

Original article

The Effect of Thinking Skills Instruction on Gifted Students' Critical and Creative Thinking Dispositions

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Abstract

This study aimed to examine the effect of thinking skills instruction on the critical and creative thinking dispositions of gifted students. For this purpose, a Thinking Skills Instructional Design (TSID) was developed. This study employed a concurrent embedded mixed-methods design, in which a quasi-experimental pretest–posttest control-group design constituted the dominant quantitative component and researcher reflective journals formed the embedded qualitative component. The sample of the study consisted of 22 gifted students attending a Science and Art Center in Türkiye during the fall semester of the 2025–2026 academic year. Data were collected through the Critical Thinking Disposition Scale, the Creative Thinking Disposition Scale, and researcher reflective journals. Quantitative data were analyzed using the Mann–Whitney U Test and the Wilcoxon Signed-Rank Test, whereas qualitative data were analyzed through inductive content analysis. The findings revealed that the developed instructional design had a significant and high-level effect on the critical and creative thinking dispositions of gifted students. Qualitative findings further indicated that this effect reflected a process-oriented structure supported by patterns of cognitive adaptation, strategy development, and social interaction. The findings may also provide practical guidance for curriculum development specialists in designing and improving programs aimed at fostering critical and creative thinking dispositions among gifted learners. By addressing critical and creative thinking dispositions through a holistic mixed-methods approach, this study fills an important gap in the literature and offers strong theoretical and pedagogical implications for thinking-oriented instructional designs in the education of gifted students.

Keywords: Thinking Skills, Instructional Design, Gifted Students, Critical Thinking Disposition, Creative Thinking Disposition

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INTRODUCTION

Thinking skills can be defined as a process involving the acquisition, processing, analysis, and evaluation of information, followed by the adaptation of this knowledge to new situations (Anderson & Krathwohl, 2001). These skills encompass higher-order cognitive processes such as problem solving, self-evaluation of one's thinking, critical thinking, creative thinking, and innovation (Liu et al., 2024). Through these mental processes, individuals enhance their capacity to access information, question the knowledge they obtain, and generate new solutions (Ramírez-Montoya et al., 2022). In this context, the development of students' thinking skills not only supports their cognitive growth-particularly in using, analyzing, and synthesizing knowledge-but also strengthens their ability to apply what they have learned (Ennis, 1996). Thus, instruction in thinking skills enables learners to become individuals who not only acquire information but also actively process and utilize it (Facione, 2015). As a result, individuals who develop these skills gain a critical lens in acquiring and processing information and become capable of generating novel ideas through creative thought processes (Abrami et al., 2008; Dilekçi & Karatay, 2023; Kardoyo et al., 2020; Sumarni & Kadarwati, 2020).

The present study aims to examine the effect of thinking-skills instruction on gifted students' critical and creative thinking dispositions. Although numerous experimental or mixed-method studies have investigated students' critical thinking (Aydede & Kesercioğlu, 2010; Bakırcı & Çepni, 2016; Cantürk-Günhan & Başer, 2009; Dal Çalışıcı & Yıldız Duban, 2025; Eğmir & Ocak, 2017; Koç Akran & Epçaçan, 2018; Sönmez & Sağlam, 2025) and creative thinking skills or dispositions (Barut & Akbaba, 2017; Haymana & Özalp, 2020; Karataş & Özcan, 2010; Mawardi & Kusuma, 2025; Sönmez & Sağlam, 2025; Suherman et al., 2025; Şener Koruk & Benzer, 2025; Şensoy & Yıldırım, 2017; Terzi & Küçük-Demir, 2022; Ülger & İmer, 2013), experimental or mixed-method studies conducted specifically with gifted students remain comparatively limited. Yet gifted students have been shown to outperform their typically developing peers across several cognitive domains, including working memory, attentional flexibility, and problem solving (Kuznetsova et al., 2024), highlighting the importance of systematically supporting their cognitive potential.

Recent structural equation modeling research also indicates that critical and creative thinking, while moderately related, function as distinct cognitive constructs rather than a single unified ability (Wechsler et al., 2018). This finding further underscores the need to examine these two dispositions separately within instructional interventions and provides a theoretical rationale for investigating their development through thinking-skills instruction. Moreover, no study has been identified in the literature that examines a thinking-skills-based instructional design aimed at improving gifted students' critical and creative thinking dispositions. This gap highlights the importance of further research in this area.

Accordingly, this study seeks to address this gap by experimentally investigating the impact of thinking-skills instruction on the critical and creative thinking dispositions of gifted students. The

instructional design implemented within the scope of the study is also expected to offer an innovative contribution to the field. The findings are anticipated to inform the development of curricula for gifted education and guide teachers in redesigning their instructional practices. In this context, the study addresses the following research questions:

1. Is there a significant difference between the pre-test and post-test critical thinking disposition scores of gifted students in the experimental and control groups?
2. Is there a significant difference between the pre-test and post-test creative thinking disposition scores of gifted students in the experimental and control groups?
3. What process-related patterns were observed during the implementation of the developed instructional design?

Literature Review

Critical Thinking

Critical thinking can be defined as a disposition characterized by questioning the foundations of proposed ideas, avoiding bias, and presenting thoughts within the framework of logical principles (Cevizci, 2015). Accordingly, critical thinking may be understood as the process through which individuals evaluate what others say or write without prejudice, subjecting ideas to logical reasoning. Critical thinking involves mental processes such as analysis, inquiry, evaluation, consideration of diverse perspectives, and, when necessary, revising one's own views (D'Northwood & Rattray, 2025; Ennis, 1996).

Developing students' critical thinking skills is important for several reasons. This can be examined across five dimensions. First, critical thinking enables students to access information independently and to analyze situations or events on their own (Kopzhassarova et al., 2016). Second, it supports students in solving problems encountered in real-life contexts in an effective and rational manner (Halpern & Dunn, 2021; Persky et al., 2019). Third, critical thinking fosters students' ability to question societal issues and to become individuals capable of generating solutions (Nikolaishvili, 2024). Fourth, it positively affects students' academic achievement and contributes to their adaptation and effectiveness in future professional contexts (Khaitov, 2024). Fifth, critical thinking promotes the development of self-confidence and supports learners in becoming lifelong learners (Abrami et al., 2008; Green, 2015).

A review of the related literature indicates that various instructional approaches have been found to influence the critical thinking skills and dispositions of gifted students. Identified approaches that positively affect gifted students' critical thinking include project-based learning (Al-Hassawi et al., 2020), the P4C approach (Acar & Arslan, 2023), differentiated instructional design (Çayır & Balcı, 2023), and interdisciplinary teaching approaches (Kaynar & Kurnaz, 2024). In addition, enrichment

programs and STEM-based instructional designs have also been shown to contribute to the development of critical thinking skills and dispositions among gifted learners (Elballah et al., 2024; García-Martínez et al., 2021).

Creative Thinking

Creative thinking can be defined as the ability to generate different perspectives, that is, to view and evaluate events from alternative angles. In other words, creative thinking refers to individuals' capacity to produce original and innovative ideas in response to events and situations (Doğan, 2011). In this context, creativity can be characterized by qualities such as originality, flexibility, and the ability to synthesize. Creative thinking is considered effective not only in scientific contexts but also in addressing everyday life problems (Carranza, 2021).

Developing students' creative thinking skills is important for several reasons, which can be examined across five dimensions. First, creative thinking equips students with a competency aligned with the demands of an era in which information spreads rapidly and undergoes constant transformation (Dilekçi & Karatay, 2023; Ritter & Mostert, 2017). Second, it enables students to become individuals who can generate alternative solutions to unexpected events or situations and adapt quickly and appropriately (Tam et al., 2023). Third, creative thinking makes a positive contribution to students' academic achievement and future professional lives (Carranza, 2021). Fourth, creative thinking is closely associated with affective factors such as creative self-efficacy and motivation (Capron Puozzo & Audrin, 2021). Fifth, creative thinking helps students become individuals who contribute to societal progress and development (Carranza, 2021).

A review of the related literature indicates that various instructional approaches influence the creative thinking skills and dispositions of gifted students. Approaches found to affect the creative thinking of gifted learners include differentiated instructional design (Altıntaş & Özdemir, 2015; Demir, 2021), differentiated problem-solving instruction (Akkaş & Öztürk, 2018), integrated mathematics-science instruction (Kim et al., 2016), interdisciplinary teaching approaches (Kaynar & Kurnaz, 2024), and the PEODE (Predict-Explain-Observe-Discuss-Explain)-based laboratory model (Coştu, 2024).

MATERIALS and METHODS

Design

This study employed a concurrent embedded mixed-methods design. In embedded mixed designs, one type of data is nested within the dominant method and used for different but complementary research purposes (Teddlie & Tashakkori, 2009). Since the primary research question focused on testing the effectiveness of the developed instructional design, the dominant component of the study was quantitative, and a quasi-experimental pretest-posttest control group design was adopted. However, qualitative data were collected concurrently and in parallel with the quantitative data collection process during the experimental intervention. These qualitative data were incorporated to strengthen the

interpretation of the quantitative findings, to gain a deeper understanding of the learning experiences emerging during the intervention, and to provide contextual support for the quantitative results. In embedded mixed-methods designs, the qualitative component does not necessarily need to be structured as a separate and fully developed qualitative design (e.g., phenomenology or case study). In such studies, qualitative data are typically used to describe the experimental process, support quantitative findings contextually, and shed light on learning experiences that emerge during implementation (Creswell & Plano Clark, 2018). Accordingly, the qualitative data in this study were not treated as an independent component intended to replace or directly explain the quantitative results; rather, they functioned in a complementary, supportive, and interpretive role. Thus, while the effect of the thinking skills instructional design on gifted students' critical and creative thinking dispositions was tested quantitatively, evidence regarding the contextual conditions under which this effect emerged and how it was experienced was revealed through a concurrent embedded mixed-methods design

Sample

The sample of the study consisted of 22 gifted students enrolled in a science and art center located in a city in Türkiye during the fall semester of the 2025–2026 academic year. In Türkiye, schools attended by gifted students are called Science and Art Centers (BİLSEM). These institutions are official public schools. Students are first nominated by their classroom teachers in their regular schools as potential candidates for admission. Nominated students then complete a two-stage examination process, and those who meet the required criteria are admitted to the science and art centers. Students continue their education in their regular schools and attend the center after school hours. According to national regulations (MoNE, 2022), the maximum number of students in a class at these centers is 15. Because gifted students constitute only a very small portion of the student population, accessing such a sample group can be considered challenging. The students in the sample were between 9 and 11 years old. Fourteen of the students were female and eight were male. The study involved two pre-existing groups consisting of 12 and 10 students. These intact groups were randomly assigned to the experimental and control conditions; individual students were not randomly assigned. The experimental group consisted of 7 female and 5 male students, while the control group included 7 female and 3 male students.

Data Collection Instruments

Critical Thinking Disposition Scale

The scale was developed by Yıldırım Döner and Demir (2022). The exploratory factor analysis was conducted with 503 students, and the confirmatory factor analysis was carried out with 506 students. To construct the trial form of the scale, a literature review was first conducted, resulting in an item pool of 43 statements. Expert opinions were then obtained, and the scale was finalized. Following the analyses, a 21-item scale was produced. The scale is a five-point Likert-type instrument, scored as follows: Always (5 points), Often (4 points), Sometimes (3 points), Rarely (2 points), and Never (1

point). In reliability analyses, the Cronbach's alpha coefficient was calculated as .868, the Spearman–Brown coefficient as .805, and the Guttman split-half coefficient as .805. A test–retest analysis was also conducted, yielding a correlation of .748. Consequently, the scale was determined to be suitable for students aged 9 to 14.

Creative Thinking Disposition Scale

The scale was developed by Deniz and Demir (2024). The exploratory factor analysis was conducted with 511 students, and the confirmatory factor analysis with 410 students. A literature review was performed to create the trial form, resulting in an item pool of 44 statements. Expert opinions were then incorporated, and the scale was finalized. As a result of the analyses, a 12-item scale was produced. The instrument is a five-point Likert-type scale, scored as follows: Always (5 points), Often (4 points), Sometimes (3 points), Rarely (2 points), and Never (1 point). Reliability analyses indicated a Cronbach's alpha of .80, a Spearman–Brown coefficient of .75, and a Guttman split-half coefficient of .75. The scale was concluded to be appropriate for students aged 9 to 15.

Data Collection and Analysis

At the outset of the study, ethical approval was obtained from the ethics committee of a university. Following this, the experimental procedure was carried out with the knowledge and consent of the school administration and the students' parents. The school is a public institution affiliated with the Ministry of National Education. Before proceeding with data analysis, the assumptions of normality were examined. The study included a total of 22 students, with 12 in the experimental group and 10 in the control group. In other words, the number of participants in each group was below 20. Given the small group sizes and the ordinal nature of the scale data, non-parametric procedures were considered appropriate. Şimşek (2023) reported that the Wilcoxon–Mann–Whitney test may provide advantages over parametric alternatives particularly under small-sample and unequal-group conditions. Therefore, non-parametric tests were selected for the data analysis. In this context, the Mann–Whitney U test was used to determine whether there was a significant difference between the pre-test scores of the experimental and control groups. The Wilcoxon Signed-Ranks Test was employed to examine whether there was a significant difference between the pre-test and post-test scores within the experimental and control groups. Additionally, change scores were calculated for each participant by subtracting the pre-test score from the post-test score (post-test – pre-test). The Mann–Whitney U test was then used to compare the change scores of the experimental and control groups. Effect sizes for the Wilcoxon Signed-Ranks and Mann–Whitney U tests were calculated using the standardized Z values and the relevant sample size.

Inductive content analysis was employed to analyze the qualitative data. In this approach, no predetermined coding or thematic framework was adopted; instead, codes and themes were derived directly from the data through repeated readings (Elo & Kyngäs, 2008). The researcher's reflective

journals were first segmented into meaningful units of expression, similar codes were grouped under broader categories, and higher-order themes were subsequently generated. In this process, qualitative data were not analyzed as an independent component intended to replace quantitative findings; rather, they were used to describe how the experimental intervention was experienced and to provide contextual support for the quantitative results.

The credibility and trustworthiness of the qualitative findings were addressed within the framework of credibility, dependability, and confirmability criteria recommended in qualitative research (Lincoln & Guba, 1985). Due to the non-reductionist and process-oriented data collection structure, the researcher's reflective journals were recorded regularly throughout the experimental intervention, thereby enhancing the contextual richness and process integrity of the qualitative data. To enhance credibility, insights derived from the journals were considered alongside the quantitative findings, and thematic coherence was carefully maintained.

Regarding dependability, the qualitative analysis was conducted systematically, with repeated returns to the data during coding and theme development to preserve consistency of meaning. In terms of confirmability, the researcher employed bracketing while analyzing their own reflective journals, attempting to suspend personal assumptions and ground interpretations as directly as possible in the data (Tufford & Newman, 2012). Furthermore, treating qualitative findings not as independent outcomes but as complementary evidence supporting the quantitative results was considered another factor that helped limit the risk of subjective interpretation. Accordingly, the qualitative findings of this study can be regarded as methodologically coherent, transparent, and defensible.

Experimental Procedure

The experimental procedure was conducted over an eight-week period during the fall semester of the 2025–2026 academic year, specifically in September and October, in a public school. Pre-test and post-test assessments were administered in the weeks preceding and following the experimental intervention. Thus, the intervention itself lasted six weeks. The six-week duration was determined in accordance with the structure of the instructional design, which included six core activities selected through expert evaluation, with one core activity implemented each week. This structure allowed the activities to be distributed systematically across the intervention period while avoiding the concentration of multiple core activities within the same week. The duration was also considered consistent with previous intervention studies conducted with gifted students. For example, Coştu (2024) implemented a 16-hour intervention, while Çayır and Balcı (2023) conducted an eight-week intervention for three hours per week.

A weekly four-lesson (160-minute) instructional schedule was implemented, amounting to a total of 16 hours of instruction. Each class session lasted 40 minutes, and four lessons per week were allocated to the experimental implementation. Instruction was scheduled for two days each week, with two lessons

conducted per day. Specifically, two lessons were held on Tuesdays and two on Thursdays. In total, four lessons (160 minutes) were delivered weekly. The four weekly lessons were distributed across two days to provide repeated engagement with the targeted thinking processes while avoiding the concentration of all instructional activities within a single session. A 10-minute break was given between each lesson. At the beginning of each session, detailed instructions were provided to the students, and they were asked to indicate any aspects they did not understand. During the six-week intervention period, the control group continued to receive the regular instructional activities provided within the Science and Art Center curriculum and did not participate in the Thinking Skills Instructional Design implemented with the experimental group. No additional thinking-skills intervention or parallel experimental program was provided to the control group during this period. Information related to the experimental procedure is presented in Table 1.

Table 1. Experimental implementation process

Week	Time	Activity
Week 1	Implementation of the pretest	
Week 2	40'+40'	Imagine
	40'+40'	Sudoku and Kakuro
Week 3	40'+40'	Wise Octubus
	40'+40'	Sudoku and Kakuro
Week 4	40'+40'	If My Thinking Stretches
	40'+40'	Sudoku and Kakuro
Week 5	40'+40'	I Have a Reason to Be Consistent
	40'+40'	Sudoku and Kakuro
Week 6	40'+40'	Find and Recall
	40'+40'	Sudoku and Kakuro
Week 7	40'+40'	Alien or Earthling?
	40'+40'	Sudoku and Kakuro
Week 8	Implementation of the posttest	

Thinking Skills Instructional Design (TSID)

The first stage in developing the instructional design for thinking skills involves conducting a needs analysis. In this context, the relevant literature on thinking skills was reviewed. Studies and instructional practices aimed at developing students' thinking skills were examined. Although various studies have been conducted to enhance students' thinking skills, research specifically focused on teaching thinking skills to gifted students remains quite limited. Thinking skills refer to the processes through which individuals acquire, process, and analyze information. These skills encompass higher-order cognitive processes, and critical and creative thinking are among these advanced mental processes. The literature indicates that critical and creative thinking are mutually influencing cognitive processes.

For this reason, the instructional design in this study was developed to enhance these two cognitive processes simultaneously.

In preparing the instructional design, activities from the educational book (Thinking Education Workshop), published by the General Directorate of Special Education and Guidance Services under the Ministry of National Education in Türkiye, were utilized. This book, prepared by experts in the field, includes activities appropriate for different age groups and educational levels. In total, it contains 24 activities, with eight designed for each of the primary, middle, and high school levels. For the selection of activities to be included in this study's instructional design, the opinion of an academic with a doctoral degree in gifted education was sought. Six activities were selected based on their potential to positively contribute to students' critical and creative thinking. In addition, several modifications were made to further strengthen the effectiveness of the activities.

To enhance the impact of the instructional design, logic puzzles were also incorporated. In this scope, the puzzles Sudoku and Kakuro were selected. Although the literature contains limited evidence demonstrating a direct effect of such logic puzzles on critical and creative thinking, there are findings suggesting potential indirect effects. Baek et al. (2008) found that the game Sudoku positively influenced students' logical thinking skills. Similarly, Jinon (2022) reported that Sudoku improved reasoning skills. According to Facione (2015), logical thinking and reasoning are foundational components of critical thinking. Runco (2006) stated that reasoning skills contribute to individuals' creative thinking abilities. Based on this reasoning, it can be inferred that such logic puzzles may influence both critical and creative thinking. Consequently, the thinking-skills instructional design was enriched with Sudoku and Kakuro, thereby contributing to its originality.

Table 2 presents an example of a weekly four-lesson (160-minute) instructional sequence within the implementation process. Figure 1 provides sample visual materials from the activities.

Table 2. Sample implementation

Lesson	Time	Activity
Lesson 1	40'	Each student is given a sheet of paper. They are asked to draw a tree they imagine. There are no limitations for the drawing; students may draw freely as they wish. Once everyone finishes their drawing, they are instructed to exchange their pictures randomly with one another. Students are expected to evaluate the tree they receive from different perspectives. After all comments are shared, the teacher highlights the importance of individual differences. The teacher emphasizes that just as everyone cannot draw the same tree, people also do not think or behave in the same way.
Lesson 2	40'	The class is divided into two or three groups depending on the number of students. The teacher displays the first flower image on the interactive board. Students are given time to examine the image. The teacher then closes the image and asks each group to write down the names of the flowers they remember. The recalled flower names are checked by reopening the image. The same procedure is repeated for the second image. The groups congratulate one another.
Lesson 3	40'	Students are given a Sudoku puzzle appropriate to their level. Those who are unable to complete the puzzle during class are asked to finish it at home and bring it to the next lesson.
Lesson 4	40'	Students are then given a Kakuro puzzle appropriate to their level. Those who are unable to complete the puzzle during class are asked to finish it at home and bring it to the following lesson.



Figure 1. Sample visual materials

FINDINGS

The findings of the study were obtained through the analysis of the collected data. Quantitative findings are presented first, followed by qualitative findings. Within the scope of the experimental design, the Mann–Whitney U test and the Wilcoxon Signed-Ranks Test were employed. First, the Mann–Whitney U test was used to compare the experimental and control groups in terms of both pre-test scores and change scores. The Wilcoxon test was then used to examine whether the difference between the pre-test and post-test scores within each group was significant. Table 3 presents the Mann–Whitney U test results for the critical thinking disposition scores of gifted students in the experimental and control groups.

Table 3. Mann–Whitney U Test results for the Pre-Test Critical Thinking Disposition scores of the Experimental and Control Groups

Group	n	Mean Rank	Sum of Ranks	U	p
Experimental	12	12.42	149.00	49.00	0.465
Control	10	10.40	104.00		

Table 3 presents the results of the Mann–Whitney U test conducted to determine whether there was a significant difference between the pre-test critical thinking disposition scores of gifted students in the experimental and control groups. The results indicated that there was no significant difference between the groups' pre-test scores ($U = 49.00$, $p > .05$). Accordingly, it can be stated that the groups were homogeneous.

Table 4 shows the Wilcoxon Signed-Ranks Test results examining whether there was a significant difference between the pre-test and post-test critical thinking disposition scores of gifted students in the experimental and control groups.

Table 4. Wilcoxon Signed-Ranks Test results for the Pre-Test and Post-Test Critical Thinking Disposition scores of the Experimental and Control Groups

Group		n	Mean Rank	Sum of Ranks	Z	p	Effect size
Experimental	Negative Ranks	2	2.50	5.00	-2.700	0.007	0.779
	Positive Ranks	10	7.30	73.00			
	Ties	0					
	Total	12					
Control	Negative Ranks	7	6.14	43.00	-1.645	0.100	-
	Positive Ranks	3	4.00	12.00			
	Ties	0					
	Total	10					

According to the Wilcoxon Signed-Ranks Test results presented in Table 4, there was a significant difference between the pre-test and post-test critical thinking disposition scores of gifted students in the

experimental group ($Z = -2.700$, $p < .05$). This difference favored the post-test scores, indicating that the critical thinking dispositions of students in the experimental group increased significantly. In addition, the effect size (0.779) was notably high.

The Wilcoxon Signed-Ranks Test results for the control group, also shown in Table 4, revealed no significant difference between the pre-test and post-test critical thinking disposition scores of gifted students ($Z = -1.645$, $p > .05$). In other words, the change observed in the control group was not statistically significant.

Table 5 presents the Mann–Whitney U test results for the critical thinking disposition change scores of gifted students in the experimental and control groups

Table 5. Mann–Whitney U Test results for the Critical Thinking Disposition Change scores of the Experimental and Control Groups

Group	n	Mean Rank	Sum of Ranks	U	p	Effect size
Experimental	12	15.42	185.00	13.00	0.002	0.676
Control	10	6.80	68.00			

Table 5 presents the results of the Mann–Whitney U test conducted to determine whether there was a significant difference between the critical thinking disposition change scores of gifted students in the experimental and control groups. The results indicated that there was a significant difference between the groups' change scores ($U = 13.00$, $p < .05$). This difference favored the experimental group, indicating that the increase in critical thinking disposition scores was significantly greater in the experimental group than in the control group. In addition, the effect size ($r = .676$) was notably high.

Table 6 presents the Mann–Whitney U test results for the creative thinking disposition scores of gifted students in the experimental and control groups.

Table 6. Mann–Whitney U Test results for the Pre-Test Creative Thinking Disposition scores of the Experimental and Control Groups

Group	n	Mean Rank	Sum of Ranks	U	p
Experimental	12	12.50	150.00	48.00	0.428
Control	10	10.30	103.00		

Table 6 presents the results of the Mann–Whitney U test conducted to determine whether there was a significant difference between the pre-test creative thinking disposition scores of gifted students in the experimental and control groups. The results indicated that there was no significant difference between the groups' pre-test scores ($U = 48.00$, $p > .05$). Accordingly, it can be stated that the groups were homogeneous.

Table 7 shows the Wilcoxon Signed-Ranks Test results examining whether there was a significant difference between the pre-test and post-test creative thinking disposition scores of gifted students in the experimental and control groups.

Table 7. Wilcoxon Signed-Ranks Test results for the Pre-Test and Post-Test Creative Thinking Disposition scores of the Experimental and Control Groups

Group		n	Mean Rank	Sum of Ranks	Z	p	Effect size
Experimental	Negative Ranks	2	3.00	6.00	-2.614	0.009	0.754
	Positive Ranks	10	7.20	72.00			
	Ties	0					
	Total	12					
Control	Negative Ranks	4	5.75	23.00	-0.486	0.627	-
	Positive Ranks	6	5.33	32.00			
	Ties	0					
	Total	10					

According to the Wilcoxon Signed-Ranks Test results presented in Table 7, there was a significant difference between the pre-test and post-test creative thinking disposition scores of gifted students in the experimental group ($Z = -2.614$, $p < .05$). This difference favored the post-test scores, indicating that the creative thinking dispositions of students in the experimental group increased significantly. In addition, the effect size (0.754) was notably high.

The Wilcoxon Signed-Ranks Test results for the control group, also shown in Table 7, revealed no significant difference between the pre-test and post-test creative thinking disposition scores of gifted students ($Z = -0.486$, $p > .05$). In other words, the change observed in the control group was not statistically significant.

Table 8 presents the Mann–Whitney U test results for the creative thinking disposition change scores of gifted students in the experimental and control groups.

Table 8. Mann–Whitney U Test results for the Creative Thinking Disposition Change scores of the Experimental and Control Groups

Group	n	Mean Rank	Sum of Ranks	U	p	Effect size
Experimental	12	14.25	171.00	27.00	0.024	0.480
Control	10	8.20	82.00			

Table 8 presents the results of the Mann–Whitney U test conducted to determine whether there was a significant difference between the creative thinking disposition change scores of gifted students in the experimental and control groups. The results indicated that there was a significant difference between the groups' change scores ($U = 27.00$, $p < .05$). This difference favored the experimental group,

indicating that the increase in creative thinking disposition scores was significantly greater in the experimental group than in the control group. In addition, the effect size ($r = .480$) was moderate.

Within the qualitative component of the study, data derived from the researcher's reflective journals were analyzed. The analysis yielded three main themes: Cognitive Adaptation and Strategy Development, Critical Evaluation and Peer Interaction, and Creative Flexibility and Originality. Findings related to the theme of Cognitive Adaptation and Strategy Development are presented in Table 9.

Table 9. The findings related to the Cognitive Adaptation and Strategy Development theme

Category	Code	Representative quote
Cognitive Adaptation	Rapid comprehension of instructions	"They quickly grasped the instructions."
	Quick adaptation to activities	"They understood what needed to be done very quickly."
Metacognitive Awareness	Error recognition	"Some students openly verbalized their mistakes."
	Self-regulation	"The student clearly identified the mistake and explained how they addressed it."
Strategy Development	Individual solution pathways	"I noticed that some students developed their own unique strategies."
	Generating alternative solutions	"Through these puzzles, I observed improvements in skills such as questioning and generating alternative solutions."
Cognitive Progression	Adapting to increasing levels of difficulty	"I observed noticeable progress in students' performance on the Sudoku and Kakuro puzzles."
	Enhanced concentration	"Compared to last week, students appeared more focused."

Table 9 presents the findings related to the Cognitive Adaptation and Strategy Development theme. The findings under this theme indicate that students adapted quickly to learning tasks and were able to organize their cognitive processes effectively. Statements in the reflective journals such as "They quickly grasped the instructions" and "They understood what needed to be done very quickly" suggest that students adapted to task demands within a short time. Beyond simply understanding instructions, students were also observed to recognize errors and reflect on their thinking processes during the activities. For instance, some students verbalized their mistakes when they made them, indicating emerging self-regulation skills. In addition, students were observed to develop individual strategies and generate alternative solution pathways. Journal entries such as "I noticed that some students developed their own unique strategies" and "It was striking that they came up with their own solution methods" highlight the visibility of strategy development processes. Progress observed in tasks with increasing levels of difficulty, along with the note "We moved on to the harder level, and the students were quite eager," suggests that cognitive adaptation strengthened over time. Overall, these findings provide

complementary evidence that aligns with the quantitative results, indicating that the instructional design supported students' cognitive adaptation and strategy development.

Table 10 presents the findings related to the Critical Evaluation and Peer Interaction theme.

Table 10. The findings related to the Critical Evaluation and Peer Interaction theme

Category	Code	Representative quote
Constructive Criticism	Non-hurtful language	"They avoided making hurtful comments."
	Empathic awareness	"They seemed aware that negative remarks could hurt their peers."
Social Interaction	Peer respect	"I was struck by the respect students showed toward each other's drawings."
	Constructive learning climate	"Students used constructive language when evaluating each other's work."
Critical Perspective	Multiperspectival thinking	"Each student interpreted their peer's drawing from a different perspective."
	Inquiry-oriented approach	"They openly voiced the parts of the activity that didn't quite make sense to them."
Value-Oriented Thinking	Awareness of prejudice	"Students were aware that they should not approach others with prejudice."

Table 10 presents the findings related to the theme of Critical Evaluation and Peer Interaction. The results under this theme indicate that critical thinking processes were observed within a context of social interaction. The diary excerpts, such as "They avoided making hurtful comments" and "They seemed aware that negative remarks could hurt their peers", suggest that students adopted an empathic and constructive stance during evaluation. Similarly, the observation "I was struck by the respect students showed toward each other's drawings" indicates that peer interaction occurred within a supportive learning environment. In addition, students appeared to consider different perspectives and display an inquiry-oriented attitude. For instance, the statement "Each student interpreted their peer's drawing from a different perspective" points to the development of multiperspectival thinking. Observations related to prejudice awareness ("Students were aware that they should not approach others with prejudice") further suggest that students developed ethical sensitivity during evaluation processes. Overall, these findings demonstrate that critical thinking encompasses not only cognitive but also social and value-oriented dimensions, and that the instructional design supported critical thinking within a social context.

Table 11 presents the findings related to the theme of Creative Flexibility and Originality.

Table 11. The findings related to the theme of Creative Flexibility and Originality

Category	Code	Representative quote
Original Production	Original ideas	“Some of the stories were quite different.”
	Creative interpretations	“One student’s comment particularly caught my attention.”
Imagination	Creative product generation	“Some of the stories were quite different.”
	Visual creativity	“Distinctly original visuals emerged.”
Creative Motivation	Willing engagement	“I observed that students were excited and eager when expressing their original ideas.”
	Learning through enjoyment	“Seeing the students carry out the activity with enjoyment motivated me.”
Metacognitive Creativity	Explaining one’s product	“Each student explained the intention behind their drawing.”
	Reflective reevaluation	“They had the opportunity to compare their ideas with their peers’ interpretations.”
Creative Flexibility	Flexible thinking	“This activity seemed to foster both inquiry and creative thinking among the students.”

Table 11 presents the findings related to the theme of Creative Flexibility and Originality. The findings under this theme indicate that students actively employed original idea generation and creative expression throughout the process. Reflective journal entries suggest that students produced imagination-driven outputs and developed diverse perspectives. For instance, observations such as “Some of the stories were quite different” and “Distinctly original visuals emerged” indicate that students generated diverse and original products throughout the activities. In particular, original interpretations, creative stories, and visual productions demonstrate that students effectively engaged with the originality dimension of creative thinking. In addition, high levels of motivation and willing participation in the activities indicate a strong affective component within the creative process. Reflections such as “I observed that students were excited and eager when expressing their original ideas” suggest that students engaged in the activities with enthusiasm and intrinsic interest. Moreover, students’ explanations of their own products and their comparisons with peer feedback point to the metacognitive dimension of creative thinking. For example, notes like “Each student explained the intention behind their drawing” indicate that students reflected on their own thinking and reconsidered their ideas through peer interaction. This suggests that students not only generated creative outputs but also engaged in processes of reevaluating and restructuring their ideas. Overall, the findings suggest that the instructional design supported creative thinking across cognitive, affective, and metacognitive dimensions, providing complementary qualitative evidence that strengthens the quantitative results

DISCUSSION

The findings of this study indicate that the developed thinking skills instructional design significantly and strongly enhanced gifted students’ critical and creative thinking dispositions. These results are consistent with previous research demonstrating that structured instructional interventions

targeting thinking processes can foster individuals' cognitive dispositions and approaches (Abrami et al., 2015; Facione, 2015; Ennis, 1996). In particular, higher-order cognitive tasks are known to promote critical and creative thinking when they provide opportunities for students to engage with information, question assumptions, draw inferences, and generate alternatives (Kardoyo et al., 2020). Furthermore, between-group comparisons of change scores showed significantly greater gains in the experimental group for both critical and creative thinking dispositions, providing additional evidence for the effectiveness of the intervention.

Qualitative data collected concurrently with the experimental intervention added contextual depth to the quantitative findings. The researcher's reflective journals revealed that students were not solely focused on reaching correct answers; rather, they generated alternative solutions, considered others' perspectives, and justified their reasoning. The themes emerging from qualitative analyses suggest that this transformation occurred simultaneously across cognitive, interactional, and creative dimensions. Notably, students' respectful and multidimensional evaluations of their peers' products indicate that critical thinking was supported not only cognitively but also dispositionally. This suggests that the observed quantitative gains in critical and creative thinking dispositions were accompanied by a process-oriented transformation reflected in classroom interactions.

Similar outcomes have been reported in experimental studies involving gifted students. For instance, Çayır and Balcı (2023) found that differentiated instructional designs positively influenced gifted students' critical thinking skills. Altıntaş and Özdemir (2015) demonstrated that comparable instructional approaches supported creative thinking skills, while Kaynar and Kurnaz (2024) reported that interdisciplinary teaching approaches enhanced both critical and creative thinking among gifted learners.

In line with these studies, the instructional design implemented in the present study appears to have supported students' cognitive adaptation and strategy development, as evidenced by qualitative findings gathered throughout the intervention. Students' rapid comprehension of instructions, flexible experimentation with alternative strategies, and revision of their products based on peer feedback indicate that critical and creative thinking were supported in a process-oriented manner. For example, the reflective journal entry "They grasped the instructions quickly" points to a high level of cognitive adaptability among participants.

One component that may have contributed to the observed gains in this study is the integration of logic-based puzzles such as Sudoku and Kakuro into the instructional design. These puzzles require multi-step reasoning, strategic planning, error monitoring, and the development of alternative solution paths. Prior research suggests that logic and mind games may support reasoning, reflective thinking, problem-solving, and related cognitive processes (Atay, 2023; Şanlıdağ & Aykaç, 2021; Weng, 2022). Jinon (2022) reported positive effects of Sudoku puzzles on students' reasoning skills, while Dal Çalışıcı

and Yıldız Duban (2025) found that Sudoku-based activities supported elementary students' critical thinking dispositions. Similarly, Baek et al. (2008) noted the positive contribution of Sudoku puzzles to students' logical thinking abilities. However, because the individual components of the instructional design were not tested separately in the present study, the observed effect cannot be attributed specifically to the use of logic puzzles. Other factors, such as the combined structure of the intervention, students' motivation and engagement, implementer-related characteristics, or other uncontrolled variables, may also have contributed to the observed outcomes.

Qualitative categories such as strategy development and cognitive adaptation further illuminate this aspect of the instructional process. Observations indicated that students experimented with multiple solution paths, restructured their approaches after errors, and developed alternative strategies. One reflective journal entry noted that students "developed their own tactics" and restructured their solution strategies following mistakes. This suggests that logic puzzles may have functioned not merely as cognitive exercises but as learning tools actively engaging students' thinking processes.

Gifted students have been found to demonstrate advantages in several cognitive domains, as well as higher intrinsic motivation and more effective problem-solving strategies (Kuznetsova et al., 2024). In this context, the problem-based tasks, inquiry-oriented activities, and logic puzzles employed during the intervention created a learning environment aligned with students' cognitive potentials. This alignment may have contributed to the significant increases observed in critical and creative thinking dispositions. Qualitative findings further suggested that the tasks elicited high levels of engagement and motivation among students despite their challenging nature. During peer evaluation activities, students were observed to consider alternative perspectives and compare their own ideas with their peers' interpretations, suggesting that critical and creative thinking were also supported through social interaction. For example, students' efforts to interpret peers' products from multiple perspectives while maintaining respectful language indicate that critical evaluation developed within a social context.

One of the most notable and unexpected findings of this study is that the instructional design appeared to extend beyond critical and creative thinking dispositions to influence students' social interaction patterns. Reflective journals documented that during product evaluation activities, students used respectful language, structured their critiques constructively, and demonstrated openness to diverse perspectives. Students' deliberate effort to avoid hurtful comments reflects an awareness that critical thinking may involve social sensitivity in addition to cognitive evaluation.

Although social-emotional learning skills were not directly measured in this study, qualitative observations provide cautious indications that critical thinking processes may relate to social-emotional components such as empathy, self-regulation, and social awareness. This aligns with literature emphasizing the ethical and social dimensions of critical thinking (Facione, 2015). Thus, the

instructional design may have contributed not only to cognitive outcomes but also to the emergence of a respectful evaluation culture within classroom interactions.

The primary aim of the instructional design was to strengthen gifted students' critical and creative thinking dispositions, and quantitative findings confirm that this aim was achieved. However, analyses of the researcher's reflective journals suggest that the program may have had a broader impact. Qualitative findings indicate that students engaged metacognitive processes, demonstrated strategic behavior and post-error restructuring tendencies, and developed more conscious attitudes in their social interactions. These observations suggest that the program may possess a holistic structure capable of indirectly supporting metacognitive regulation and social interaction alongside critical and creative thinking dispositions.

The unique contribution of this study lies in experimentally demonstrating the impact of a holistic thinking skills instructional design on gifted students. While prior studies often address critical and creative thinking separately, research integrating both dispositions within a single instructional framework remains limited. Moreover, the integrated use of logic puzzles such as Sudoku and Kakuro adds an additional layer of originality. By concurrently integrating quantitative and qualitative findings, this study makes the impact of the instructional design visible not only at the outcome level but also across processual and interactional dimensions.

Conclusion

This study developed a structured thinking skills instructional design aimed at enhancing gifted students' critical and creative thinking dispositions and experimentally tested its effectiveness. The instructional design incorporated activities that activated higher-order cognitive competencies, supporting processes such as inquiry, reasoning, inference, and the generation of alternative solutions. Previous research has demonstrated a positive relationship between critical thinking and metacognitive processes (Guamanga et al., 2025), while meta-analytic evidence indicates that structured instructional interventions can foster critical thinking skills and dispositions (Abrami et al., 2008, 2015).

To evaluate the effectiveness of the instructional design, a pretest–posttest quasi-experimental design with a control group was implemented with 22 gifted students. Quantitative findings revealed that the thinking skills instructional design produced significant and high-level increases in students' critical and creative thinking dispositions. The magnitude of the experimental effect indicates that the intervention constitutes a strong and effective approach for supporting the cognitive dispositions of gifted learners.

The integration of diverse learning activities—such as logic puzzles, visual interpretation tasks, and product evaluation exercises—demonstrates the holistic and enriched structure of the instructional design. This diversity enabled students to engage with thinking processes from multiple perspectives, contributing to the process-oriented development of critical and creative thinking.

Qualitative data collected concurrently with the quantitative phase provided contextual evidence regarding the implementation process. Observations derived from researcher reflective journals indicate that students moved beyond focusing solely on correct answers and instead generated alternative solutions, considered peers' perspectives, and justified their reasoning. Emerging themes suggest that students demonstrated cognitive adaptation and strategy development, used constructive and respectful language in peer interactions, and increasingly displayed original thinking patterns over time. In particular, the respectful and structured manner in which students evaluated peers' products highlights the attitudinal and interactional dimensions of critical thinking.

These findings suggest that the instructional design may have indirectly influenced certain social-emotional indicators observed during the implementation process. However, these reflections should be interpreted cautiously, as they are based on contextual observations rather than direct measurement of social-emotional learning outcomes. In this respect, the study indicates that the quantitative gains in critical and creative thinking dispositions may have been accompanied by a multidimensional transformation reflected in classroom interactions and learning processes. Accordingly, the findings provide preliminary and noteworthy evidence that thinking-oriented instructional designs may support not only cognitive development but also classroom interaction dynamics among gifted learners.

In conclusion, this study experimentally demonstrates the impact of a structured and holistic thinking skills instructional design on gifted students. Through the integration of qualitative evidence supporting quantitative findings, the study offers a contextualized understanding of how the observed effects were experienced during implementation. The mixed-methods approach thus makes visible not only outcome-level changes but also the learning processes through which these changes emerged.

Future Research and Implications

Several limitations should be considered when interpreting the findings. First, the study was conducted with a relatively small sample due to the natural constraints of accessing gifted populations, which may limit generalizability. Future studies involving larger samples from different regions or multiple science and art centers could enhance external validity.

Second, the study was limited to a specific intervention duration. Given that thinking dispositions develop over time, the long-term effects of the intervention were not examined. Longitudinal research designs are therefore recommended to explore the persistence and developmental continuity of thinking skills instruction.

Third, qualitative data were based on researcher reflective journals. While this source provided rich contextual insights, its interpretive nature does not fully eliminate researcher subjectivity. Future research incorporating multiple qualitative data sources, such as student interviews, classroom video analyses, or peer feedback, could enhance the depth and credibility of qualitative findings.

In this study, logic puzzles such as Sudoku and Kakuro were incorporated into a holistic instructional design. Future research could conduct comparative experimental studies investigating these puzzles either as standalone interventions or in combination with different thinking skill components. Additionally, studies incorporating chess, tangram, reasoning cards, or digital game-based learning environments could contribute to more comprehensive models of game-based thinking instruction.

Qualitative findings in this study provide preliminary indications that thinking-oriented instructional designs may relate to social-emotional learning variables. However, these reflections were not based on direct measurement. Future mixed-method studies that jointly examine critical and creative thinking alongside variables such as empathy, respect, emotional awareness, and peer interaction are therefore recommended.

From a practical perspective, the findings suggest that integrated thinking skills instruction may represent an effective pedagogical approach for gifted learners. Teacher education programs could include applied modules focusing on the classroom use of logic puzzles, inquiry-based activity design, and instructional strategies that connect thinking processes with social interaction. In addition, the findings may provide curriculum development specialists with practical guidance for designing and revising gifted education curricula that systematically incorporate activities aimed at fostering critical and creative thinking dispositions. At the policy level, integrating thinking skills-based instructional designs into enrichment programs, such as those implemented in science and art centers, may enhance both cognitive and interactional development among gifted students.

Additional Declaration

Author Contributions

The study was conducted by a single author.

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Responsible Artificial Intelligence Statement

In this study, artificial intelligence (ChatGPT) was used solely for language editing, including improvements in academic style, fluency, grammar, and expression. I declare that I take full responsibility for any issues that may arise from the use of artificial intelligence in the language-editing process.

Conflicts of Interest

The author declares that there are no conflicts of interest related to the publication of this study.

Ethics Approval

In all processes of this study, the principles of Pen Academic Publishing Research Ethics Policy were followed.

The study received ethical approval from the Ethics Committee of Bursa Uludağ University on June 27, 2025 (Session/Decision No: 2025-06/46).

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