Educational Policy Analysis and Strategic Research, V20, N2, 2025

Critical and Analytical Thinking: Unique and Overlapping Aspects from the Perspective of Teacher Candidates

Funda ÖRGE YAŞAR[1]

Çanakkale Onsekiz Mart University

Mehtap ÖZDEN[2]

Çanakkale Onsekiz Mart University

Enes YAŞAR[3]

Çanakkale Onsekiz Mart University

Abstract

This study examines the distinct and overlapping dimensions of critical and analytical thinking from the perspective of teacher candidates. In the rapidly evolving landscape of the 21st century, these cognitive skills are fundamental to academic achievement and social adaptation. The research aims to evaluate pre-service teachers' tendencies toward critical and analytical thinking, considering variables such as gender, age, field of study, grade level, and GPA. The study, conducted with 1,562 pre-service teachers from an education faculty in Türkiye, adopts a causal research design utilizing the "Critical Thinking Standards Scale for the Teacher Candidates" and the "Analytical Thinking Tendency Scale." The findings reveal that female candidates demonstrate higher tendencies toward critical thinking, whereas analytical thinking does not significantly vary by gender. Age positively influences analytical thinking but has no significant effect on critical thinking. The field of study impacts both skills, with candidates from verbal disciplines exhibiting higher scores. Furthermore, critical thinking shows a positive correlation with GPA, whereas analytical thinking appears to be independent of academic performance. These results highlight the necessity of integrating both cognitive skills into teacher education. The study suggests that while analytical thinking tends to develop with age and experience, critical thinking is more closely associated with structured educational practices. Future research should focus on practical strategies to enhance these cognitive abilities within teacher training programs.

Keywords: Critical Thinking, Analytical Thinking, Teacher Candidates, Cognitive Skills, Education

DOI: 10.29329/epasr.2025.1329.2

Submitted: 15 March 2025 **Accepted:** 13 June 2025 **Published:** 30 June 2025

Introduction

[1] Assoc. Prof. Dr., Faculty of Education, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye, ORCID: 0000-0002-8207-9685, Email: fundaorge@comu.edu.tr

Correspondence: mehtapgunes@comu.edu.tr

[2] Assoc. Prof. Dr., Faculty of Education, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye, ORCID: 0000-0003-0385-5744, Email: mehtapgunes@comu.edu.tr

[3] Assoc. Prof. Dr., Faculty of Education, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye, ORCID: 0000-0003-4606-2592, Email: enesyasar@comu.edu.tr

Thinking is one of the defining characteristics that distinguish humans from other living beings. An individual's thinking ability serves as a fundamental building block in the formation of knowledge, culture, and civilization. In the 21st century, the rapid advancement of information and technology necessitates that individuals possess various thinking skills not only for academic success but also for effective participation in social life. The primary responsibility for developing these skills lies with educational institutions. While schools provide students with an environment conducive to enhancing their cognitive abilities, teachers play a crucial role in shaping and reinforcing this process. Among 21st-century skills, critical and analytical thinking—both higher-order cognitive abilities—have gained increasing importance. The growing need for these two essential skills stems from rapidly changing life conditions, easy access to information, and the necessity to cope with global challenges.

Critical Thinking

The presence of individuals who can think effectively, propose viable solutions to problems, and evaluate events from multiple perspectives is a crucial factor directly influencing the development of a society. Critical thinking is among the fundamental skills that individuals must possess in social life. Particularly in the 21st century and beyond, adapting to personal, social, and societal demands has made critical thinking one of the core components of education (Paul, 1995). However, critical thinking is sometimes perceived negatively and misunderstood as merely focusing on the negative aspects of situations or individuals. In reality, critical thinking is a process of examining a situation or event within specific criteria and questioning it with an objective sense of skepticism.

The concept of critical thinking was introduced nearly two thousand years ago by Socrates. The term "critical" derives from the Greek word *kritikos*, meaning evaluation, discernment, and judgment. It later entered Latin as *criticus* and eventually spread to other languages. Various definitions of critical thinking have emerged in academic studies on the subject. Dewey, described critical thinking as reflective thought (Cody, 2002; Riddell, 2007), while Ennis (1991) defined it as a thinking process that enables individuals to make rational decisions regarding their beliefs and actions. Chance (1986) characterized critical thinking as the ability to analyze facts, solve problems, make inferences, draw comparisons, and evaluate different perspectives. Craver (1989) emphasized that critical thinking involves assessing diverse viewpoints, generating explanations, and structuring relationships between concepts in the process of acquiring knowledge. Epstein (2006) viewed critical thinking as an effective defense mechanism in today's world, where information flows rapidly and individuals are exposed to various persuasive influences. Cüceloğlu (2002) defined critical thinking as an organized and active cognitive process in which individuals become aware of their own thinking, apply learned knowledge while considering others' perspectives, and strive to understand both themselves and their surroundings. Hensley (2002) argued that critical thinking is not merely a problem-solving process but is also directly related to how acquired information is evaluated and applied. Fisher (2001) defined critical thinking as

the ability to develop techniques for problem-solving, emphasize evidence and claims, draw logical inferences, acquire and organize accurate information, recognize overlooked theories and value judgments, and communicate ideas clearly and coherently.

Scriven and Paul (1987) argue that critical thinking is not an innate ability but rather a skill that can be learned and developed over time (as cited in Uribe Enciso et al., 2017). Like other cognitive skills, critical thinking can be acquired, taught, and enhanced through various practices. Introducing this skill at an early age is crucial for fostering a lasting habit of critical thinking and ensuring its lifelong application. In this context, educators bear significant responsibility in facilitating its development. Critical thinking should be systematically instilled in individuals and transformed into a practical skill applicable to daily life. Indeed, one of the common objectives of undergraduate education programs is to equip students with critical thinking skills (Bilgin & Eldeleklioğlu, 2007; Cody, 2006; Riddell, 2007; Wolcott et al., 2002). The constructivist approach places particular emphasis on critical thinking, encouraging students to develop independent thought processes and make sense of the knowledge they acquire (Mayer, 2002). This skill enables students to integrate new information while considering their own perspectives and interpreting prior learning accordingly (Norris, 1985). Furthermore, students who embrace critical thinking as a lifelong skill can transfer their learning across different domains by relating it to their existing competencies (Wood, 2010).

Critical thinking significantly contributes to the development of both individuals and societies. The cultivation and continuity of this skill should be regarded as one of the fundamental priorities in education, requiring meticulous attention at every stage of the educational process (Facione, 1990; Miller, 2003). Gündoğdu (2009) underscores the importance of critical thinking by stating, *"In a society, without critical thinking, it is hardly possible to attain both science and accurate knowledge, as well as tolerance and democracy."*

Analytical Thinking

Analytical thinking is rooted in the logical studies that derive their philosophical foundations from Aristotle's principles of reasoning (Shields, 2012; as cited in Akkuş Çakır & Senemoğlu, 2016). The term "analytical" originates from the Greek word *analytikos*, which means separation and examination.

The literature offers various definitions of analytical thinking. Bloom et al. (1956) define analytical thinking as the process of breaking down a situation into its components, establishing relationships among them, and identifying the principles underlying these connections. Sternberg (1999) conceptualizes analytical thinking as the ability to evaluate, judge, and compare by analyzing the information-processing components of intelligence. Amer (2005) describes it as the independent examination of objects or the analysis of interactions among components that ensure the functioning of a system. Dewey (2017) contrasts analytical thinking with holistic thinking, emphasizing that each

object should be considered separately. Marzano and Kendall (2007) define it as a process of organizing and categorizing information in detail, identifying similarities and differences, and formulating new principles through generalizations. Lane (2020) characterizes analytical thinking as the examination of individual components while simultaneously analyzing their relationship with the whole.

Analytical thinking is a crucial skill that aids in simplifying complex situations and developing solutions by identifying problems. In the literature, analytical thinking is defined as an active engagement in the thought process, wherein an individual analyzes the whole by breaking it down into its components and determining the relationships among them (Amer, 2005; Anderson et al., 2001; Bloom et al., 1956; Brookhart, 2010; Chaffee, 2018; Elder & Paul, 2016; Tsalapatas et al., 2011).

Analytical thinking is positioned at the fourth level of Bloom's Taxonomy. At this stage, individuals engage in an in-depth analysis of complex information, identify relationships and patterns, and develop solutions to problems. Individuals with well-developed analytical thinking skills break down complex problems into simpler components, generate solutions for each part, and thereby make problem-solving more practical and efficient.

Analytical thinking should be a fundamental part of the educational process. This skill is crucial for students to effectively solve problems they may encounter in daily life and to achieve academic success. Developing analytical thinking skills, such as problem-solving, making independent decisions, and being selective in acquiring information, will help students adapt to the rapidly changing world (Thaneerananon et al., 2016).

Critical and analytical thinking are often considered separate concepts, yet they are closely related. Critical thinking includes the ability to analyze and allows for a comprehensive approach to understanding a situation or problem (Amer, 2005). Both in daily and professional life, many situations can be encountered where these two concepts intersect. Analytical thinking enables the analysis of causes, consequences, and the chronological order of events, while critical thinking questions the accuracy of information and evaluates the reliability of sources. When these two skills are used together, individuals not only acquire information but also develop the ability to analyze and assess that information. In the technological age, it is crucial to equip students with these skills. The aim of the research is to determine the tendencies of prospective teachers towards critical and analytical thinking, to examine whether these tendencies differ according to various variables, and to analyze the relationship between critical thinking and analytical thinking and their mutual effects. The study focused on the following questions.

Tendencies of prospective teachers towards critical and analytical thinking:

- Do these tendencies differ according to the gender of the prospective teachers?
- Do these tendencies differ according to the age of the prospective teachers?

▪ Do these tendencies differ according to the grade levels of the prospective teachers?

▪ Do these tendencies differ according to the departments of the prospective teachers?

▪ Do these tendencies differ according to the Grade Point Average (GPA) of the prospective teachers?

Method

Research Model

In this study, which aims to determine the tendencies of pre-service teachers toward critical thinking and analytical thinking, a causal design, one of the quantitative research approaches, was used. Causal design focuses on understanding the cause of an event. It seeks to identify the factors that contribute to the occurrence of the event (Fraenkel et al., 2012).

Study Group

The study group consists of 1,562 pre-service teachers who were randomly selected from a population of 3,167 pre-service teachers enrolled in the Faculty of Education at a university located in western Türkiye during the spring term of the 2023-2024 academic session and voluntarily participated in the study. Among the participants, 1,142 (73.1%) are female, and 420 (26.9%) are male. Detailed information about the participants is presented in Table 1.

Table 1. Pre-Service Teachers' Demographic Profiles

Variables	Group	n	%
Gender	Female	1.142	73.1
	Male	420	26.9
Age	Ages 18 to 19	492	31.5
	Ages 20 to 21	665	42.6
	Ages 22 to 23	326	20.9
	24 years and older	79	5.1
Field of Study	Guidance and Psychological Counseling	205	13.1
	Preschool Education	186	11.9
	Mathematics Education	115	7.4
	English Language Education	87	5.6
	Music Education	34	2.2
	Chemistry Education	61	3.9
	Science Education	154	9.9
	Japanese Language Education	60	3.8
	Art Education	24	1.5
	Geography Education	54	3.5
	Social Studies Education	119	7.6
	Special Education for Mental Disabilities	183	11.7
	Classroom Education	132	8.5
	Turkish Language Education	148	9.5

Class Level	1st Year	441	28.2
	2nd Year	412	26.4
	3rd Year	370	23.7
	4th Year	339	21.7
Grade Point Average	0.00-1.99	457	29.3
	2.00-2.49	158	10.1
	2.50-2.99	466	29.8
	3.00-4.00	481	30.8

Data Collection Instruments

In the study, two data collection instruments were used: the *Critical Thinking Standards Scale for Teacher Candidates* and the *Analytical Thinking Tendency Scale*. Written permission was obtained from the researchers who developed these scales to use them within the scope of the study. Detailed information regarding the data collection instruments is provided below.

Critical Thinking Standards Scale for the Teacher Candidates (CTSS)

The *CTSS* was developed by Aybek et al. (2015) to identify the critical thinking standards of teacher candidates. The draft scale was applied to 586 teacher candidates, consisting of 372 female and 214 male students from the Faculty of Education at Çukurova University. After conducting exploratory and confirmatory factor analyses, a scale consisting of three sub-dimensions and 42 items was obtained. Eighteen items are related to the sub-dimension of depth, width, and competence; twelve items to the sub-dimension of precision and accuracy; and twelve items to the sub-dimension of importance, relevance, and clarity. The internal consistency coefficient of the entire scale, as measured by Cronbach's Alpha, was calculated to be .75. These findings indicate that the scale is a valid and reliable measurement tool for determining the critical thinking standards of teacher candidates.

Analytical Thinking Tendency Scale (ATSS)

The ATTS was developed by Aksu & Eser (2020) to determine the analytical thinking tendencies of university students. The draft scale was applied to 577 university students, consisting of 408 female and 169 male students from the Faculty of Education, Faculty of Arts and Sciences, and Faculty of Administrative Sciences at Adnan Menderes University. After conducting exploratory and confirmatory factor analyses, a scale consisting of two sub-dimensions and 19 items was obtained. Six items are related to the association sub-dimension, and 13 items are related to the differentiation sub-dimension. The internal consistency coefficient of the entire scale, as measured by Cronbach's Alpha, was calculated to be .92. These findings indicate that the scale is both a valid and reliable measurement tool for determining the analytical thinking tendencies of university students.

Reliability

To determine the critical and analytical thinking skills of pre-service teachers, internal consistency analysis was conducted for both scales, and the Cronbach Alpha reliability coefficient was

calculated. Accordingly, the internal consistency coefficient of the *"CTSS"* was found to be .94. The Cronbach Alpha internal consistency coefficients for the sub-dimensions were calculated as follows: .95 for the depth, width and competence dimension, .83 for the precision and accuracy dimension, and .84 for the importance, relevance, and clarity dimension.

The internal consistency coefficient of the *"ATTS"* was found to be .91. The Cronbach Alpha internal consistency coefficients for the sub-dimensions were calculated as follows: .89 for the differentiation dimension and .72 for the association dimension

Data Collection

The data were collected during the spring term of the 2023-2024 academic session from students enrolled in the faculty of education at a university in western Türkiye. The data were obtained through the face-to-face administration of the *CTSS* and the *ATTS* by the researchers.

Data Analysis

The data gathered from the data collection tools were transferred to IBM SPSS Statistics 21 software for analysis. To determine whether the data in the dataset followed a normal distribution, the skewness and kurtosis values of the items were calculated. It was found that the skewness and kurtosis values in the "ATTS" ranged from -1.5 to +1.5, indicating that the data followed a normal distribution. However, in the "CTSS", the values were outside the range of -1.5 to +1.5, suggesting that the data did not follow a normal distribution. Therefore, both parametric and non-parametric tests were used in the analysis of the data. Independent samples t-test, ANOVA, Mann-Whitney U Test, Kruskal-Wallis H Test, Pearson Product-Moment Correlation Analysis, and Simple Linear Regression Analysis were employed. To identify the specific groups causing significant differences detected by the One-Way ANOVA, Scheffe's Post-Hoc Multiple Comparison Analysis (for homogenous variances, $p>.05$) and Tamhane's T2 Post-Hoc Multiple Comparison Analysis (for non-homogenous variances, $p<.05$) were used. Additionally, descriptive statistical methods such as standard deviation, arithmetic mean, frequency, and percentage were employed to analyze the data. The significance level for the statistical analyses of the study was set at $p\leq.05$.

Results

In this section of the study, the results related to the teacher candidates' critical and analytical thinking skills have been examined.

Results on the Scores for Critical and Analytical Thinking

Table 2. Descriptive Statistics for Critical Thinking and Its Sub-Dimensions

Sub-dimensions	n	$\bar{x}$	SD	Min	Max	Skewness	Kurtosis
1. Depth, Width and Competence	1562	3.97	.69	1.00	5.00	-1.59	3.66
2. Precision and Accuracy	1562	3.72	.72	1.33	4.92	-1.23	1.21
3. Importance, Relevance and Clarity	1562	3.85	.60	1.33	5.00	-1.50	3.39
Critical Thinking	1562	3.86	.55	1.19	4.81	-1.67	4.13

An examination of Table 2 reveals that the mean score of pre-service teachers regarding critical thinking is $\bar{x}$ = 3.86. The arithmetic means of the scores obtained from the sub-dimensions of the scale range between $\bar{x}$ = 3.72 and $\bar{x}$ = 3.97.

Table 3. Descriptive Statistics for Analytical Thinking and Its Sub-Dimensions

Sub-dimensions	n	$\bar{x}$	SD	Min	Max	Skewness	Kurtosis
1. Differentiation	1562	3.96	.53	2.23	5	.02	-.21
2. Association	1562	4.09	.53	1.33	5	-.45	.80
Analytical Thinking	1562	4.00	.49	2.16	5	-.03	-.05

An examination of Table 3 reveals that the mean score of pre-service teachers regarding analytical thinking is $\bar{x}$ = 4.00. The arithmetic means of the scores obtained from the sub-dimensions of the scale were found to be $\bar{x}$ = 3.96 for the differentiation dimension and $\bar{x}$ = 4.09 for the association dimension.

Results on the Relationships Between Critical Thinking and Analytical Thinking

Table 4. Pearson Product-Moment Correlation Analysis Results for the Relationships Between Analytical Thinking and Critical Thinking

	Critical Thinking	***Analytical Thinking***
Critical Thinking	1	.34*
Analytical Thinking		1
*n=1562, *p<.01*		

According to the data in Table 4, there is a positive and moderate significant correlation (r = .34) between the scores of pre-service teachers on the *CTSS* and the *ATTS*.

Results on the Predictive Level of Critical Thinking for Analytical Thinking

Table 5. Simple Linear Regression Analysis Results for the Relationship Between Critical Thinking and Analytical Thinking

Analytical Thinking	B	SHB	β	t	R	R^2	F	p
Intercept	2.85	.08		34.16				.00
Critical Thinking	.30	.02	.34	14.02	.34	.11	196.58	.00
n=1562*p<.001								

According to Table 5, critical thinking significantly predicts analytical thinking. Critical thinking explains 11% of the variance in analytical thinking ($F_{(1, 1562)}$=196.58, p<.001, R=.34, R^2=.11). It was also found that 93% of the variance in analytical thinking can be explained by other variables. Based on the data in Table 5, a 1-unit increase in critical thinking leads to a 0.30 unit increase in

analytical thinking. The regression equation predicting analytical thinking based on simple linear regression analysis is as follows:

Analytical Thinking = (0.30 × Critical Thinking) + 2.85

Results on the Analysis of Critical Thinking Scores According to Various Variables

Table 6. Mann-Whitney U Test Results for Critical Thinking Scores by Gender Variable

	Gender	**N**	**Mean Rank**	**Sum of Ranks**	**Mann Whitney U**	**Z**	***p***
Critical Thinking	Female	1.142	805.14	919466.00	212827.00	-3.416	.00*
	Male	420	717.23	301237.00	301237.00		

*p<.01

According to Table 6, the critical thinking scores of pre-service teachers differ significantly by gender (p<.05), favoring female participants.

Table 7. Kruskal-Wallis H Test Results for Critical Thinking Scores by Age Variable

	Age	**N**	**Mean Rank**	**Chi-Square**	**df**	***p***
Critical Thinking	Ages 18 to 19	492	782.08	1.776	3	.62
	Ages 20 to 21	665	769.56			
	Ages 22 to 23	326	791.87			
	24 years and older	79	835.61			

p>.05

According to Table 7, the critical thinking scores of pre-service teachers do not differ significantly by age (p>.05).

Table 8. Kruskal-Wallis H Test Results for Critical Thinking Scores by Field of Study Variable

	Field of Study	**N**	**Mean Rank**	**Chi-Square**	**df**	***p***
Critical Thinking	Guidance and Psychological Counseling	205	830.70	48.751	13	.00*
	Preschool Education	186	854.68			
	Mathematics Education	115	716.77			
	English Language Education	87	777.75			
	Music Education	34	741.93			
	Chemistry Education	61	655.48			
	Science Education	154	733.35			
	Japanese Language Education	60	957.95			
	Art Education	24	815.27			
	Geography Education	54	850.19			
	Social Studies Education	119	784.74			
	Special Education for Mental Disabilities	183	673.16			
	Classroom Education	132	705.47			
	Turkish Language Education	148	882.112			

∗ p<.05

According to Table 8, the critical thinking scores of pre-service teachers differ significantly based on their field of study (p<.05). The results of the Mann-Whitney U test applied to determine which groups contributed to the significant differences in the critical thinking scores of teacher candidates are presented in Table 9.

Table 9. Mann-Whitney U Test Results for Critical Thinking Scores by Field of Study Variable

	Significant Differences Between Groups
Critical Thinking	*8-3, *8-4, *8-5, *8-6, *8-7, *8-11, *8-12, *8-14, *1-6, *1-12, *2-6, *2-12, *10-6, *10-12, *14-6, *14-12, *11-12

**In favor; Groups: 1) Guidance and Psychological Counseling, 2) Preschool Education, 3) Mathematics Education, 4) English Language Education, 5) Music Education, 6) Chemistry Education, 7) Science Education, 8) Japanese Language Education, 9) Art Education, 10) Geography Education, 11) Social Studies Education, 12) Special Education for Mental Disabilities, 13) Classroom Education, 14) Turkish Language Education*

According to the data in Table 9, statistically significant differences have been found in favor of pre-service teachers in the Japanese Language Education department compared to those in the Mathematics Education, English Language Education, Music Education, Chemistry Education, Science Education, Social Studies Education, Special Education for Mental Disabilities, and Turkish Language Education departments. Similarly, pre-service teachers in the Guidance and Psychological Counseling department scored significantly higher than those in the Chemistry Education and Special Education for Mental Disabilities departments. Significant differences were also observed in favor of pre-service teachers in the Preschool Education department compared to those in the Chemistry Education and Special Education Special Education for Mental Disabilities departments, as well as in favor of pre-service teachers in the Geography Education department over those in the Chemistry Education and Special Education for Mental Disabilities departments. Additionally, pre-service teachers in the Turkish Language Education department demonstrated significantly higher scores than those in the Chemistry Education and Special Education for Mental Disabilities departments, while those in the Social Studies Education department scored significantly higher than those in the Special Education for Mental Disabilities department.

Table 10. Kruskal-Wallis H Test Results for Critical Thinking Scores by Grade Level Variable

	Class Level	**N**	**Mean Rank**	**Chi-Square**	**df**	***p***
Critical Thinking	1st Year	441	773.84	2.312	3	.51
	2nd Year	412	778.45			
	3rd Year	370	765.01			
	4th Year	339	813.17			

p>.05

According to Table 10, the critical thinking scores of pre-service teachers do not differ significantly by grade level (p>.05).

Table 11. Kruskal-Wallis H Test Results for Critical Thinking Scores by GPA Variable

	Grade Point Average	N	Mean Rank	Chi-Square	df	*p*
Critical Thinking	0.00-1.99	457	774.39	27.863	3	.00
	2.00-2.49	158	662.77			
	2.50-2.99	466	748.47			
	3.00-4.00	481	859.26			
*p<.01						

According to Table 11, the critical thinking scores of pre-service teachers differ significantly based on their grade point averages (p<.05). The results of the Mann-Whitney U test applied to determine which groups contributed to the significant differences in the critical thinking scores of teacher candidates are presented in Table 12.

Table 12. Mann-Whitney U Test Results for Critical Thinking Scores by GPA Variable

	Significant Differences Between Groups
Critical Thinking	*4-1, *4-2, *4-3, *2-1, *3-1
**In favor; Groups: 1) 0.00-1.99, 2) 2.00-2.49, 3) 2.50-2.99, 4) 3.00-4.00*	

According to the data in Table 12, statistically significant differences have been found between pre-service teachers with a GPA between 3.00-4.00 and those with GPAs in the ranges of 0.00-1.99, 2.00-2.49, and 2.50-2.99, with the differences favoring the 3.00-4.00 GPA group. Additionally, statistically significant differences have been found between pre-service teachers with a GPA between 2.00-2.49 and those with a GPA between 0.00-1.99, favoring the 2.00-2.49 GPA group, and between pre-service teachers with a GPA between 2.50-2.99 and those with a GPA between 0.00-1.99, favoring the 2.50-2.99 GPA group.

Results on the Analysis of Analytical Thinking Scores According to Various Variables

Table 13. Independent Samples T-Test Results for Analytical Thinking Scores by Gender Variable

	Gender	n	$\bar{x}$	SD	t	p
Analytical Thinking	Female	1142	4.00	.49	.04	.97
	Male	420	4.00	.51		
df=1560, p<.05						

According to Table 13, the analytical thinking scores of pre-service teachers do not differ significantly by gender (p>.05).

Table 14. One-Way ANOVA Results for Analytical Thinking Scores by Age Variable

	Age	n	$\bar{x}$	SD	**SV**	**SS**	df	**MS**	**F**	p
Analytical Thinking	Ages 18 to 19	492	3.96	.51	B. Groups	3.40	3	1.13	4.70	.00*
	Ages 20 to 21	665	3.99	.47	W. Groups	375.61	1558	.24		
	Ages 22 to 23	326	4.05	.48	Total	379.01	1561			
	24 years and older	79	4.15	.57						
	Total	1562	4.00	.49						

*p<.01

According to Table 14, the analytical thinking scores of pre-service teachers differ significantly by age (p<.01). The results of the Scheffe multiple comparison analysis, applied to determine which groups contributed to the significant differences in the analytical thinking scores of teacher candidates, are presented in Table 15.

Table 15. Tamhane's T2 Post-Hoc Multiple Comparison Analysis Results for Analytical Thinking Scores by Age Variable

	Significant Differences Between Groups
Analytical Thinking	*4-1
**In favor; Groups: 1) Ages 18 to 19, 2) Ages 20 to 21, 3) Ages 22 to 23, 4) 24 years and older*	

According to the data in Table 15, statistically significant differences have been found between pre-service teachers aged 24 and above and those aged 18-19, with the differences favoring the 24 and above age group.

Table 16. One-Way ANOVA Results for Analytical Thinking Scores by Field of Study Variable

	Field of Study	n	$\bar{x}$	SD	**SV**	**SS**	df	**MS**	**F**	p
Analytical Thinking	Guidance and Psychological Counseling	205	4.02	.57	B. Groups	6.46	13	.50	2.07	.01*
	Preschool Education	186	3.99	.58	W. Groups	372.55	1548	.24		
	Mathematics Education	115	3.89	.58	Total	379.01	1561			
	English Language Education	87	3.99	.60						
	Music Education	34	4.09	.54						
	Chemistry Education	61	3.95	.63						
	Science Education	154	3.96	.67						
	Japanese Language Education	60	4.04	.67						
	Art Education	24	4.13	.60						
	Geography Education	54	4.05	.56						
	Social Studies Education	119	4.04	.58						
	Special Education for Mental Disabilities	183	4.00	.53						
	Classroom Education	132	3.93	.69						
	Turkish Language Education	148	4.14	.67						
	Total	1562	4.00	.60						

*p<.05

According to Table 16, the analytical thinking scores of pre-service teachers differ significantly based on their field of study (p<.05). The results of the Tamhane's T2 multiple comparison analysis, applied to determine which groups contributed to the significant differences in the analytical thinking scores of teacher candidates, are presented in Table 17.

Table 17. Tamhane's T2 Post-Hoc Multiple Comparison Analysis Results for Analytical Thinking Scores by Field of Study Variable

	Significant Differences Between Groups
Analytical Thinking	*1-2, *1-3
**In favor; Groups: 1)* Turkish Language Education, *2)* Classroom Education, *3)* Mathematics Education	

According to the data in Table 17, statistically significant differences have been found between pre-service teachers studying in the Turkish Language Education department and those studying in the Classroom Education and Mathematics Education departments, with the differences favoring the Turkish Language Education department.

Table 18. One-Way ANOVA Results for Analytical Thinking Scores by Grade Level Variable

	Class Level	n	$\bar{x}$	SD	**SV**	**SS**	df	**MS**	**F**	p
Analytical Thinking	1st Year	441	3.99	0.51	B. Groups	1.95	3	0.65	2.68	.04
	2nd Year	412	3.99	0.49	W. Groups	377.06	1558	0.24		
	3rd Year	370	3.97	0.49	Total	379.01	1561			
	4th Year	339	4.07	0.48						
	Total	1562	4.00	0.49						
*p<.05										

According to Table 18, the analytical thinking scores of pre-service teachers differ significantly by grade level (p<.05). The results of the Scheffe multiple comparison analysis, applied to determine which groups contributed to the significant differences in the analytical thinking scores of teacher candidates, are presented in Table 19.

Table 19. Scheffe Post-Hoc Multiple Comparison Analysis Results for Analytical Thinking Scores by Grade Level Variable

	Significant Differences Between Groups
Analytical Thinking	*4-3
**In favor; Groups: 1) 1st year, 2) 2nd year, 3) 3rd year, 4) 4th year*	

According to the data in Table 19, statistically significant differences have been found between pre-service teachers studying in the 4th year and those studying in the 3rd year, with the differences favoring the 4th-year pre-service teachers.

Table 20. One-Way ANOVA Results for Analytical Thinking Scores by GPA Variable

	Grade Point Average	n	$\bar{x}$	SD	**SV**	**SS**	df	**MS**	**F**	p
Analytical Thinking	0.00-1.99	457	4.00	0.51	B. Groups	0.88	3	0.29	1.21	.30
	2.00-2.49	158	3.96	0.53	W. Groups	378.13	1558	0.24		
	2.50-2.99	466	3.99	0.47	Total	379.01	1561			
	3.00-4.00	481	4.03	0.48						
	Total	1562	4.00	0.49						

p>.05

According to Table 20, the analytical thinking scores of pre-service teachers do not differ significantly based on their grade point averages (p>.05).

Discussion, Conclusion and Recommendations

The pre-service teachers' tendencies for critical and analytical thinking are generally at a high level; however, it is observed that they have relatively lower scores in certain dimensions of critical thinking (such as certainty and accuracy), which is consistent with the general trends found in previous research. For instance, studies conducted by Kırmızı et al. (2014), Özcan (2007), and Yılmaz Özelçi (2012) have identified that pre-service teachers' critical thinking skills are above average. However, there are also studies indicating low levels of analytical thinking skills (Irwanto et al., 2017; Yulina et al., 2019; Kala & Kirman Bilgin, 2020). The findings of the present study are consistent with previous research. A positive, moderate-level relationship was found between the pre-service teachers' tendencies for critical and analytical thinking. Accordingly, it was found that pre-service teachers with a high tendency for critical thinking also have a high tendency for analytical thinking, but a large portion of the factors explaining analytical thinking (89%) is dependent on variables other than critical thinking.

The tendencies for critical and analytical thinking of pre-service teachers are in favor of female candidates; however, there is no significant difference between genders in analytical thinking. Similar results have been found in previous studies. Research conducted by Bedir et al. (2022), Özbaş and Uluçınar Sağır (2014), Çubukçu (2004), Azizi et al. (2022), and Ani et al. (2020) has shown that the thinking styles of pre-service teachers do not vary based on gender and that gender does not significantly influence analytical or critical thinking skills. On the other hand, studies by Aliakbari and Sadeghdaghighi (2011), Beşoluk and Önder (2010), Çetinkaya (2011), Çığrı Yıldırım (2005), Dewi and Erman (2022), Gülveren (2007), Ramdani et al. (2021), Rudd et al. (2000), Shubina and Kulakli (2019), and Zayıf (2008) have stated that gender has a significant effect on critical thinking skills. In some studies, it is indicated that males are more effective in critical thinking skills, while other studies suggest that female students possess more advanced critical thinking skills. However, Özdemir (2005), Şen (2009), Korkmaz (2009), Çelik et al. (2018), Kizilet (2017), Kutluca et al. (2018), Sarıgöz (2014), Özsoy Güneş et al. (2013), Ocak et al. (2016), Demir and Cetinbas (2023), and Ramdani et al. (2021) found that gender does not create a significant difference in critical thinking skills. These studies reveal that

there is no difference in critical thinking levels between male and female students, and in some cases, the average scores of females are slightly higher than those of males.

Unlike critical thinking, the gender factor has not been a determining factor in analytical thinking. However, some studies suggest that gender may have an influence on analytical thinking skills; Uchia and Yunianta (2021), Kuncoro et al. (2022) have conducted studies indicating that female students outperform male students in analytical skills. Nevertheless, the findings align with the literature suggesting that gender does not affect analytical thinking skills and reveal that analytical thinking abilities can develop independently of gender.

There is no significant difference in critical thinking based on age in terms of teacher candidates' critical and analytical thinking tendencies; however, some studies in the literature show different results. Research indicates a positive relationship between age and critical thinking, with older age groups possessing more developed critical thinking skills (Azodi et al., 2010; Tümen Akyıldız, 2020; Emir, 2012). On the other hand, some studies suggest that there is no significant difference between age and critical thinking (Shirazi & Heidari, 2019; Babamohammadi et al., 2011). This inconsistency suggests that the impact of age on critical thinking skills may vary depending on context and sample characteristics. However, in this study, it was found that age had an impact on analytical thinking, with analytical thinking developing as age increased.

Teacher candidates' tendencies in critical and analytical thinking vary according to their fields of study. These skills are found to be higher in verbal fields, while they are lower in numerical fields. Research indicates that the type of department has a significant impact on critical thinking skills. In particular, some studies emphasize that there are meaningful differences in critical thinking skills among students from different academic disciplines (Aliakbari & Sadeghdaghighi, 2011; Emir, 2012). However, some studies argue that the type of department does not create a significant difference in critical thinking skills (Özdemir, 2005). This difference suggests that the extent to which the department type affects critical thinking skills may be more complex and context-dependent. Differences among academic disciplines may affect the development of students' critical thinking skills in various ways.

Teacher candidates' tendencies in critical and analytical thinking do not show a significant difference according to grade level in terms of critical thinking, while analytical thinking is seen as a skill that can be developed according to grade level. Akkuş Çayır and Senemoğlu (2015) found similar results in their study. However, studies by Bedir et al. (2022), Depinet (2012), and Arum and Roksa (2011) did not find a significant difference according to grade level, indicating that the impact of grade level on analytical thinking skills is not always apparent, and factors such as the sample used, methodology, or curriculum may influence this difference.

The finding that teacher candidates' tendencies in critical thinking do not show significant differences according to grade level, when compared with various studies conducted on this topic,

reveals the following pattern: While studies by Shirazi and Heidari (2019), Kuvaç and Koç (2014), Özsoy Güneş et al. (2013), Çetin (2008), Saçlı and Demirhan (2008), Zayıf (2008), Gülveren (2007), and Akar (2007) found significant differences between grade level and critical thinking, Noohi et al. (2014), Kürüm (2002), Beşoluk and Önder (2010), and Ekinci and Aybek (2010) did not identify a significant relationship between grade level and critical thinking. This situation suggests that the impact of grade level on critical thinking skills may be complex and context-dependent.

The tendencies of teacher candidates in critical and analytical thinking suggest that critical thinking is directly related to academic success, whereas analytical thinking skills can develop independently of academic success. According to Özdelikara et al. (2012), Öztürk and Ulusoy (2008), and Ricketts and Rudd (2005), as academic success increases, critical thinking skills also improve. On the other hand, studies by Giancarlo and Facione (2001), Barkhordary et al. (2014), Stupnisky et al. (2008), and Shirazi & Heidari (2019) found no significant connection between academic success and critical thinking. However, Changwong et al. (2018) noted that students who develop the ability to think deeply tend to perform better academically. While some studies find a strong relationship between these two factors, others suggest that the relationship is either non-existent or weak. These discrepancies indicate that further research is needed to determine whether there is a direct relationship between academic success and critical thinking skills.

The finding regarding the relationship between teacher candidates' analytical thinking and their GPA contradicts the studies by Al-Hasnawi and Al-Mousawi (2021) and Lajthia et al. (2024). These researchers demonstrated that students with critical and analytical thinking skills tend to be more successful in their university education. However, in this study, no significant relationship was found between analytical thinking and academic success. This discrepancy could be attributed to sample characteristics, measurement tools used, or contextual factors of the study. Therefore, it can be concluded that the relationship between analytical thinking and academic success may vary depending on the context, sample, and research methodology.

This study examined various factors influencing critical and analytical thinking skills. The findings indicate that critical thinking is higher in women, but gender does not play a determining role in analytical thinking. While age does not affect critical thinking, analytical thinking increases with age. In terms of class level, no significant difference was found in critical thinking, but it was determined that 4th-year students had higher analytical thinking scores. When the department variable was examined, it was found that students in verbal departments (such as Turkish, Japanese, Guidance, etc.) had higher tendencies for both critical and analytical thinking. Additionally, a positive relationship was found between academic success and critical thinking, while analytical thinking was found to be independent of GPA. The results highlight that critical and analytical thinking are related to individual and academic variables in different ways, emphasizing the importance of strategies to develop these

skills in educational processes. It can be concluded that more applied studies should be included to develop these skills in education. The development of analytical thinking skills with age and experience indicates that the educational process should be structured in a way that supports these skills. On the other hand, the strong relationship between critical thinking and academic success suggests that this skill should be further encouraged in the educational process.

Policy Implications

This study provides valuable insights for informing educational policies aimed at enhancing higher-order thinking skills among pre-service teachers. The moderate positive correlation between critical and analytical thinking, alongside the predictive effect of critical thinking on analytical thinking, underscores the necessity of systematically integrating critical thinking instruction into teacher education curricula. Gender-based disparities in critical thinking highlight the importance of implementing gender-responsive pedagogical strategies to promote equitable cognitive development. Although no significant gender differences were observed in analytical thinking, the adoption of broad-based instructional approaches remains essential to address the diverse needs of learners. Furthermore, disciplinary differences—particularly the lower critical thinking scores in numerically oriented fields such as chemistry and mathematics—indicate the need to embed thinking-oriented pedagogies within discipline-specific contexts.

In addition, the positive association between age or class level and analytical thinking points to the potential benefits of experiential learning methods, such as case-based and problem-based learning, which should be progressively incorporated into teacher education programs. Policymakers are encouraged to consider longitudinal curricular frameworks that facilitate the sustained development of analytical competence. The observed relationship between GPA and critical thinking—but not analytical thinking—also prompts a critical reconsideration of current assessment practices. Diversifying evaluation methods to include performance-based and reflective assessments may better support the development of critical reasoning skills. Finally, given that a substantial portion of the variance in analytical thinking remains unexplained by critical thinking alone, a multidimensional policy perspective is warranted. Addressing cognitive, affective, and contextual dimensions through comprehensive support systems and inclusive pedagogical practices will be essential. In sum, strengthening pre-service teachers' critical and analytical thinking skills necessitates integrated, inclusive, and context-sensitive policy reforms encompassing curriculum design, instructional approaches, and assessment strategies, ultimately contributing to the improvement of teacher quality and overall educational effectiveness.

Conflict of Interest

No potential conflict of interest was declared by the authors.

Funding Details

No funding or grant was received from any institution or organization for this research.

Ethical Statement

Ethics committee approval within the scope of the research has been obtained from the Scientific Research Ethics Committee of Canakkale Onsekiz Mart University with the decision number 03, dated April 4, 2024.

Credit Author Statement

The authors contributed equally to this research.

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