scaffolding and Montessori principles appears to provide an effective instructional framework for developing writing skills in five-year-old children and supports the potential value of systematically introducing early writing instruction during the preschool period.

Keywords: Cognitive Apprenticeship; Writing Skills; Vygotsky; Montessori; Preschool Children; Educational Package

1. Introduction

Early childhood represents a foundational period in which cognitive, linguistic, social, emotional, and motor capacities develop rapidly and become increasingly integrated into more complex forms of learning. During these years, children acquire not only basic competencies in communication and self-regulation but also the precursor skills required for later academic performance. Contemporary developmental research increasingly emphasizes that children's learning trajectories are shaped by interactions among biological maturation, executive functioning, socioemotional adjustment, environmental stimulation, and the quality of educational experiences. Accordingly, early education should not be viewed merely as preparation for formal schooling, but as an active developmental context in which appropriately designed experiences can accelerate the emergence of higher-order capacities and reduce later learning difficulties. Evidence concerning preschool social-emotional development also indicates that structured support during the early years can influence children's emotional regulation, interpersonal functioning, and readiness for subsequent educational demands (Varalakshmi & Varun, 2025; Vatou et al., 2026). At the same time, research on children exposed to developmental or environmental adversity demonstrates that disturbances during childhood can affect attention, language, cognition, emotional security, and academic functioning, further highlighting the importance of early, developmentally appropriate educational intervention (Esmailzadeh et al., 2026; Katsarou & Angelidou, 2026).

The growing emphasis on early intervention is particularly relevant to the acquisition of foundational academic skills. Literacy development does not begin at the point of formal school entry; rather, it emerges through a gradual process involving oral language, phonological awareness, symbol recognition, executive attention, visual-motor coordination, conceptual understanding, and opportunities for meaningful interaction with print. Children's ability to attend to relevant information, inhibit distractions, organize responses, and sustain goal-directed activity contributes substantially to the acquisition of early literacy-related competencies. Research examining phonological awareness, for example, has shown that attentional processes and executive control are closely related to children's ability to process the sound structure of language, a capacity strongly linked to later reading and writing development (Yao et al., 2024). Similarly, work on

executive functioning in children with developmental difficulties demonstrates that deficits in cognitive control, working memory, planning, and attentional regulation may significantly constrain educational performance (Megari, 2026). These findings suggest that successful instruction in writing should address not only the visible motor act of producing letters or words but also the broader cognitive processes that support planning, sustained attention, representational thinking, and self-monitoring.

Writing is among the most complex academic skills acquired in childhood because it requires the integration of several developmental systems. Even elementary writing tasks require children to coordinate fine-motor control, visual-spatial processing, language, memory, attention, symbolic representation, and the capacity to translate internal ideas into externally organized marks. Difficulties in any of these domains may interfere with the development of fluent written expression. Studies of children with specific learning disorders and other developmental conditions consistently demonstrate that weaknesses in executive functioning, language, visuospatial processing, or general academic skill acquisition can be associated with poorer educational performance (Megari, 2026; Micheletti et al., 2024). Visual-spatial competence is also increasingly recognized as an important component of children's academic learning because it supports the organization and manipulation of symbolic information and facilitates the development of structured school-related abilities (Poltz et al., 2025). Although some of this literature has focused on mathematics and broader academic functioning, its implications extend to writing, in which spatial organization, visual discrimination, sequencing, and coordinated representation are essential.

The complexity of writing development becomes particularly evident when considering children who are at risk for learning difficulties. Parents and teachers often identify developmental warning signs before formal academic failure becomes established, including problems with attention, language processing, fine-motor coordination, task persistence, memory, and early symbol-related learning (İzoğlu-Tok & Doğan, 2024). Such evidence supports a preventive educational perspective in which instruction is introduced at a stage when children's developmental systems are highly malleable and before persistent academic difficulties become consolidated. Early educational experiences can therefore function both as learning opportunities and as mechanisms for identifying individual differences in developmental readiness. This

approach is consistent with broader calls for individualized and responsive educational planning, particularly for children whose neurodevelopmental characteristics may influence their participation in conventional instructional settings (Şahin, Soylu, et al., 2024). Rather than assuming that all children should encounter the same learning tasks at the same chronological age, developmentally responsive education emphasizes the importance of adjusting instruction to children's emerging capacities.

This emphasis on responsiveness is closely aligned with Vygotsky's sociocultural theory. Vygotsky proposed that higher mental functions develop through social interaction and that learning can actively promote development when instruction is situated within the learner's zone of proximal development. From this perspective, the important question is not merely what children can perform independently, but what they can accomplish with the guidance of a more competent adult or peer. Recent applications of Vygotskian theory continue to emphasize the developmental importance of social mediation, collaborative activity, scaffolding, and guided participation in the cognitive growth of contemporary children (Malik et al., 2025). Such principles are especially relevant to young learners, whose emerging competencies often appear first in supported social contexts before becoming internalized as independent skills. Therefore, early writing instruction may be more effective when it is organized around structured assistance, modeling, guided participation, gradual transfer of responsibility, and opportunities for children to actively construct their own understanding.

Cognitive apprenticeship provides a practical instructional framework that is highly compatible with this sociocultural view of learning. In cognitive apprenticeship, learners acquire skills by observing competent performance, participating in authentic activities, receiving guided support, articulating their understanding, practicing repeatedly, and gradually assuming greater responsibility as external assistance is withdrawn. This approach differs from conventional direct instruction because it attempts to make otherwise hidden cognitive processes observable and accessible to the learner. Within early writing instruction, such a framework may enable children to observe how writing tasks are approached, participate in meaningful writing activities, receive indirect or scaffolded feedback, and gradually move toward independent performance. The model is particularly relevant to skills that are difficult to acquire through verbal explanation alone because it integrates demonstration, practice, social interaction, and

progressive self-regulation. Research emphasizing active and socially mediated learning indicates that well-structured educational interaction can support cognitive development beyond the passive transmission of information (Wei & Chen, 2025).

Montessori education offers a complementary developmental perspective. Montessori's approach emphasizes sensitive periods, self-directed activity, hands-on learning, environmental organization, repetition, sensory experience, and indirect adult guidance. Central to the Montessori method is the assumption that children possess developmental readiness for particular forms of learning during specific periods and that education should provide the environmental conditions necessary for these capacities to emerge. Rather than positioning the teacher as the continuous source of instruction, Montessori education encourages observation, carefully prepared materials, opportunities for repetition, and progressive independence. This orientation has important implications for early writing because the ability to write does not emerge solely through explicit instruction in letter production. It depends on a sequence of preparatory experiences involving hand control, manipulation of objects, sensory discrimination, movement, visual perception, and engagement with meaningful symbolic activity. When these experiences are appropriately arranged, young children may demonstrate competencies that are underestimated by age-based conventional educational expectations.

The relationship between developmental readiness and instruction remains a central theoretical issue in education. Piagetian perspectives traditionally place greater emphasis on the developmental structures that constrain what children can understand at a given stage, whereas Vygotskian perspectives assign a more active role to instruction in advancing development. Contemporary examinations of cognitive development continue to demonstrate the value of developmental-stage frameworks while also recognizing variability in developmental pathways and the importance of environmental support (Tosolini et al., 2025). These perspectives need not be treated as mutually exclusive. Rather, they highlight the importance of designing learning experiences that are developmentally appropriate while also challenging children slightly beyond their current level of independent functioning. An instructional package that combines Montessori's emphasis on developmental sensitivity and self-directed activity with Vygotsky's emphasis on scaffolding and social mediation may therefore

provide a theoretically coherent basis for early writing education.

The need for such integrative educational models has become more important as contemporary education increasingly prioritizes active learning, inclusion, technological adaptation, and individual differences. Modern educational systems are expected to respond to diverse learner needs while promoting autonomy, creativity, collaboration, and higher-order thinking. Interactive environments have been shown to support engagement, creativity, and learning by allowing children to manipulate information and participate actively rather than remain passive recipients of instruction (Momenifard, 2025). In the same way, emerging technologies and inclusive learning frameworks are increasingly being used to support children with attentional and developmental differences, reinforcing the broader principle that educational environments should be adapted to learners rather than requiring learners to conform rigidly to a single instructional format (Drigas et al., 2025). These developments strengthen the rationale for educational packages that incorporate active participation, structured guidance, flexible support, and repeated practice.

The importance of such adaptation is also evident in research on inclusive education and teacher preparation. Early childhood educators frequently encounter children with heterogeneous developmental needs and are required to implement individualized strategies within ordinary classroom settings (Şahin, Soylu, et al., 2024). However, the effectiveness of such strategies depends on teachers' professional competence, access to appropriate resources, and understanding of developmental principles. Studies of educators in rural and resource-limited settings suggest that teachers often require further professional development to implement learner-centered, differentiated, and contemporary educational practices effectively (Şahin, Atapour, et al., 2024). Moreover, educational equity remains an important consideration when implementing new instructional approaches. Access to high-quality educational experiences should not depend on geographic, technological, or socioeconomic advantage, and educational models must therefore be designed in ways that are adaptable across different school contexts (Shariati et al., 2024). A structured and validated early writing package may help address this challenge by providing teachers with an organized framework that can be implemented consistently while still allowing adaptation to individual learner needs.

Socioemotional factors also influence children's readiness to engage in academic tasks. Learning does not

occur independently of motivation, emotional security, confidence, and perceived competence. Children who experience anxiety, attentional dysregulation, chronic stress, or reduced emotional security may be less able to sustain participation in cognitively demanding activities (Esmailzadeh et al., 2026; Zhu, 2025). Conversely, interventions integrating socioemotional learning, relaxation, and self-regulatory development have demonstrated potential benefits for cognitive functioning and academic achievement among school-aged children (Galinha et al., 2025). These findings are relevant to writing instruction because early writing can be demanding and potentially frustrating for young children if taught through rigid correction or excessive performance pressure. An instructional model emphasizing supportive guidance, peer interaction, repeated practice, indirect feedback, and progressive independence may reduce stress while simultaneously strengthening competence and self-efficacy.

The broader literature also demonstrates that children's judgments, motivation, and learning are influenced by the social contexts in which educational resources and opportunities are distributed. Developmental research has shown that children are capable of making sophisticated judgments about fairness, merit, and the allocation of educational resources, suggesting that they are active interpreters of their social learning environments rather than passive recipients of adult decisions (Forbes et al., 2026). This perspective further supports learner-centered educational models in which children are given meaningful opportunities to participate, make choices, express preferences, and experience a sense of competence. In writing instruction, such participation may include selecting tasks, generating personally meaningful content, collaborating with peers, and progressing from externally modeled forms toward increasingly autonomous written expression.

Interactive, experiential, and multimodal approaches may be particularly valuable for children at preschool age because learning is strongly connected to action, perception, emotion, and social interaction. Research on creativity and interactive environments demonstrates that children's cognitive engagement can be enhanced when learning tasks are designed to be participatory and exploratory rather than purely didactic (Momenifard, 2025). Likewise, interventions designed to improve executive functioning and emotional security suggest that structured creative activities can contribute to cognitive development in children with developmental challenges (Zhu, 2025). Although such

interventions differ in content from writing instruction, they share a common principle: children's higher-order capacities can be strengthened when educational activities actively engage multiple developmental systems. This principle is highly relevant to a cognitive apprenticeship approach to writing, which integrates observation, movement, language, social interaction, practice, feedback, and self-regulation.

The rationale for introducing writing instruction during the preschool years is further strengthened by evidence that cognitive development is not uniformly fixed by chronological age. Children display considerable individual variability in the timing and expression of their abilities, and some may be capable of performing advanced tasks when appropriate supports are provided. Meta-analytic evidence concerning cognitively enriching educational programs indicates that children's reasoning and broader cognitive functioning can be improved through structured intervention (Wei & Chen, 2025). In addition, the developmental literature suggests that supportive social interaction, responsive environments, and high-quality educational experiences can influence children's learning trajectories even when they differ substantially in baseline ability. Thus, age alone may be an insufficient criterion for determining whether a child is ready to begin learning foundational writing skills.

At the same time, early instruction should not be interpreted as simply moving conventional primary-school teaching downward into preschool. Developmentally inappropriate acceleration may be ineffective or counterproductive if young children are expected to perform formal academic tasks through repetitive, teacher-centered instruction without sufficient readiness, play, exploration, or scaffolding. The more appropriate question is whether writing can be introduced through a method designed specifically for the developmental characteristics of five-year-old children. Such a method should avoid excessive direct correction, should incorporate meaningful interaction and playful or experiential elements, and should allow children to progress from supported to independent performance. It should also recognize that attention, executive function, language, emotional adjustment, and motor control contribute to writing development and therefore should be accommodated rather than ignored. Research on children with ADHD and specific learning disorders further reinforces the need for flexible approaches because developmental differences in attention, language, and executive functioning can substantially influence

participation in literacy learning (Katsarou & Angelidou, 2026; Megari, 2026).

Taken together, current evidence supports an understanding of early learning as a dynamic process influenced by developmental readiness, social mediation, environmental organization, executive functioning, emotional security, and the quality of instruction. Vygotsky's theory provides a framework for understanding how guided social interaction can move children beyond their current level of independent functioning, whereas Montessori's approach emphasizes sensitive developmental periods, self-directed activity, prepared environments, and indirect guidance. Cognitive apprenticeship offers a practical bridge between these perspectives by translating theoretical principles into observable instructional processes such as modeling, scaffolding, guided practice, peer support, repeated activity, reflection, and gradual independence. Contemporary findings on individualized education, interactive learning, executive functioning, educational equity, teacher development, socioemotional learning, and early developmental variability all suggest that educational programs for young children should be flexible, participatory, developmentally sensitive, and empirically evaluated (Drigas et al., 2025; Galinha et al., 2025; Şahin, Atapour, et al., 2024; Şahin, Soylu, et al., 2024; Shariati et al., 2024).

Despite this growing body of evidence, an important gap remains regarding whether a systematically designed cognitive apprenticeship package that explicitly integrates Vygotskian and Montessori principles can improve writing skills in five-year-old children before the conventional age of formal writing instruction. Existing studies have examined cognitive development, executive functioning, inclusive education, interactive learning, social-emotional development, learning disorders, and developmental readiness from different perspectives, but these lines of research have rarely been integrated into a single structured early-writing intervention (İzoğlu-Tok & Doğan, 2024; Micheletti et al., 2024; Poltz et al., 2025; Vatou et al., 2026). Furthermore, the increasing diversity of children's developmental profiles and educational contexts creates a need for interventions that are not only theoretically grounded but also validated for content and tested experimentally. Designing such a package may contribute to both developmental theory and educational practice by clarifying the extent to which structured, scaffolded, child-centered instruction can facilitate writing before formal primary-school entry.

Accordingly, the aim of the present study was to design and validate a cognitive apprenticeship training package based on Vygotsky's and Montessori's theories and to evaluate its effectiveness in improving writing skills among five-year-old children.

2. Methods and Materials

2.1. Study Design and Participants

The present study was conducted in two sequential stages and combined a developmental component with an experimental evaluation of the developed educational intervention. In the first stage, a cognitive apprenticeship training package based on the theoretical principles of Vygotsky and Montessori was designed and psychometrically evaluated. The package was developed through a review of theories, educational resources, and previous studies concerning early childhood education, executive functions, writing development, Vygotsky's sociocultural approach, and Montessori educational principles. Particular attention was given to scaffolding, the zone of proximal development, guided participation, indirect feedback, practical experience, learner-centered activities, and the developmental characteristics of five-year-old children. The initial version of the package was reviewed by specialists, and a group of 10 university faculty members in elementary education and educational management was selected through purposive-accessible sampling to evaluate its face and content validity. Expert recommendations were incorporated into the package, and a pilot implementation was subsequently conducted to identify practical difficulties and adapt the activities to the developmental characteristics of the target population.

In the second stage, the effectiveness of the developed package was examined using an experimental pretest–posttest design with an experimental group and a control group. The statistical population consisted of five-year-old preschool children attending preschool centers in Bukan during the 2021–2022 academic year. Participants were recruited through purposive sampling according to the study eligibility criteria. Inclusion criteria consisted of being exactly five years old, not being enrolled in gifted or exceptional-talent groups, having no reported mental or psychological disorder, having an average intelligence quotient, willingness to participate, and parental consent. Initially, 34 eligible children were recruited and randomly assigned to the experimental and control groups, with 17 children allocated to each group. Two participants from each

group were subsequently excluded because of repeated absence or unwillingness to continue participation; consequently, the final analyses were conducted on 30 children, including 15 participants in the experimental group and 15 in the control group. Before the intervention, both groups completed the writing-skills pretest. The experimental group then received the cognitive apprenticeship training package based on Vygotsky's and Montessori's theories, whereas the control group received no corresponding intervention and served as the comparison condition. The educational package consisted of 20 sessions of approximately 45 minutes each. The sessions progressed from understanding instructional objectives and modifying beliefs and attitudes toward writing to increasing awareness of learning, engaging children in practical writing experiences, receiving indirect feedback, and finally evaluating changes in writing performance. During the practical phase, children engaged in drawing and writing from provided models and gradually progressed toward producing written material based on their own ideas. Consistent with Montessori and Vygotskian principles, direct intervention by the instructor was minimized, and guidance was provided primarily through scaffolding, modeling, peer assistance, environmental support, and indirect feedback. After completion of the intervention, both groups completed the posttest using the same writing assessment administered at baseline.

2.2. Data Collection Tools

The principal outcome measure was the Ragheb and Hadian Writing Test, developed in 2005 to assess writing achievement. The instrument evaluates writing through four subtests: word writing, sentence writing, writing the names of pictures, and writing the names of pictures within incomplete sentences. In scoring the instrument, each correctly written word receives one point. Sentences are divided into their constituent words, and each correctly produced word is scored according to the same principle. The instrument therefore provides both an overall writing-skill score and scores for its specific dimensions. The psychometric evidence reported for the instrument indicated satisfactory reliability and validity. Internal consistency coefficients were reported as .85 for word writing, .86 for writing picture names, and .54 for writing picture names in incomplete sentences, while the overall reliability coefficient for the total writing test was reported as .934. Evidence of criterion-related validity was obtained through

correlations between writing-test scores and Raven intelligence scores ($r = .205$, $p < .05$), dictation performance ($r = .36$, $p < .01$), and academic grade-point average ($r = .287$, $p < .01$). In addition, correlations between the four subscales and the total writing score were .921 for word writing, .936 for sentence writing, .801 for writing picture names, and .624 for writing picture names in incomplete sentences; all of these coefficients were statistically significant at $p < .01$.

The second research instrument was the researcher-developed cognitive apprenticeship training package based on Vygotsky's and Montessori's theories. The package was constructed by integrating theoretical foundations and instructional activities appropriate for early childhood learning and writing development. Its instructional framework incorporated clarification of learning objectives, modification of attitudes and beliefs, enhancement of learning awareness, direct practical experience, indirect feedback, and progressive development of writing and reading-related skills. The educational content was designed to maintain children's motivation and engagement through varied age-appropriate activities and to accommodate differences in cognitive development and learning readiness. Face and content validity were evaluated by expert reviewers, and the recommendations obtained during this process were used to revise the content and sequencing of the sessions. The manuscript further reports that the package was evaluated using content-validity procedures, Kendall's coefficient of concordance, internal-consistency assessment using Cronbach's alpha, confirmatory factor analysis, and convergent and discriminant validity procedures. The reported Kendall agreement coefficients for various aspects of the package exceeded .70, supporting satisfactory agreement among experts regarding its face and content validity.

2.3. Data Analysis

Data were entered and analyzed using SPSS version 26. The analysis proceeded through descriptive and inferential stages. Descriptive statistics were first calculated to characterize the participants and study variables, including measures of central tendency and dispersion. The distributional characteristics of the study variables were assessed using skewness and kurtosis indices. Because the

distributions were considered approximately normal, parametric statistical procedures were subsequently employed. Homogeneity of demographic characteristics between the experimental and control groups was examined using the chi-square test for categorical characteristics and the independent-samples t-test for quantitative characteristics.

To evaluate intervention effects, analysis of covariance was used to compare posttest writing scores between the experimental and control groups while statistically controlling for corresponding pretest scores. Independent-samples and paired-samples t-tests were also employed for relevant between-group and within-group comparisons. Before performing the covariance analyses, the required statistical assumptions were examined, including the appropriateness of the score distributions and the homogeneity of regression slopes. The manuscript reports that the interaction used to evaluate the homogeneity-of-regression-slopes assumption was not statistically significant, indicating that this assumption was satisfied and that ANCOVA could appropriately be conducted. Inferential analyses were performed both for the overall writing-skill score and for the four writing dimensions of word writing, sentence writing, writing picture names, and writing picture names in incomplete sentences. Effect sizes were reported using eta squared to estimate the proportion of variance in posttest writing performance attributable to the educational intervention after adjustment for baseline differences. Statistical significance was evaluated according to the probability levels reported for each analysis.

3. Findings and Results

The qualitative phase focused on the development, expert evaluation, refinement, and final organization of the cognitive apprenticeship training package based on Vygotsky's and Montessori's theories. The initial package was reviewed in terms of the necessity of its content, simplicity of presentation, relevance of the materials to the intended educational objectives, clarity of the instructional content, consistency between the package and its theoretical foundations, appropriateness of session sequencing, and overall quality of the instructional materials. Ten experts participated in the face- and content-validity assessment. The expert-evaluation results are presented in Table 1.

Table 1

Expert Ratings for the Face and Content Validity of the Cognitive Apprenticeship Training Package

Package Component	Necessary	Useful	Unnecessary	Completely Simple	Simple	Relatively Simple	Not Simple	Completely Relevant	Relevant	Relatively Relevant	Not Relevant	Completely Clear	Clear	Relatively Clear	Not Clear
Writing and composition of the package	8	2	1	9	0	1	0	8	1	1	0	7	2	1	0
Alignment of content with objectives	9	1	0	10	0	0	0	8	1	1	0	8	1	0	1
Appropriate sequencing of sessions	10	0	0	8	0	1	1	7	1	1	1	8	2	0	0
Consistency with theoretical foundations	8	1	1	8	1	1	0	6	3	1	0	7	2	1	0
Overall package content	8	1	1	7	2	1	0								

As shown in Table 1, the expert ratings generally supported the appropriateness of the package across the evaluated domains. Most experts classified the content as necessary or useful, simple or completely simple, relevant or completely relevant, and clear or completely clear. The strongest consensus concerning necessity was observed for the appropriate sequencing of the sessions, for which all experts classified this component as necessary. Alignment between the instructional content and the package objectives also received strong endorsement, with nine experts rating this component as necessary and all 10 experts rating its presentation as completely simple. Although some variation occurred in the evaluation of theoretical consistency and clarity, the overall distribution of expert responses was

concentrated within the favorable response categories. These findings provided initial evidence that the designed package possessed acceptable face and content validity and was sufficiently coherent for implementation after incorporating the experts' recommendations.

The degree of agreement among the experts was subsequently examined using Kendall's coefficient of concordance. The resulting coefficients for necessity, simplicity, relevance, and clarity are summarized in Table 2. The manuscript reports coefficients exceeding .70 across all four validity dimensions, indicating a high level of consistency among the experts in their evaluation of the educational package.

Table 2

Kendall's Agreement Coefficients for the Validity of the Cognitive Apprenticeship Training Package

Validity Dimension	Kendall's Agreement Coefficient
Necessity	.929
Simplicity	.772
Relevance	.898
Clarity	.860

As indicated in Table 2, all Kendall agreement coefficients were greater than .70. The highest agreement was obtained for necessity ($W = .929$), followed by relevance ($W = .898$), clarity ($W = .860$), and simplicity ($W = .772$). These coefficients demonstrate substantial agreement among the participating experts regarding the appropriateness of the educational package. In particular, the very high coefficient for necessity suggests that there was strong consensus that the selected educational components were required for the intended intervention. Similarly, the high coefficients for relevance and clarity indicate that the content was regarded as closely aligned with the objectives of the intervention and sufficiently understandable for implementation. Although agreement concerning simplicity

was somewhat lower than the other dimensions, its coefficient remained above .70 and therefore supported the acceptability of the package. Based on these findings, the experts' comments were incorporated into the intervention before preparation of the final version.

Following expert evaluation, the final educational package was organized into 20 sessions. The progression of the intervention moved from understanding instructional objectives and modifying attitudes toward writing to increasing awareness of learning, providing extensive practical writing experiences accompanied by indirect feedback, and concluding with final evaluation and direct corrective guidance. The complete organization of the intervention is presented in Table 3.

Table 3

Complete Session Structure of the Cognitive Apprenticeship Training Package Based on Vygotsky's and Montessori's Theories

Sessions	General Objective	Specific Objectives	Main Content and Activities
Sessions 1–2	Understanding instructional objectives	Recognizing the basic purposes of reading and writing; identifying topics related to reading and writing skills; learning to hold a pencil correctly; speaking within a group; expressing future goals and aspirations; distinguishing good from poor handwriting	The intervention objectives were introduced and the purposes of reading, writing, and communication were discussed. Instruction was provided through explanation, question-and-answer activities, and relevant animations. Children's initial awareness was evaluated through questions at the end of the sessions, and educational materials related to reading and writing were provided.
Sessions 3–4	Changing attitudes and beliefs	Developing positive beliefs about the usefulness of writing; recognizing that writing skill is influenced by behavior and practice; understanding the potential benefits of education; recognizing behaviors that can improve writing; encouraging consultation with teachers, parents, and peers	Brainstorming and group discussion were used to identify and modify incorrect beliefs and reinforce adaptive beliefs concerning writing. Films and animations demonstrated reading and writing activities before children engaged in practical exercises. Children identified perceived advantages and disadvantages of learning to read and write, discussed their beliefs with peers and family members, and evaluated positive and negative attitudes within the group. The researcher primarily guided and monitored the discussion rather than directly providing solutions.
Sessions 5–6	Increasing awareness of learning	Understanding the concept and purpose of writing; recognizing the importance of writing; making appropriate decisions to write in relevant situations; identifying appropriate times for writing and reading; participating in writing activities; strengthening confidence in writing ability; recognizing personal capability for improvement; explaining methods of learning to write	Group discussions were conducted to help children identify factors related to writing and become familiar with learning methods and features of the learning environment. Children practiced holding pencils, communicating with peers, making preliminary marks on paper, and engaging in elementary writing-related activities. They discussed personal writing goals in groups of three to five and considered intermediate steps required to reach those goals.
Sessions 7–18	Practical experience and indirect feedback	Writing directly; reading independently; developing writing without continuous direct instruction; completing specified tasks; performing writing activities with reduced stress	Practical experience and indirect feedback were implemented simultaneously over 12 sessions. Children practiced writing in hypothetical and practical situations. Initially, models of lines, shapes, and writing patterns were provided for copying or drawing. As the sessions progressed, children were gradually encouraged to write independently based on their own ideas. In accordance with Montessori and Vygotskian principles, direct intervention was minimized and the instructor provided indirect feedback when required. More competent peers were used as models for children who required additional support, and children worked in small groups to develop and present solutions.
Sessions 19–20	Evaluation of change in writing skill	Receiving final feedback concerning acquired skills; qualitative evaluation of writing performance; learning final corrective techniques	The final sessions focused on completing and evaluating the skills developed during the intervention. The instructor provided direct guidance on selected final techniques and devoted greater attention to children whose writing performance appeared comparatively weaker. Children were then prepared for the final assessment of their writing skills.

Table 3 demonstrates that the package followed a progressive instructional sequence rather than beginning immediately with formal writing drills. The first six sessions established motivational, attitudinal, cognitive, and preparatory foundations for writing. The core of the intervention occurred during Sessions 7–18, in which children repeatedly engaged in authentic writing activities while direct instructor intervention was deliberately reduced. Modeling, peer support, gradual transfer of responsibility, practical participation, and indirect feedback were central features of these sessions. The final two sessions served both an evaluative and corrective function. Thus, the final

intervention operationalized the central cognitive-apprenticeship principles of modeling, scaffolding, guided participation, gradual independence, practical performance, and feedback while also incorporating Montessori-oriented emphasis on child activity and indirect adult intervention.

After completion of the qualitative development and validation phase, the effectiveness of the intervention was evaluated quantitatively. The final analysis included 15 children in the experimental group and 15 children in the control group. Descriptive statistics for overall writing skill and its four dimensions at pretest and posttest are presented in Table 4.

Table 4

Means and Standard Deviations of Writing Skill and Its Dimensions at Pretest and Posttest

Variable	Group	Pretest M	Pretest SD	Posttest M	Posttest SD
Overall writing skill	Experimental	83.70	5.48	101.94	5.41
	Control	84.70	5.02	85.05	4.78
Word writing	Experimental	24.52	2.55	29.58	3.18
	Control	23.41	3.39	23.82	3.32
Sentence writing	Experimental	32.17	3.90	34.52	4.01
	Control	33.17	2.87	32.76	3.96
Writing picture names	Experimental	21.00	2.91	26.17	3.24
	Control	21.12	2.78	21.06	2.74
Writing picture names in incomplete sentences	Experimental	6.00	1.76	11.64	1.77
	Control	7.00	1.93	7.41	1.77

The descriptive results in Table 4 indicate a clear increase in writing performance among children who received the cognitive apprenticeship intervention. Overall writing skill in the experimental group increased from $M = 83.70$ ($SD = 5.48$) at pretest to $M = 101.94$ ($SD = 5.41$) at posttest, whereas the control group demonstrated only a minimal change from $M = 84.70$ ($SD = 5.02$) to $M = 85.05$ ($SD = 4.78$). Similar patterns were evident across the writing dimensions. Word-writing scores in the experimental group increased from 24.52 to 29.58, writing picture names increased from 21.00 to 26.17, and writing picture names in incomplete sentences increased from 6.00 to 11.64. Sentence writing showed a smaller but still observable increase from 32.17 to 34.52. In contrast, scores in the control group

remained largely stable across the assessment occasions, with sentence writing and writing picture names showing slight numerical decreases at posttest. These descriptive patterns therefore suggested improvement following the intervention, although inferential analysis was required to determine whether the observed group differences were statistically significant.

Analysis of covariance was subsequently conducted to compare posttest writing performance between the groups while controlling for pretest scores. The manuscript reports significant intervention effects for overall writing ability and for each of the four writing dimensions. The detailed ANCOVA results are presented in Table 5.

Table 5

Analysis of Covariance for Overall Writing Skill and Its Dimensions

Dependent Variable	Source	SS	df	MS	F	p	η^2
Overall writing skill	Pretest	343.029	1	343.029	21.576	.001	.41
	Group	2579.810	1	2579.810	162.268	.001	.84
	Error	492.853	31	15.898	—	—	—
Word writing	Pretest	166.428	1	166.428	27.443	.001	.49
	Group	168.494	1	168.494	27.784	.001	.50
	Error	169.806	28	6.065	—	—	—
Sentence writing	Pretest	179.284	1	179.284	17.309	.001	.38
	Group	62.898	1	62.898	6.072	.050	.18
	Error	290.024	28	10.358	—	—	—
Writing picture names	Pretest	130.370	1	120.370	28.829	.001	.48
	Group	202.369	1	202.369	40.093	.001	.58
	Error	141.329	28	5.047	—	—	—
Writing picture names in incomplete sentences	Pretest	69.774	1	69.774	25.011	.001	.47
	Group	195.946	1	195.946	70.238	.001	.71
	Error	78.113	28	2.790	—	—	—

As shown in Table 5, after controlling for baseline writing performance, a statistically significant group effect was

found for overall writing skill, $F = 162.268$, $p = .001$, $\eta^2 = .84$. The eta-squared value indicated that 84% of the variance

in adjusted posttest writing scores was associated with group membership, demonstrating a substantial intervention effect. Significant group effects were also obtained for word writing, $F = 27.784$, $p = .001$, $\eta^2 = .50$; sentence writing, $F = 6.072$, $p = .050$, $\eta^2 = .18$; writing picture names, $F = 40.093$, $p = .001$, $\eta^2 = .58$; and writing picture names in incomplete sentences, $F = 70.238$, $p = .001$, $\eta^2 = .71$. Accordingly, the intervention accounted for 50%, 18%, 58%, and 71% of the variance in these respective outcomes. The largest dimension-specific effect was observed for writing picture names in incomplete sentences, followed by writing picture

names and word writing, whereas the smallest effect was observed for sentence writing. Taken together, these results demonstrated that the cognitive apprenticeship package significantly improved both overall writing performance and each of the specific writing components assessed in the study.

To determine the direction and magnitude of the adjusted group differences more precisely, Bonferroni post-hoc comparisons were performed. The results for overall writing skill and the four writing dimensions are presented in Table 6.

Table 6

Bonferroni Post-Hoc Comparisons of Writing Skill Between the Experimental and Control Groups

Dependent Variable	Comparison	Mean Difference	SE	p	95% CI Lower	95% CI Upper
Overall writing skill	Experimental – Control	17.505	1.374	.001	14.702	20.308
Word writing	Experimental – Control	4.863	0.923	.001	2.973	6.752
Sentence writing	Experimental – Control	2.971	1.206	.020	0.501	5.441
Writing picture names	Experimental – Control	5.329	0.842	.001	3.605	7.053
Writing picture names in incomplete sentences	Experimental – Control	5.244	0.626	.001	3.962	6.526

The Bonferroni comparisons presented in Table 6 confirmed that the adjusted posttest mean of the experimental group was significantly higher than that of the control group for overall writing skill and for all four writing dimensions. For total writing skill, the adjusted mean difference was 17.505 points in favor of the experimental group ($SE = 1.374$, $p = .001$, 95% CI [14.702, 20.308]). The experimental group also exceeded the control group by 4.863 points in word writing ($SE = 0.923$, $p = .001$, 95% CI [2.973, 6.752]), 2.971 points in sentence writing ($SE = 1.206$, $p = .020$, 95% CI [0.501, 5.441]), 5.329 points in writing picture names ($SE = 0.842$, $p = .001$, 95% CI [3.605, 7.053]), and 5.244 points in writing picture names in incomplete sentences ($SE = 0.626$, $p = .001$, 95% CI [3.962, 6.526]). All confidence intervals were entirely above zero, confirming that the direction of the differences consistently favored the intervention group. Therefore, the post-hoc findings corroborated the ANCOVA results and provided further evidence that the cognitive apprenticeship training package based on Vygotsky's and Montessori's theories was effective in improving both general writing ability and specific components of writing performance among the participating five-year-old children.

4. Discussion and Conclusion

The present study was conducted to design and validate a cognitive apprenticeship training package based on

Vygotsky's and Montessori's theoretical principles and to determine its effectiveness in improving writing skills among five-year-old children. The findings provided support for both the qualitative validity of the designed educational package and its quantitative effectiveness. In the qualitative phase, expert evaluations indicated strong agreement concerning the necessity, simplicity, relevance, and clarity of the package. Kendall's coefficients of agreement were .929 for necessity, .772 for simplicity, .898 for relevance, and .860 for clarity, demonstrating substantial consistency among experts regarding the appropriateness of the intervention. In the quantitative phase, after controlling for pretest differences, the experimental group achieved significantly higher posttest scores than the control group in overall writing skill and all four writing dimensions. The intervention had a particularly large effect on overall writing skill, with an eta-squared value of .84. Significant effects were also observed for word writing ($\eta^2 = .50$), sentence writing ($\eta^2 = .18$), writing picture names ($\eta^2 = .58$), and writing picture names in incomplete sentences ($\eta^2 = .71$). Bonferroni comparisons further confirmed that the adjusted posttest scores of the experimental group were significantly higher than those of the control group across all assessed outcomes.

The first important finding concerned the successful development and validation of the cognitive apprenticeship package. The high expert agreement regarding necessity,

relevance, and clarity suggests that the instructional components were theoretically coherent and appropriately organized for five-year-old children. This result can be understood in light of Vygotsky's sociocultural perspective, according to which educational activities become particularly effective when they provide children with structured social support and opportunities to perform tasks that exceed their independent level of functioning. Contemporary applications of Vygotskian theory likewise emphasize scaffolding, collaborative activity, social mediation, and gradual internalization as key mechanisms underlying cognitive and social development (Malik et al., 2025). The package developed in the present study reflected these mechanisms through modeling, peer assistance, indirect feedback, guided participation, and progressive transfer of responsibility from the instructor to the child. Consequently, the favorable expert evaluation may partly reflect the internal consistency between the theoretical assumptions of cognitive apprenticeship and the practical organization of the sessions.

The structure of the intervention also corresponded to contemporary views of developmentally appropriate and individualized education. Rather than immediately requiring children to perform formal writing tasks, the package began with understanding the purpose of writing, modifying attitudes and beliefs, increasing awareness of learning, and preparing children for progressively more independent participation. Such sequencing is consistent with evidence showing that children differ substantially in developmental readiness and that educational programs are more effective when instruction is adapted to individual cognitive, behavioral, and neurodevelopmental characteristics (İzoğlu-Tok & Doğan, 2024; Şahin, Soylu, et al., 2024). The emphasis on flexible scaffolding may therefore have increased the suitability of the intervention for preschool children whose initial writing abilities and developmental capacities were not identical.

The principal quantitative finding was the substantial improvement in overall writing skill among children who received the cognitive apprenticeship program. After adjustment for baseline performance, group membership accounted for 84% of the variance in posttest writing scores, indicating a strong educational effect. This finding is theoretically compatible with Vygotsky's proposition that learning can lead development when instructional tasks are positioned within the child's zone of proximal development. From this perspective, children are capable of performing at a higher level when supported by an adult or a more

competent peer than when working entirely independently. Over time, these socially supported performances can become internalized and transformed into independent cognitive and behavioral competencies. Contemporary research similarly suggests that structured, socially mediated educational activities can enhance cognitive development by requiring children to reason, interact, explain, and gradually regulate their own performance (Malik et al., 2025; Wei & Chen, 2025). The marked increase in writing performance observed in the present study is therefore consistent with a model in which external scaffolding gradually becomes internal self-regulation.

The findings are also compatible with the broader literature on interactive and experiential learning. The intervention required children to manipulate writing materials, observe models, participate in small-group activities, generate their own responses, and receive feedback while actively engaged in the learning process. Interactive educational environments have been associated with enhanced creativity, engagement, and learning because they transform children from passive recipients of information into active participants in the construction of knowledge (Momenifard, 2025). In a similar manner, cognitive apprenticeship emphasizes learning through authentic performance rather than through verbal explanation alone. For five-year-old children, whose learning is strongly connected to action and sensory-motor experience, repeated opportunities to draw, trace, copy, produce symbols, and eventually write more independently may have strengthened both procedural familiarity and cognitive understanding of the writing process.

The improvement in overall writing performance may also be explained through the contribution of executive functions. Writing requires children to maintain task goals, direct attention toward relevant visual and linguistic information, inhibit competing responses, retrieve appropriate representations, monitor performance, and coordinate motor actions. Executive-function research has repeatedly demonstrated that weaknesses in attention, working memory, inhibitory control, and cognitive flexibility can interfere with academic learning, particularly among children with neurodevelopmental or specific learning difficulties (Megari, 2026). Similarly, attentional control has been associated with language-related precursor skills such as phonological awareness (Yao et al., 2024). The cognitive apprenticeship program required sustained engagement, repeated practice, peer observation, task completion, and gradual self-management; therefore, it may

have improved writing partly by creating conditions in which executive processes were repeatedly activated and practiced within meaningful activities.

The significant improvement in word writing provides further evidence for the effectiveness of the intervention. The experimental group showed a clear increase in word-writing performance, and the adjusted group effect accounted for 50% of the variance. Word writing requires the integration of symbol recognition, orthographic representation, phonological processing, memory, and controlled hand movements. The practical and repetitive structure of the intervention may have strengthened the association between visual forms, linguistic representations, and motor production. This interpretation is compatible with research indicating that children's academic development depends on coordinated cognitive and perceptual processes rather than isolated skill practice (Micheletti et al., 2024; Poltz et al., 2025). Although Poltz et al. primarily examined mathematical development, their findings concerning the relevance of visual-spatial abilities are conceptually important for writing because successful written production also requires the spatial organization and visual discrimination of symbols (Poltz et al., 2025).

The significant effect on sentence writing was smaller than the effects observed for the other dimensions, with an eta-squared value of .18. Nevertheless, the experimental group significantly outperformed the control group in Bonferroni comparisons. This comparatively smaller effect is theoretically plausible because sentence writing is more cognitively demanding than writing isolated words or identifying and writing picture names. Sentence writing requires not only graphomotor and orthographic skills but also language formulation, syntactic organization, working memory, sequencing, and the ability to maintain semantic coherence. Research on developmental and learning difficulties has shown that more complex academic tasks tend to place greater demands on executive and linguistic systems (Katsarou & Angelidou, 2026; Megari, 2026). Accordingly, five-year-old children may have acquired basic writing components more rapidly than the higher-level linguistic organization required for sentence production. The significant, although more modest, effect suggests that such higher-order skills may be teachable at this age but may require a longer intervention period or more specialized language-focused activities to produce effects comparable with those found for simpler writing tasks.

A particularly strong intervention effect was observed for writing picture names, for which group membership

explained 58% of the posttest variance. Picture-based writing activities may be especially appropriate for preschool children because images provide direct semantic cues that reduce the abstract demands associated with generating written content. Visual stimuli can support retrieval, attention, and organization by anchoring children's linguistic responses to concrete representations. The integration of visual and motor information is also consistent with evidence concerning the contribution of visuospatial capacities to children's academic development (Poltz et al., 2025). The cognitive apprenticeship framework may have further enhanced this process by allowing children to observe how picture information could be translated into written symbols, initially with assistance and subsequently with increasing independence. Thus, the combination of concrete visual stimuli and scaffolded written production may explain the relatively large effect observed for this subskill.

The largest dimension-specific effect was observed for writing picture names in incomplete sentences, with an eta-squared value of .71. This finding suggests that children benefited substantially when the writing task combined structured contextual cues with an opportunity to complete an incomplete linguistic unit. Such tasks may reduce cognitive demands by providing part of the semantic and syntactic structure in advance, allowing the child to focus attention on identifying the missing concept and producing the corresponding written representation. This form of task organization is closely aligned with scaffolding because the instructional environment supplies partial support while still requiring active completion by the learner. As competence increases, such external support can gradually be reduced. This interpretation fits well with Vygotskian approaches emphasizing supported performance as a precursor to independent functioning (Malik et al., 2025). It is also consistent with evidence that structured interventions can improve children's cognitive functioning when demands are carefully calibrated to their current abilities (Wei & Chen, 2025).

The findings can additionally be interpreted from the perspective of Montessori education. Montessori-oriented instruction emphasizes sensitive periods, repeated activity, self-correction, indirect adult intervention, and the organization of environments that encourage children to perform tasks independently. The present intervention incorporated these principles by minimizing unnecessary direct correction, allowing repeated practice, using concrete educational materials, and gradually encouraging children to

produce writing based on their own ideas. Such features may have promoted both mastery and motivation. When children are allowed to repeat an activity without excessive external control, repeated sensorimotor and cognitive experiences can become increasingly automatized. This process may be particularly relevant to early writing, in which the coordination of visual perception, fine-motor control, and symbolic representation initially requires considerable effort.

The emotional and motivational climate of the intervention may also have contributed to its effectiveness. The sessions emphasized discussion, peer collaboration, indirect feedback, confidence, and reduced stress during writing performance. Children were encouraged to express their beliefs about writing and to view writing as a meaningful and achievable activity before engaging in more demanding practical tasks. This feature is consistent with research emphasizing the contribution of socioemotional competence to children's mental health and learning (Varalakshmi & Varun, 2025). Interventions that combine self-regulatory and socioemotional components with structured educational activity have also demonstrated benefits for cognitive functioning and academic achievement (Galinha et al., 2025). Thus, the improvement observed in the experimental group may not have resulted exclusively from repeated writing practice; it may also have reflected increased confidence, reduced performance anxiety, greater persistence, and a more positive orientation toward learning.

This interpretation is particularly important because cognitive and academic functioning can be disrupted by emotional insecurity and developmental stress. Research concerning children exposed to adverse experiences shows that psychological distress can influence attention, learning, and developmental functioning (Esmailzadeh et al., 2026). Similarly, interventions designed to enhance executive functioning and emotional security suggest that cognitive development may benefit when emotional and behavioral conditions are simultaneously supported (Zhu, 2025). Although the participants in the present study were not selected on the basis of psychological difficulties, the supportive and low-pressure nature of the intervention may have created a learning environment conducive to sustained engagement and experimentation.

The findings further support contemporary calls for educational systems to become more individualized, inclusive, and responsive to developmental diversity. Children do not enter educational settings with identical

cognitive, linguistic, attentional, or social capacities, and rigid instructional practices may therefore fail to make optimal use of their learning potential. Early childhood educators have emphasized the importance of individualized planning for children with different neurodevelopmental profiles (Şahin, Soylu, et al., 2024), while studies of teacher development indicate that educators require further preparation to implement flexible and learner-centered strategies effectively (Şahin, Atapour, et al., 2024). The cognitive apprenticeship package examined in the present study offers a structured format through which teachers can provide individualized levels of assistance while maintaining common instructional objectives.

The findings also have implications for educational equity. If appropriately validated early-writing programs can improve children's performance before formal school entry, access to such programs may help reduce disparities that emerge from differences in home literacy environments, educational resources, or teacher preparation. Contemporary educational research emphasizes that equitable education requires not merely access to schooling but access to effective and adaptable learning opportunities (Shariati et al., 2024). Similarly, technology-supported and inclusive approaches have been proposed to help teachers create environments that support children with attentional and developmental differences (Drigas et al., 2025). The present findings suggest that cognitive apprenticeship principles could potentially be incorporated into such broader inclusive frameworks.

At a broader developmental level, the results support the proposition that chronological age should not be treated as the sole determinant of educational readiness. Research shows considerable variation in children's developmental trajectories, particularly among those with sensory, neurodevelopmental, or learning-related differences (İzoğlu-Tok & Doğan, 2024; Tosolini et al., 2025). Children may therefore demonstrate competencies beyond conventional age expectations when appropriate environmental and interpersonal supports are available. The present study does not establish that formal schooling should universally begin at age five; however, it does indicate that five-year-old children can make substantial gains in structured writing skills when instruction is developmentally sensitive, scaffolded, interactive, and progressively individualized. Such findings shift the focus from asking whether children of a particular age are categorically "ready" to considering what forms of support enable them to demonstrate emerging competencies.

Finally, the positive findings should be understood within a broader conception of childhood development in which cognition, motivation, emotion, social interaction, and educational experience operate together. Children actively interpret their environments and are capable of making increasingly sophisticated judgments about competence, fairness, and opportunities for participation (Forbes et al., 2026). Providing meaningful roles within the learning process may therefore enhance both cognitive engagement and ownership of learning. The cognitive apprenticeship model used in this study encouraged children to participate rather than merely receive instruction, and this active role may have been an important mechanism underlying the observed gains. Taken together, the results support the effectiveness of integrating Vygotskian scaffolding, Montessori-oriented developmental sensitivity, peer interaction, authentic practice, indirect feedback, and gradual independence in early writing instruction.

Several limitations should be considered when interpreting these findings. The sample was relatively small and was drawn from preschool centers in a single geographical area, which restricts the extent to which the results can be generalized to children from other cultural, socioeconomic, linguistic, or educational settings. Although participants were randomly assigned after recruitment, purposive sampling was used to identify eligible children, which may have introduced selection bias. The study employed a pretest–posttest design without a longer-term follow-up assessment; therefore, it is unclear whether the observed gains were maintained after the intervention ended. The control group did not receive an active alternative intervention, making it difficult to separate the specific effects of cognitive apprenticeship from nonspecific influences such as increased adult attention, novelty, group interaction, or additional instructional time. The intervention was also implemented by the researcher, which may have introduced expectancy or implementation effects. Finally, several aspects of developmental readiness, including executive functioning, fine-motor skill, language ability, socioeconomic background, home literacy environment, and parental involvement, were not modeled as potential moderators of intervention effectiveness.

Future studies should replicate the intervention with larger and more diverse samples drawn from multiple preschool centers, regions, and sociocultural contexts. Randomized controlled trials involving active comparison groups would provide stronger evidence regarding whether the observed effects are specifically attributable to the

cognitive apprenticeship components of the program. Researchers should incorporate follow-up measurements over several months to determine the durability of writing gains and whether early improvements predict later reading, spelling, and academic achievement after formal school entry. Future studies could also compare cognitive apprenticeship directly with Montessori-only, Vygotskian scaffolding-only, play-based, multisensory, and conventional writing instruction to identify the most effective components of the integrated package. Examining executive functioning, language development, fine-motor abilities, motivation, self-regulation, and family literacy as mediators or moderators would provide a more detailed explanation of how and for whom the intervention works. Qualitative interviews with children, parents, and educators could also clarify perceived feasibility, acceptability, and developmental appropriateness.

Preschool teachers and early-childhood educators may consider introducing structured writing experiences before formal primary-school entry when these activities are adapted to children's developmental abilities and are delivered through supportive rather than rigid instructional methods. Writing instruction at this age should emphasize modeling, playful and meaningful practice, peer collaboration, visual materials, small achievable steps, and gradual reduction of adult assistance. Teachers should avoid excessive correction or pressure and should instead create environments in which children can experiment with writing, repeat activities, receive indirect feedback, and progressively assume greater responsibility for their own performance. The intervention may also be useful as a framework for teacher-training programs because it provides a structured way to integrate developmental theory with classroom practice. Preschool centers should consider adapting instructional intensity and support to individual children rather than applying uniform expectations based only on chronological age.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

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

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We hereby thank all individuals for participating and cooperating us in this study.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

References

- Drigas, A., Pergantis, P., Chaidi, I., & Christou, A. (2025). The KIDSWELL Project: Supporting Teachers to Ensure a Learning and Inclusive Environment for Children with ADHD Based on the Introduction of Emerging Technologies for the Development of Skills as an Active Citizen. *World Journal of Advanced Research and Reviews*, 25(3), 1807-1818. <https://doi.org/10.30574/wjarr.2025.25.3.0945>
- Esmailzadeh, A., Jafari, S., Jabbari Amiri, J., & Esmaeili, S. (2026). The Impact of War on the Development of Post-Traumatic Stress Disorder in Children and Adolescents: A Narrative Review. *Journal of Archives in Military Medicine*, 14(1), e167497. <https://doi.org/10.69107/jamm-167497>
- Forbes, M. B., Sims, R. N., & Killen, M. (2026). Children and young adults factor merit into their judgments of gender-based science resource inequalities. *Developmental science*, 29(1), e70096. <https://doi.org/10.1111/desc.70096>
- Galinha, I. C., de Carvalho, J. L. D. C. S., de Oliveira, A. C. P., Arriaga, P., Gaspar, A. D., Silva, H. P., & Ortega, V. (2025). MindRegulation-SEL: Randomized Controlled Trial of the Effects of a Relaxation and Guided Imagery Intervention with Socioemotional Learning on the Psychological and Biophysiological Well-Being, Socioemotional Development, Cognitive Function and Academic Achievement of Elementary School Children. *Trials*, 26(1). <https://doi.org/10.1186/s13063-025-08899-3>
- İzoğlu-Tok, A., & Doğan, Ö. (2024). Preliminary developmental challenges of children at risk for specific learning disabilities: Insights from parents and teachers-a qualitative study. *Current Psychology*, 1-17. <https://doi.org/10.1007/s12144-024-06231-x>
- Katsarou, D. V., & Angelidou, A. A. (2026). The Impact of ADHD on Children's Language Development. *Children (Basel, Switzerland)*, 13(2), 206. <https://doi.org/10.3390/children13020206>
- Malik, M. S., Maslahah, M., Maulida, A. Z., Nikmah, L., & Hashinuddin, A. (2025). Vygotsky's Theory in the Development of Social and Cognitive Skills of the Alpha Generation. *FASHLUNA*, 6(1), 28-39. <https://doi.org/10.47625/fashluna.v6i1.968>
- Megari, K. (2026). Cognitive Pathways in Atypical Development: Executive Functions in Children With Attention-Deficit/Hyperactivity Disorder and Specific Learning Disorders. *International Journal of Developmental Neuroscience*, 86(1). <https://doi.org/10.1002/jdn.70094>
- Micheletti, S., Galli, J., Vezzoli, M., Scaglioni, V., Agostini, S., Calza, S., Merabet, L. B., & Fazzi, E. (2024). Academic skills in children with cerebral palsy and specific learning disorders. *Developmental Medicine & Child Neurology*, 66(6), 778-792. <https://doi.org/10.1111/dmcn.15808>
- Momenifard, M. (2025). Designing Interactive Play Environments to Enhance Creativity and Improve Mathematics Learning in Elementary-School Children: A Study in Isfahan. *Engineering Development Conference Center Article Database*, 2(8), 1-11.
- Poltz, N., Ehlert, A., Quandt, S., Kucian, K., von Aster, M., & Esser, G. (2025). Visual-spatial skills and children's math development. *Learning and Instruction*, 101, 102246. <https://doi.org/10.1016/j.learninstruc.2025.102246>
- Şahin, A., Atapour, N., & Soylu, D. (2024). Early Childhood Educators' Views on Implementing Individualized Education Plans for Neurodevelopmental Disorders. *Iranian Journal of Neurodevelopmental Disorders*, 2(4), 19-27. <https://doi.org/10.61838/kman.jndd.2.4.3>
- Şahin, A., Soylu, D., & Jafari, M. (2024). Professional Development Needs of Teachers in Rural Schools [Research Article]. *Iranian Journal of Educational Sociology*, 7(1), 219-225. <https://doi.org/10.61838/kman.ijes.7.1.22>
- Shariati, F., Niazazari, K., & Jabbary, N. (2024). Presenting a Model for Virtual Education Considering Educational Equity with a Phenomenological Approach in Schools of Golestan Province [Research Article]. *Iranian Journal of Educational Sociology*, 7(1), 66-78. <https://doi.org/10.61838/kman.ijes.7.1.7>
- Tosolini, K. E., Damen, S., Janssen, M. J., & Minnaert, A. E. (2025). A Piagetian lens on cognitive development of children and youths with congenital deafblindness: A scoping review. *Frontiers in Education*, 10, 1479668. <https://doi.org/10.3389/educ.2025.1479668>
- Varalakshmi, V., & Varun, P. (2025). The Contribution of Social and Emotional Skills to Children's Mental Health Development. *Shanlax International Journal of Arts, Science and Humanities*, 12(2), 145-151. <https://doi.org/10.34293/sijash.v12iS2-Jan.8901>
- Vatou, A., Evangelou Tsitiridou, M., Tympa, E., Gregoriadis, A., & Vatou, A. (2026). Parenting intervention programs supporting social-emotional development in preschool children: A literature review. *Encyclopedia*, 6(1), 17. <https://doi.org/10.3390/encyclopedia6010017>
- Wei, C., & Chen, L. (2025). The Effects of Philosophy for Children on Children's Cognitive Development: A Three-Level Meta-Analysis. *Journal of Intelligence*, 13(10), 130. <https://doi.org/10.3390/jintelligence13100130>
- Yao, C., Jun, H., & Dai, G.-S. (2024). Predicting Phonological Awareness: The Roles of Mind-Wandering and Executive Attention. *International Journal of Education and Cognitive Sciences*, 5(2), 1-7. <https://doi.org/10.22034/injoeas.2024.454689.1084>
- Zhu, Q. (2025). The Influence of Art Therapy Intervention on Executive Function Development and Emotional Security in Children with Autism Spectrum Disorder