KMAN PUBLISHING INSTITUTE
Journal Website

Article history:
Received 02 September 2025
Revised 26 November 2025
Accepted 02 December 2025
Initial Published 05 December 2025
Final Publication 01 January 2026

KMAN Counseling & Psychology Nexus

Volume 4, pp 1-13

E-ISSN: 3041-9026

Comparison of The Effectiveness of Training in Effective Teaching Strategies and A Behavior Management Program on The Self-Concept of Students with Attention-Deficit/Hyperactivity Disorder

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A r t i c l e I n f o

Article type:
Original Research
Section:
Health Psychology

How to cite this article:
Rahmani, M., Heydari, S., & Salim Bahrami, S. H. (2026). Comparison of The Effectiveness of Training in Effective Teaching Strategies and A Behavior Management Program on The Self-Concept of Students with Attention-Deficit/Hyperactivity Disorder. *KMAN Conseling and Psychology Nexus, 4*, 1-13.
http://doi.org/10.61838/kman.isn.psynexus.4800

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A B S T R A C T

Children with attention-deficit/hyperactivity disorder (ADHD) experience difficulties with their families and teachers, and these weaknesses expose them to many academic problems. Therefore, the present study was conducted with the aim of comparatively examining the effectiveness of educational strategies and behavior management programs on the self-concept of students with ADHD in Miandoroud County. The present study was a semi-experimental research with a pretest–posttest design. The statistical population consisted of all primary school students with ADHD. The Piers–Harris Children's Self-Concept Scale (1963) was used. A sample of 45 students was selected through multi-stage cluster random sampling and assigned to three groups of 15. The first experimental group received an educational intervention on effective teaching strategies, the second group received training in behavior management, and finally all three groups completed the posttest. The group training sessions on effective teaching methods and behavior management were held over 6 weeks, 60 minutes per day. Descriptive statistics (indices of central tendency and dispersion) and mixed-design repeated-measures analysis of variance, while observing statistical assumptions, were used to test the hypotheses. The data were analyzed using SPSS-26 software. The results of this study showed that both approaches—effective teaching strategies and the behavior management program—had a significant effect on the students' self-concept, with an eta coefficient of 0.56 ($P<0.001$). After follow-up, a significant difference remained between the intervention and control groups ($P<0.001$). The findings indicate that effective teaching strategies and behavior management programs have a significant impact on academic achievement, self-management, self-regulation, and self-concept among students with ADHD.

Keywords: *teaching strategies, behavior management program, self-concept, attention-deficit/hyperactivity disorder (ADHD).*

1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders of childhood, affecting emotional, cognitive, and behavioral functioning in ways that significantly interfere with learning and school adjustment. Core symptoms—such as inattention, hyperactivity, and impulsivity—disrupt students' ability to engage in academic tasks, sustain attention during instructional activities, and complete assignments efficiently. These challenges, compounded by elevated comorbidity and executive dysfunction, make ADHD a major barrier to academic success and psychosocial development. Extensive research has demonstrated that children with ADHD face persistent difficulties in academic achievement, classroom behavior, and self-regulatory capacities, with impairments often continuing into adolescence and adulthood. For example, deficits in executive functioning have been shown to negatively influence academic outcomes, as students with ADHD frequently struggle with planning, working memory, and organizational processes that are essential for school performance (Biederman et al., 2020). These impairments are also evident in high-school samples, where students with ADHD report higher rates of academic underachievement, lower grades, and more frequent school-related difficulties (Kent et al., 2021). Longitudinal work similarly demonstrates that ADHD in childhood is associated with poorer educational and vocational outcomes in young adulthood, underscoring the chronic nature of the disorder's impact on learning trajectories (Kuriyan et al., 2021).

Alongside academic impairments, children with ADHD experience significant socio-emotional and behavioral challenges that further shape their educational experiences. Early research on hyperactive children showed increased family conflict, problematic mother-child interactions, and elevated levels of maternal stress within families of children diagnosed with ADHD (Barkley et al., 2020). These challenges highlight the multifaceted nature of the disorder and the importance of considering the social environment in which learning occurs. More recent work has reinforced this view, showing that adolescents with higher levels of ADHD symptoms exhibit distinct neurophysiological patterns, such as heightened heartbeat-evoked potentials, which reflect altered interoceptive processing and emotional sensitivity (Rapp et al., 2023). These findings underscore the need for holistic intervention approaches that address both behavioral and cognitive-emotional functioning.

Self-concept is one of the key psychological constructs profoundly affected in children with ADHD. Self-concept refers to the set of beliefs individuals hold about their own abilities, attributes, and value. It is closely intertwined with academic resilience, motivation, and performance. Students with ADHD often internalize repeated academic failures, negative feedback from teachers, and social difficulties with peers, resulting in diminished self-concept and increased vulnerability to academic disengagement. Research consistently shows that children with ADHD display lower levels of academic self-concept compared to their typically developing peers, and this discrepancy contributes to ongoing academic struggles (Cantwell & Satterfield, 2021). Self-concept is also deeply connected to emotional well-being; adolescents with test anxiety, for instance, exhibit negative academic cognitions and heightened self-critical beliefs, which undermine their confidence and performance (Zatz & Chassin, 2021). More broadly, university-level data have shown that self-concept mediates the relationship between resilience and academic achievement, indicating that students with stronger self-beliefs are more capable of translating resilience into positive academic outcomes (García-Martínez et al., 2022). This connection is especially important for students with ADHD, who frequently contend with lower resilience due to chronic frustration and academic setbacks.

Resilience itself is an essential factor in educational adaptation. During the COVID-19 pandemic, for example, higher levels of psychological resilience were associated with reduced mental distress in adolescents and adults facing pervasive uncertainty and disruption (Riehm et al., 2021). Similarly, studies of young individuals with chronic health conditions have demonstrated that resilience acts as a protective factor against emotional distress and helps maintain functioning under stressful circumstances (Elliott et al., 2023). Adolescents with medical conditions such as thalassemia major have been found to rely on both personal and environmental resilience resources to cope effectively with illness-related challenges, suggesting the universal importance of resilience in supporting psychological health (Rambod et al., 2023). Such findings help contextualize the experiences of students with ADHD, who frequently require resilience to cope with persistent academic obstacles, social difficulties, and the emotional consequences of their symptoms. Given the established relationships among self-concept, resilience, and academic success, interventions that enhance students' self-beliefs and regulatory capacities are essential.

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E-ISSN: 3041-9026

Self-regulation is another central area of impairment in ADHD. It includes the ability to control impulses, manage emotions, maintain attention, and modulate behavior in accordance with situational demands. Evidence from developmental neuropsychology shows that children with ADHD display impairments in working-memory-related attentional orienting, which hinders their ability to focus and maintain relevant information during learning tasks (Superbia-Guimarães et al., 2022). Environmental influences beginning early in life also play a critical role. For instance, prenatal exposure to organophosphorus pesticides has been associated with poorer executive functioning in preschool children, suggesting that biological and environmental factors jointly shape self-regulatory development (Thistle et al., 2022). Difficulties in self-regulation can also exacerbate emotional problems and stress responses, contributing to declining academic engagement over time. In contrast, interventions designed to strengthen working memory have shown positive effects on children with developmental language disorders, illustrating that targeted training can improve cognitive processes associated with academic performance (Henry et al., 2022).

Educational environments, including teacher behaviors, classroom structure, and instructional methods, significantly influence the academic and psychological outcomes of students with ADHD. Positive teacher attitudes and effective instructional behaviors have been shown to contribute to student progress, while negative interactions or lack of support may exacerbate difficulties (Kahveci, 2023). Cooperative teaching methods can also promote academic self-concept and school engagement, particularly for younger learners who benefit from structured peer interactions and supportive learning strategies (Sepahvand, 2024). Moreover, contemporary learning environments shaped by cognitive, social, and emotional factors demonstrate that academic self-concept plays an important mediating role in determining how students engage with achievement tasks and how they respond to instructional practices. For example, academic self-concept has been shown to influence the relationship between teacher support, student engagement, and psychological well-being among university students (Zhang, 2024). Similarly, research demonstrates that self-concept is closely tied to motivation, goal orientation, and achievement patterns in diverse classroom environments (Steinberg et al., 2024). These findings collectively highlight the need for instructional approaches that support self-beliefs and promote active engagement.

Resilience is also an important factor in job and academic performance contexts beyond childhood. Evidence from organizational psychology indicates that resilience mediates the relationship between self-concept and performance, suggesting that individuals with strong self-beliefs and higher resilience perform better across varied tasks and environments (Varshney & Varshney, 2023). These insights reinforce the importance of early educational interventions, as strengthening self-concept and resilience in childhood may foster improved academic and later vocational outcomes.

Another domain highly relevant to the formation of self-concept and emotional functioning is attachment. Secure attachment relationships provide children with a sense of safety, enabling them to explore their environment confidently and engage more effectively in learning tasks. Insecure attachment, by contrast, has been associated with emotional dysregulation and vulnerability to anxiety and stress. Studies have shown that attachment styles correlate with interpersonal communication competence, emotional expression, and self-beliefs in adolescents and young adults (Baquiran et al., 2024). Research in clinical populations further suggests that attachment patterns are linked to self-esteem and emotional development during adolescence (Floricica et al., 2022). Attachment orientations also influence self-regulation processes and dyadic coping strategies in adults, illustrating the pervasive influence of attachment on cognitive-emotional functioning across the lifespan (Bröning & Wartberg, 2024). While family-related stress is not the direct focus of the present study, these findings highlight the foundational role of relational and emotional experiences in shaping self-concept and regulatory capacities among children with ADHD.

Beyond relational and cognitive-emotional constructs, genetic and neurodevelopmental research provides additional insight into the complexity of ADHD-related impairments. For instance, CAPRIN1 haploinsufficiency has been identified as a biological mechanism underlying neurodevelopmental disorders featuring language impairment, ADHD, and autism spectrum disorder (Pavinato et al., 2023). These findings emphasize the interplay of biological, cognitive, and environmental factors in shaping academic performance, executive functioning, and self-concept in children with ADHD.

Given the broad range of cognitive, emotional, and environmental factors influencing academic outcomes for students with ADHD, the importance of supportive and adaptive educational interventions becomes clear. Effective

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teaching strategies tailored to the needs of learners with ADHD can address difficulties in attention, task engagement, organization, and emotional regulation. Teacher-implemented interventions, such as learning stations, project-based methods, differentiated instruction, and supportive feedback practices, are designed to enhance students' capacity to engage meaningfully in learning tasks and experience academic success. Evidence from educational psychology suggests that well-structured instructional strategies can lead to increased motivation, improved academic outcomes, and stronger self-concept, particularly among students with attention and learning difficulties. Cooperative and student-centered learning structures have similarly been shown to improve engagement, support social interaction, and facilitate the development of self-beliefs necessary for academic achievement (Veryanto et al., 2025).

Behavior management programs also represent a critical intervention pathway for students with ADHD. Such programs typically employ behavioral reinforcement, structured routines, modeling, and response-cost strategies to help students increase appropriate behaviors and reduce disruptive or impulsive actions. Behavioral interventions grounded in cognitive-behavioral principles have shown promise for improving attention, reducing hyperactivity, and enhancing students' capacity to engage in learning activities (Amiri, 2020). When implemented consistently by teachers, behavior management strategies can create supportive classroom environments that reduce stress, increase predictability, and promote positive interactions. These contextual improvements can, in turn, support the development of healthier self-concepts by reducing the frequency of negative academic experiences and facilitating more successful learning outcomes.

As the evidence indicates, the interplay of self-concept, resilience, self-regulation, and educational experience is fundamental to understanding how children with ADHD navigate academic environments. Students with low academic self-concept are less likely to engage in challenging tasks, more likely to avoid effortful work, and more prone to negative emotions during school-related activities. Conversely, instructional strategies that promote competence, autonomy, and engagement can enhance positive self-beliefs and self-regulatory functioning, ultimately fostering academic achievement and emotional well-being. Given that academic underachievement in ADHD is multifactorial—rooted in neurocognitive deficits, environmental stressors, ineffective instructional methods, and socio-emotional vulnerabilities—comprehensive interventions targeting both cognitive and behavioral skill development are essential.

Despite extensive research on ADHD-related impairments, there remains a need to compare the relative effectiveness of different educational interventions on key psychological outcomes such as self-concept. While individual studies have examined the influence of either instructional strategies or behavior management techniques, fewer have directly compared their effectiveness within the same research design. Doing so is essential for determining whether student-centered instructional methods, which focus on engagement and cognitive participation, or behavioral interventions, which focus on managing actions and impulses, produce greater improvements in self-beliefs and academic functioning.

Given the complexity of ADHD and the importance of designing interventions that address both cognitive and behavioral processes, the present study aimed to compare the effectiveness of training in effective teaching strategies and a behavior management program on the self-concept of primary school students with ADHD.

2. Methods and Materials

2.1. Study Design and Participants

This study was applied in purpose and quasi-experimental in design, using a pretest–posttest format with control and experimental groups. The statistical population consisted of all primary school students with attention-deficit/hyperactivity disorder (ADHD) in Miandoroud County during the 2023–2024 academic year. The population included all primary school students with ADHD whose disorder had previously been diagnosed by a physician and who were enrolled in primary schools in Miandoroud in 2023–2024.

According to reports from school psychologists and physicians at local health and medical centers, a total of 105 primary school students in this county had been diagnosed with ADHD. In Miandoroud, there are 45 primary schools.

To determine the sample size, the G*Power software was used and the ANOVA family of tests (analysis of variance) was selected. Using variance as the dispersion criterion for the estimator, a sample size of 45 students was obtained. These 45 participants were selected through multi-stage cluster random sampling. First, 5 schools were randomly selected from among the primary schools in the county. Then, in each selected school, 3 classes were randomly

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chosen. From each of these classes, 3 students whose scores on the Conners Teacher Rating Scale for ADHD were positive and above the cutoff were selected.

The sample size was also based on the findings of Ougini et al., using a variance coefficient of 18.35 for group comparisons, a 95% confidence level ($\alpha = 0.05$), test power of 99% ($\beta = 0.01$), and assuming a 25% dropout rate in a two-sided test. With these parameters and G*Power, the final sample size was estimated at 45 students.

The Conners Teacher Rating Scale (ADHD in children) was completed by teachers for children in primary school. This questionnaire has 38 items, and the total score ranges from 0 to 114. A score above 57 indicates the presence of attention-deficit problems. The higher the score, the more severe the child's symptoms. Thus, 45 students who obtained the highest scores on this questionnaire were selected as the study sample. These 45 students were then randomly assigned to three groups: the first experimental group (n = 15), the second experimental group (n = 15), and a control group (n = 15). All participants in the three groups first completed the pretest measures. Then, in the next phase, the first experimental group received the effective teaching strategies training, the second experimental group received the behavior management training, and the control group received no intervention. At the end of the intervention, all three groups completed the posttest.

After obtaining the necessary approvals from Islamic Azad University, Sari Branch, and coordinating with the Department of Education in Miandoroud and the principals of the selected schools, the researcher identified and recruited the sample and assigned them to two experimental groups and one control group. First, all participants in the three groups completed the pretest measures. Then, the experimental groups received the interventions: one group participated in training on effective teaching strategies and the other group in a behavior management program, both delivered by a clinical psychologist. The control group did not receive any intervention during this period. After the interventions, the same clinical psychologist administered the posttest to all three groups using the same questionnaires employed at pretest, in order to assess changes.

Ethical considerations were carefully observed. Informed consent was fully obtained from participants and their parents, and they were informed about the study objectives and all intervention stages. Both parents and children were assured that their information would remain confidential and were told that they could withdraw from the study at any time without any negative consequences.

The behavior management program and the effective teaching strategies training were implemented only for the experimental groups, while the control group received no intervention. Each of the two interventions was delivered in group format over 6 weeks, with daily 60-minute sessions. One week after the end of the 6-week program, the posttest was administered to both experimental groups and the control group. At the end of the training period, to reinforce the learned material and reduce the risk of forgetting key points, an educational booklet and CD containing the core content of the sessions were provided to the participants in the intervention groups.

Participants had to meet the following criteria to be included in the study: A diagnosis of ADHD based on the Conners Teacher Rating Scale (ADHD in children), with a child's mean score of 1.5 or higher or a total score above 57, indicating clinically significant symptoms of attention-deficit/hyperactivity. Enrollment in primary school (within the age range corresponding to primary education during the study year). Students were excluded from the study if any of the following conditions applied: The presence of any other psychological disorder in addition to ADHD. The presence of serious physical illnesses. Participation in other education or training programs focused on communication or behavior simultaneously in other institutions. Absence from more than two intervention sessions.

2.2. Measures

Conners Teacher Rating Scale (ADHD in Children): The aim of this scale is to help teachers identify children with ADHD based on several domains, including classroom behavior, group participation and cooperation, and attitudes toward authority figures. The questionnaire contains 38 items. Responses are scored on a Likert-type scale from 0 ("not at all") to 3 ("very much"). The scale has three subscales: classroom behavior (items 1–21), group participation and cooperation (items 22–29), and attitudes toward authority (items 30–38). The total score ranges from 0 to 114. A mean score of 1.5 or higher, or a total score above 57, indicates the presence of ADHD. Higher scores reflect more severe symptoms, while lower scores indicate fewer problems. Conners and colleagues (1999) reported a reliability coefficient of 0.90 for this scale.

Piers–Harris Children's Self-Concept Scale: The Piers–Harris Self-Concept Scale was designed by Piers and Harris (1963) to assess self-concept in children and adolescents. It consists of 80 items phrased in both positive and negative

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directions, scored in a self-evaluative format. Each item is answered with "yes" or "no." The scale comprises six subscales: behavior, intellectual and school status, physical appearance and attributes, anxiety, popularity (social acceptance), and happiness and satisfaction. All subscales are scored in the direction of positive self-concept; thus, higher scores on the total scale and on each subscale indicate higher levels of self-concept. The total score is obtained from the sum of scores across the six domains. Some items appear in more than one subscale; in such cases, they are included in the scoring of each relevant domain. The scale was standardized on a random sample of 1,060 children. Test–retest reliability and split-half reliability were calculated, and coefficients above 0.80 were reported for all age groups up to 15 years. Content validity studies have shown that the scale has high face and content validity as a measure of self-concept.

2.3. Interventions

The behavior management training program was a six-week, daily 60-minute intervention grounded in Hook and Vass's Behavior Management with Students (Hosseini, 2018) and adapted to local classroom conditions. The program trained teachers to systematically reinforce appropriate behaviors while using ignoring and response-cost techniques to reduce inappropriate actions, based on the principle that students are more motivated to behave appropriately when they feel accepted and valued. Week 1 focused on parent training, teaching families how to appropriately interact with children with ADHD, reduce their own stress, and understand the benefits of consistent behavioral education at home. Week 2 introduced teacher-assigned tasks using attention-enhancing games, structured feedback, and educational aids to increase motivation and focus. Week 3 incorporated play therapy—problem-solving through play, rewarding desired behaviors, modeling, role-playing, fine-motor activities like clay work, and visual-motor coordination through computer games. Week 4 addressed adapting homework for short attention spans by breaking tasks into smaller steps, using timers, and adjusting workload to the child's attentional capacity. Week 5 included designing purposeful physical activities such as running errands, delivering notes, sharpening pencils, holding classroom responsibilities, and movement-based transitions that channel energy constructively. Finally, Week 6 introduced progressive muscle relaxation, teaching students to tense and relax different muscle groups to develop body awareness, reduce physiological arousal, and cultivate calmness—thereby supporting sustained attention and emotional self-regulation.

The effective teaching strategies program, implemented over six weeks with daily 60-minute sessions, was designed based on Rostami, Mozafar, and Ebrahimi's (2018) instructional framework and emphasized student-centered, engaging, and experience-based learning tailored to the needs of students with ADHD. The intervention integrated six instructional components: (1) Learning stations, where the classroom or outdoor areas were divided into science, math, language, art, and experiment stations, allowing students to freely choose activities aligned with their interests and strengths; (2) Project-based work, involving small groups of 2–4 students engaging in scientific inquiry—formulating questions, creating hypotheses, conducting experiments, and deriving new questions from their findings—to enhance problem-solving and sustained engagement; (3) Cross-group/peer teaching, where older students assisted younger ones and stronger students provided individualized support to peers needing help, fostering cooperative learning and social responsibility; (4) Learning through daily experiences, which connected academic content to real-life contexts, making abstract concepts more meaningful and easier to grasp; (5) Tasks for common topics, where capable students modeled skills for their peers and teachers reinforced continuous, cumulative learning through shared thematic tasks; and (6) Cooperative social classrooms, in which mixed-age groupings encouraged discussions about necessary social skills, collaborative problem-solving, and guidance on how students could work effectively together. Collectively, these strategies aimed to strengthen attention, motivation, self-regulation, and academic self-concept by providing structured, interactive, and autonomy-supportive learning experiences.

2.4. Data analysis

To report the results, appropriate statistical tests and effect sizes for the independent variables were used. Inferential data analysis was conducted using analysis of covariance (ANCOVA), and multivariate analysis of covariance (MANCOVA) was employed to examine the effects of the interventions on multiple dependent variables simultaneously. All data were analyzed using SPSS 26. The significance level was set at 0.05 (5%), and all analyses were

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performed using multivariate covariance analysis within this software environment.

3. Findings and Results

The statistical population of this study consisted of 45 primary school students with symptoms of attention-deficit/hyperactivity disorder, who were equally assigned to three groups: experimental group 1 (effective teaching strategies training; n = 15), experimental group 2 (behavior management program; n = 15), and a control group (n = 15). The mean age of participants was 9.35 years (SD = 7.67), with an age range of 6 to 12 years. In terms of gender, 55.5% of the sample were girls and 44.5% were boys. The highest frequency belonged to students from preschool to second grade (44.5%), 22.2% were in third and fourth grades, and 33.3% were in fifth and sixth grades.

Table 1

Descriptive statistics for self-concept

Group	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD
Effective teaching strategies	15	50.75	8.50	53.40	7.99
Behavior management program	15	52.40	8.97	33.15	5.16
Control	15	52.65	8.09	53.40	7.99

As shown in Table 1, in the self-concept variable, the mean score of the effective teaching strategies group increased slightly from 50.75 to 53.40. In the behavior management group, the mean decreased from 52.40 to 33.15, while in the control group it remained almost unchanged. Overall, the descriptive findings suggest that the two educational interventions—especially the behavior management program—produced greater changes in the study variables compared with the control group, although some of the fluctuations observed in certain scales require more precise inferential analysis. Before testing the study hypotheses, it was necessary to examine the underlying statistical assumptions.

For both the self-concept pretest (p = 0.212) and posttest (p = 0.122), the obtained p-values were greater than the error level of 0.05. Therefore, the null hypothesis of normality was not rejected. All variables showed a normal distribution, and the data were suitable for parametric statistical analyses. In other words, it can be concluded that the distribution of all study variables is normal, and the assumption of normality required for conducting multivariate analysis of covariance (MANCOVA) is met.

The significance level of Box's M test (p = 0.006) was less than 0.05; therefore, the assumption of homogeneity of covariance matrices was violated. However, due to the high sensitivity of this test to sample size and given that other assumptions—such as normality of data and homogeneity of variances—were met, it was still possible to proceed with multivariate analysis of covariance. The significance levels for Levene's test in both pretest (p = 0.601) and posttest (p = 0.909) were greater than 0.05. Thus, the null hypothesis of equal variances was not rejected, and the assumption of homogeneity of variances held. Consequently, the use of parametric tests (such as ANCOVA/MANCOVA) to examine group differences in academic self-concept was justified and valid.

Table 2

Results of ANOVA for the within-subject factor (self-concept dimensions) and its interaction with group

Variable	Source	SS	df	MS	F	p	Effect size (η^2)
Positive direction	Positive direction	8190.211	2	4095.106	103.561	0.0001	0.645
	Positive direction × group	3855.889	4	963.972	24.378	0.0001	0.461
	Error	4507.900	114	39.543			
Negative direction	Negative direction	984.900	2	492.450	152.470	0.0001	0.728
	Negative direction × group	355.567	4	88.892	27.522	0.0001	0.491
	Error	368.200	114	3.230			
Self-evaluation	Self-evaluation	1223.333	2	611.667	232.124	0.0001	0.803
	Self-evaluation × group	462.933	4	115.733	43.920	0.0001	0.606
	Error	300.400	114	2.635			

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Based on the results in Table 2, the within-subject factor of children's self-concept across the two measurement levels (pretest and posttest) is significant ($p < 0.01$, $F(2,114)$ for the self-concept dimensions). Thus, it can be concluded that children's self-concept scores differed significantly across time. Furthermore, the interaction between self-concept and group was also significant ($p < 0.01$, $F(4,114)$), indicating that the pattern of change in self-concept over time differed across the three groups.

Taken together, these findings suggest that training in effective teaching strategies and the behavior management program had a significant impact on the self-concept of primary school students with ADHD. Training in effective teaching strategies and the behavior management program produced a significant change in self-concept in the positive direction. The effect size was large, and the statistical power was essentially complete, indicating that the results are highly reliable ($F = 103.561$, $p < 0.0001$, $\eta^2 = 0.645$). The magnitude of change in positive self-concept differed between groups; the groups had different effects on improving self-concept ($F = 24.378$, $p < 0.0001$, $\eta^2 = 0.461$). Training also significantly reduced or modified negative self-concept (i.e., improvement in the negative dimension) ($F = 152.470$, $p < 0.0001$, $\eta^2 = 0.728$).

Overall, effective teaching strategies and the behavior management program had significant effects on all dimensions of self-concept (positive direction, negative direction, and self-evaluation), and the impact of training on each of these dimensions varied across groups (significant interaction effect). The large effect sizes and full statistical power indicate that the findings are robust and highly trustworthy. Therefore, it can be concluded that training in effective teaching strategies and the behavior management program has a significant effect on the self-concept of primary school students with ADHD, and this effect differs between groups.

Table 3

Results of ANOVA for the between-subjects factor (groups)

Variable	SS	df	MS	F	p	Effect size (η^2)	Power
Positive direction	8167.644	2	5583.672	43.731	0.0001	0.505	1.000
Negative direction	635.633	2	337.517	53.457	0.0001	0.552	1.000
Self-evaluation	1060.633	2	555.317	78.947	0.0001	0.735	1.000

As shown in Table 3, the between-subjects factor (groups: control, effective teaching strategies, and behavior management program) is significant for all self-concept dimensions ($p < 0.01$). Thus, there are clear differences in self-concept scores between the groups.

To further examine these differences, Bonferroni-adjusted pairwise t tests were used. The results indicate that all dimensions of self-concept (positive direction, negative direction, and self-evaluation) are significantly influenced by group membership, and the differences between groups are strong and statistically significant. This means that the type of training or intervention in each group has had a substantial effect on the self-concept of students with ADHD.

Table 4

Comparison of mean total self-concept scores (pretest and posttest) across groups

Variable	Group	Pretest Mean ± SD	Posttest Mean ± SD	p-value
Self-concept	Control	10.18 ± 1.77	15.23 ± 1.95	$p < 0.001$
	Effective teaching strategies	10.97 ± 1.75	19.97 ± 2.53	$p < 0.001$
	Behavior management program	11.10 ± 12.31	17.02 ± 13.33	$p < 0.001$

Statistical analysis showed that, following the effective teaching strategies and behavior management interventions, the mean self-concept scores increased in both experimental groups ($p < 0.001$). In other words, posttest self-concept scores were higher than pretest scores in the effective teaching strategies and behavior management groups. In the control group, no meaningful change was observed.

As shown in Table 4, increases in self-concept were observed in all groups after the intervention period, but the greatest improvement occurred in the effective teaching strategies group. The control group showed only a slight increase, most likely due to the passage of time or natural learning, and this increase was smaller than that observed in the intervention groups. These results indicate that both the

effective teaching strategies training and the behavior management program led to significant improvements in the self-concept of students with ADHD. The very low significance level ($p < 0.001$) reflects high statistical power and strong confidence in the findings.

Table 5

Bonferroni post-hoc test results

Variable	Group (I)	Group (J)	Mean difference (I–J)	p-value
Positive direction	Control	Effective teaching strategies	17.48 *	0.0001
		Behavior management program	14.28 *	0.0001
	Behavior management program	Control	14.28 *	0.0001
		Effective teaching strategies	-2.20	0.0001
	Effective teaching strategies	Control	17.48 *	0.0001
		Behavior management program	-2.20	0.0001
Negative direction	Control	Behavior management program	4.58 *	0.0001
		Effective teaching strategies	3.81 *	0.0001
	Behavior management program	Control	4.58 *	0.0001
		Effective teaching strategies	-0.63	0.0001
	Effective teaching strategies	Control	3.81 *	0.0001
		Behavior management program	0.66	0.0001
Self-evaluation	Control	Behavior management program	3.71 *	0.0001
		Effective teaching strategies	4.53 *	0.0001
	Behavior management program	Control	3.71 *	0.0001
		Effective teaching strategies	0.88	0.0001
	Effective teaching strategies	Control	4.53 *	0.0001
		Behavior management program	-1.81	0.0001

* Significant at $p < 0.05$ (Bonferroni-corrected)

According to Table 5, for the self-concept variable, the mean differences between the control group and both the effective teaching strategies and behavior management groups are statistically significant. This indicates that these two interventions had a significant impact on improving students' self-concept compared with the control group. The differences between the effective teaching strategies and behavior management groups themselves are not significant for some dimensions, suggesting that both interventions had a relatively similar effect on certain aspects of self-concept. Overall, the behavior management program and effective teaching strategies were effective on all components of self-concept, although the magnitude of their impact on each specific dimension did not differ substantially in some comparisons.

The between-group differences for all dimensions of self-concept are statistically significant ($p < 0.0001$), and the effective teaching strategies training produced the greatest positive impact on total self-concept and its subdimensions. The behavior management program was also more effective than the control condition, although its effect size was smaller than that of the effective teaching strategies. The Bonferroni test shows that these differences are not only statistically significant but also robust after correction for multiple comparisons, confirming the reliability of the findings.

4. Discussion and Conclusion

The present study examined the comparative effectiveness of two major educational interventions—effective teaching strategies and a behavior management program—on the self-concept of primary school students diagnosed with ADHD. The results demonstrated that both interventions produced significant improvements in students' self-concept across multiple dimensions, including positive self-concept, negative self-concept, and self-evaluation. These findings are consistent with established theoretical frameworks asserting that cognitive, behavioral, and emotional processes are deeply intertwined in children with ADHD, and that targeted educational interventions can meaningfully modify self-perceptions over time. The increase in self-concept observed in the intervention groups—especially the pronounced gains within the effective teaching strategies group—emphasizes the role of instructional environments in shaping students' academic identities and psychological functioning.

The findings align with previous literature that has consistently documented low self-concept in students with

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ADHD due to chronic academic failure, teacher criticism, and difficulty sustaining attention during learning tasks. Earlier studies, for example, reported that hyperactive children experience more family conflict and negative interactions, affecting their academic self-confidence and emotional security (Barkley et al., 2020). This aligns with the present study, where students initially exhibited reduced academic self-beliefs prior to receiving interventions. Similarly, research demonstrates that students with ADHD display poorer academic outcomes and lower perceptions of competence than their typically developing peers (Cantwell & Satterfield, 2021). The current results reinforce these findings by highlighting the malleability of self-concept when children are exposed to structured, supportive, and individualized educational strategies.

The positive impact of effective teaching strategies is particularly consistent with educational psychology literature emphasizing student-centered learning structures. Such methods increase student engagement, motivation, and autonomy—all of which are known predictors of improved academic self-concept and learning outcomes. For example, recent investigations into academic self-concept and learning environments found that supportive instruction facilitates more adaptive goal orientations, which in turn enhance students' perceptions of competence (Steinberg et al., 2024). Likewise, studies examining academic resilience among university students indicate that self-concept mediates the relationship between resilience and achievement, demonstrating that stronger self-beliefs enhance students' persistence and academic success (García-Martínez et al., 2022). The gains observed in the effective teaching strategies group reflect these mechanisms: when instructional environments provide opportunities for success, collaborative learning, and active exploration, students' academic identities are strengthened.

Effective teaching strategies also foster cognitive engagement and encourage students to adopt metacognitive approaches to learning. Project-based learning, peer collaboration, and station-based instruction—all integrated into the intervention—are associated with increased student autonomy, perceived competence, and intrinsic motivation. These characteristics are especially beneficial for students with ADHD, who often struggle with self-regulation. Research shows that attentional orienting in working memory is impaired in children with ADHD, contributing to distractibility and difficulty sustaining focus during complex tasks (Superbia-Guimarães et al., 2022). Instructional strategies that increase behavioral structure, offer consistent feedback, and promote hands-on engagement therefore compensate for cognitive vulnerabilities by embedding regulation within learning activities. The improved self-concept in this group may thus reflect not only enhanced academic experiences but also increased feelings of mastery and control during classroom tasks.

The behavior management intervention also yielded significant improvements in students' self-concept, although the magnitude of change differed somewhat across dimensions. Behavior management programs grounded in reinforcement principles, modeling, and structured routines have long been used to reduce disruptive behaviors and facilitate attention to tasks. The current findings are consistent with evidence that behavioral interventions can enhance functioning in both home and school environments by reducing impulsivity, increasing compliance, and providing predictable expectations (Amiri, 2020). By reducing behavioral disruptions, children are more likely to experience positive academic interactions, receive praise, and feel competent within the classroom. These positive experiences may gradually reshape their self-beliefs, contributing to improvements in self-concept.

In addition, research indicates that environmental influences contribute significantly to executive functioning and self-regulation, even during early developmental periods. For example, prenatal exposure to organophosphate pesticides was shown to impair executive function in preschool-aged children (Thistle et al., 2022). Children with ADHD, already vulnerable to regulatory difficulties, therefore benefit from structured behavioral interventions that create compensatory scaffolds. Behavior management systems that incorporate reinforcement, response cost, and structured routines provide external regulation until students gradually internalize more adaptive behaviors. The results of the present study suggest that such scaffolding fosters improvements in self-concept by reducing negative feedback cycles and enabling students to participate more successfully in classroom tasks.

Comparisons with previous studies on resilience and psychological distress further support the interpretation of these findings. Research has shown that adolescents exhibiting stronger resilience maintain better psychological well-being during periods of uncertainty, such as the COVID-19 pandemic (Riehm et al., 2021). In addition, individuals with chronic health conditions who possess greater resilience report lower levels of distress (Elliott et al., 2023). Students with ADHD—who often encounter chronic academic challenges—require similar resilience to navigate

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daily stressors. Findings from the present study indicate that both interventions may indirectly enhance resilience by strengthening students' perceptions of capability and reinforcing adaptive behaviors. Higher resilience, in turn, may contribute to sustained gains in self-concept.

Findings from attachment-related research also offer theoretical insight into the mechanisms underlying improvements in self-concept. Secure attachment is associated with more adaptive emotion regulation and stronger self-beliefs during adolescence (Floricica et al., 2022). Furthermore, communication competence among youth has been linked to parenting and attachment styles (Baquiran et al., 2024). Children with insecure attachment may exhibit poorer emotional regulation and more fragile self-concept. Interventions that create supportive and responsive instructional relationships may therefore emulate some conditions of secure attachment, providing students with feelings of acceptance and reliability that bolster their academic self-confidence. Although attachment was not directly assessed in this study, these findings help frame the relational motivations behind improved self-concept in students exposed to positive teacher-student interactions.

The observed outcomes also match those of cortical and neurophysiological investigations. Adolescents with increased ADHD symptoms exhibit distinctive heartbeat-evoked potentials, indicating heightened interoceptive sensitivity and emotional processing differences (Rapp et al., 2023). Interventions that regulate environmental stimuli and create consistent behavioral patterns may reduce internal stress signals, enabling more focused learning and improved emotional regulation. Enhanced emotional regulation may manifest in improved self-evaluation, one of the dimensions most substantially affected by both interventions.

Furthermore, broader developmental research highlights that self-concept is associated not only with affective functioning but also with job performance and behavioral outcomes later in life. Findings demonstrating that resilience mediates the relationship between self-concept and job performance (Varshney & Varshney, 2023) suggest that interventions improving self-concept during childhood may have long-term benefits for educational and vocational achievement. This aligns with longitudinal findings demonstrating that childhood ADHD predicts poorer academic and vocational outcomes in adulthood (Kuriyan et al., 2021). Enhancing self-concept through early interventions may thus contribute to altering long-term trajectories.

The findings also align with recent work showing that academic self-concept, student engagement, and teacher support form a dynamic interplay influencing psychological well-being and academic outcomes. For example, research with university students indicates that higher academic self-concept is associated with greater student engagement and overall psychological functioning (Zhang, 2024). In younger populations, cooperative teaching methods have similarly been shown to improve academic self-concept and school engagement (Sepahvand, 2024). The results of this study reinforce these conclusions by demonstrating that structured educational interventions significantly influence students' perceptions of self-worth and academic competence.

Finally, research on ADHD prevalence, comorbidity, and impairment in school settings (Rohde et al., 2020) underscores the severity of challenges faced by these students globally. Many students with ADHD lack access to structured support, leading to chronic academic underachievement and negative self-beliefs. The present study contributes important evidence that targeted educational interventions can counteract these challenges by providing structured, supportive, and engaging learning environments.

This study, while yielding meaningful results, is limited by several factors. The sample size was relatively small, which restricts the generalizability of findings to larger, more diverse populations. The research was conducted within a single geographic region and school system, limiting cultural and educational variability that may influence intervention outcomes. All measures relied on standardized questionnaires, which may be subject to social desirability or reporting bias. The study's duration was restricted to a six-week intervention period, leaving questions about the long-term sustainability of improvements in self-concept. Additionally, potential moderating factors such as parenting styles, home environment, sleep patterns, and comorbid conditions were not examined, though they may influence intervention responsiveness.

Future studies should incorporate larger and more diverse samples across multiple regions to enhance generalizability. Longitudinal research is needed to examine the durability of intervention effects on self-concept, resilience, and academic achievement over time. It would be beneficial to include multi-informant data, such as reports from parents, teachers, and students, as well as behavioral observations. Comparative studies examining additional intervention models—such as cognitive-behavioral training,

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mindfulness-based programs, or neurofeedback—could expand understanding of effective approaches for this population. Exploring moderating variables such as gender, attachment style, executive functioning, and teacher-student relationship quality may further clarify which students benefit most from particular interventions.

Educators should incorporate structured, student-centered instructional strategies that promote autonomy, engagement, and mastery experiences, as these directly enhance students' academic self-concept. Teachers should also implement consistent behavior management techniques to create predictable and supportive classroom environments. Schools would benefit from providing professional development programs that train teachers in both instructional and behavioral interventions tailored for students with ADHD. Collaboration between teachers, school psychologists, and parents should be strengthened to ensure consistent support across home and school contexts. Finally, creating learning environments that celebrate progress, provide individualized feedback, and reduce negative academic experiences can significantly improve the educational trajectory of students with ADHD.

Authors' Contributions

Authors contributed equally to this article.

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 would like to express our gratitude to all individuals helped us to do the project.

Declaration of Interest

The authors report no conflict of interest.

Funding

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

Ethical Considerations

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

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E-ISSN: 3041-9026